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# FINAL SITE INVESTIGATION REPORT FOR THE PRELIMINARY ASSESSMENT/ SITE INVESTIGATION LIGHTER AIR CUSHION VEHICLE 30 TON (LACV-30) MAINTENANCE FACILITY WETLANDS AREA FORT STORY VA

12/1/1992

JAMES M. MONTGOMERY CONSULTING ENGINEERS

0021

U.S. Army Corps
of Engineers

Omaha District

# Fort Story, Virginia

## *Preliminary Assessment/Site Investigation*
## *LACV-30 Maintenance Facility Wetlands Area*

JMM

# ARCHITECT-ENGINEER
# DRAFT FINAL SITE INVESTIGATION REPORT

Fort Story
Virginia Beach, Virginia

Preliminary Assessment/Site Investigation
LACV-30 Wetlands Area

Contract No. DACW45-89-D-0501

Prepared for:

U.S. Army Corps of Engineers
Missouri River Division
Omaha District
Omaha, Nebraska

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| A-E | Architect-Engineer |
| ARAR | applicable or relevant and appropriate requirement |
| ARR | Analytical Results Report |
| ATGAS | Atlantic Street Gas Station |
| bls | below land surface |
| BNA | base/neutral/acid extractable compound |
| CDAP | Chemical Data Acquisition Plan |
| CFR | Code of Federal Regulations |
| DEH | Directorate of Engineering and Housing |
| DOD | Department of Defense |
| DQOs | data quality objectives |
| EC | electrical conductivity |
| EPA | U.S. Environmental Protection Agency |
| ESE | Environmental Science and Engineering |
| FIT | field investigation team |
| HRSD | Hampton Roads Sanitation District |
| IRP | Installation Restoration Program |
| JMM | James M. Montgomery, Consulting Engineers, Inc. |
| LUFT | leaking underground fuel tank |
| MCL | Maximum Contaminant Level |
| MCLG | Maximum Contaminant Level Goal |
| MRL | Method Reporting Level |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| MW | monitoring well |
| ND | no detectable concentration |
| NGVD | National Geodetic Vertical Datum of 1929 |
| OSHA | Occupational Safety and Health Administration |
| PA/SI | Preliminary Assessment/Site Investigation |
| PARCC | precision, accuracy, representativeness, completeness and comparability |
| PCB | polychlorinated biphenyls |
| PID | photoionization detector |
| PPE | personal protective equipment |
| QA | quality assurance |
| QC | quality control |
| QCSR | Quality Control Summary Report |
| RCRA | Resource Conservation and Recover Act |
| RI/FS | Remedial Investigation/Feasibility Study |
| SB | soil boring |
| SD | sediment |
| SSHP | Site Safety and Health Plan |
| SW | surface water |
| TFH-H | total fuel hydrocarbons - heavy fraction |
| TSCA | Toxic Substances Control Act |
| USACE | U.S. Army Corps of Engineers |
| USCS | Unified Soil Classification System |
| UST | underground storage tank |
| VGWPL | Virginia Groundwater Protection Level |
| VOC | volatile organic compound |

## EXECUTIVE SUMMARY

James M. Montgomery, Consulting Engineers, Inc. (JMM) has completed a Preliminary Assessment/Site Investigation (PA/SI) evaluation for Site 11, Lighter Air Cushion Vehicle 30-Ton (LACV-30) Maintenance Facility Wetlands Area located at Fort Story, Virginia. This site is referred to as the LACV-30 Site. JMM performed this project under contract to the U.S. Army Corps of Engineers (USACE) for the Directorate of Engineering and Housing (DEH).

This PA/SI evaluation was intended to identify environmental contamination, if any, at the LACV-30 Site, and the possible avenues by which compounds could migrate from the site into surrounding wetlands areas. Site surface waters, sediment, soil, and groundwater were sampled and analyzed, especially in areas near detention ponds, oil/water separators, storage areas, underground storage tanks, outfalls, and maintenance facilities.

JMM concluded that site soil, surface water, and sediment are not significantly contaminated. The groundwater sampling activities detected low levels of volatile organic compounds (VOC) in a groundwater monitoring well sampled near the PN-49 Maintenance Facility (i.e., MW-1403). The VOCs detected in groundwater sample MW-1403 included benzene, 1,1-dichlorethane, 1,1-dichlorethene, and xylene isomers. The levels of these constituents, however, were all below their respective Maximum Contaminant Levels (MCLs). So no further investigations are warranted at the LACV-30 Site.

## 1.0 INTRODUCTION

James M. Montgomery, Consulting Engineers, Inc. (JMM) is the prime Architect-Engineer (A-E) contracted by the U.S. Army Corps of Engineers (USACE) under Delivery Order Number 0014 of Contract DACW45-89-D-0501. The work authorized under Delivery Order 0014 consists of a Preliminary Assessment/Site Investigation (PA/SI) for Site 11, Lighter Air Cushion Vehicle, 30-Ton (LACV-30) Maintenance Facility Wetlands Area located at Fort Story, Virginia. This site is referred to as the LACV-30 Site. JMM is performing this project for the Directorate of Engineering and Housing (DEH) under the Department of Defense's (DOD's) Installation Restoration Program (IRP). This PA/SI report discusses the significance of constituents detected in site media at the LACV-30 Site.

## 1.1 OBJECTIVES

A Preliminary Assessment/Site Investigation (PA/SI) is an initial analysis of existing information and preliminary contamination data intended to determine if a release or discharge of hazardous substances might be serious enough to warrant additional investigation or action. The PA is the first phase in the process of determining whether a site has released, or has the potential to release, hazardous substances, pollutants, or contaminants into the environment and whether response action is necessary. The SI is the first phase in the process of characterizing the presence of hazardous substances in environmental media, via collection and analysis of multi-media samples.

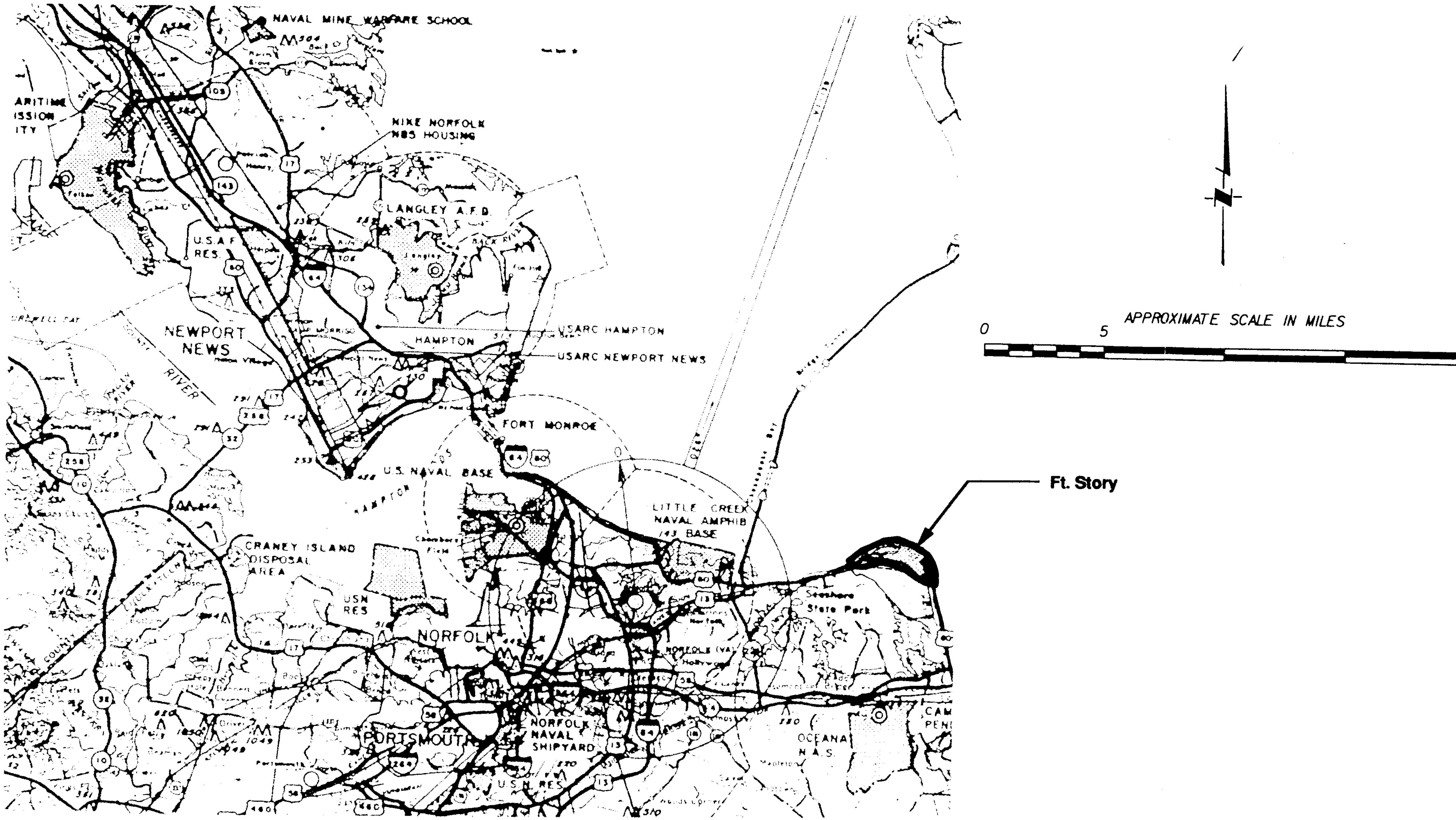
The PA/SI attempts to establish whether the site has the potential to adversely affect the environment; however, it is not intended to determine the magnitude or extent of environmental contamination. These determinations would be made during a Remedial Investigation/Feasibility Study (RI/FS) of the site. Also, the PA/SI qualitatively assesses contaminant transport pathways in environmental media; however, it is not intended to quantify site exposure concentrations or dosages or associated health/environmental risk levels. Exposure and risk levels associated with transport pathways and receptors would be characterized during the RI/FS process.

The PA/SI at the LACV-30 Site was designed to meet the following objectives:

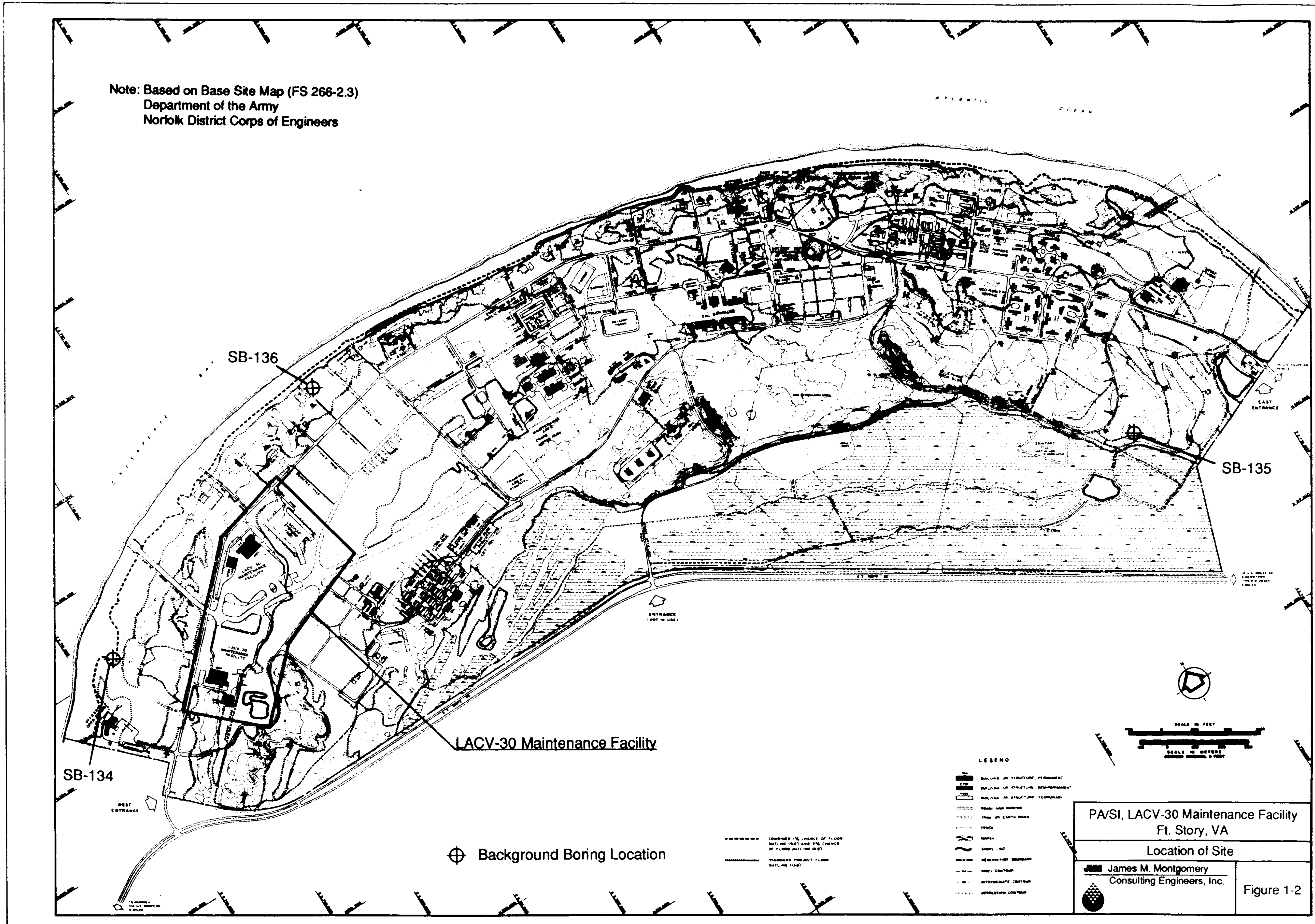
- Confirm the presence or absence of significant contamination in site soils, sediments, groundwater and surface waters.
- Qualitatively assess the potential for contaminant migration into the surrounding wetland areas.
- Evaluate the effectiveness of existing oil/water separation and transfer systems to manage stormflow runoff.
- Define future investigations or other actions required.

## 1.2 SITE DESCRIPTION

Fort Story is located in the City of Virginia Beach in southeastern Virginia, as indicated in Figure 1-1. The LACV-30 Site is located on the western portion of Fort Story, as indicated in Figure 1-2. Virginia Beach is located in the Hampton Roads region of southeastern Virginia, which is included in the coastal tidewater portion of the Atlantic Coastal Plain physiographic province. Occupying an area of approximately 1,450 acres, Fort Story is situated on Cape Henry, which roughly divides the waters of the Chesapeake Bay to the north from those of the Atlantic Ocean to the east.
A detailed description of the topography, climate and hydrogeology at Fort Story is provided in Sections 1.2.1, 1.2.2 and 1.2.3, respectively.




| PA/SI - SI/DPS, Ft. Story, VA | |
|---|---|
| Vicinity Map<br>Location of Ft. Story, VA | |
| James M. Montgomery<br>Consulting Engineers, Inc. | Figure 1-1 |



Note: Based on Base Site Map (FS 266-2.3)
Department of the Army
Norfolk District Corps of Engineers
SB-136
SB-135
SB-134
LACV-30 Maintenance Facility
Background Boring Location
PA/SI, LACV-30 Maintenance Facility
Ft. Story, VA
Location of Site
James M. Montgomery
Consulting Engineers, Inc.
Figure 1-2

The LACV-30 Site is located near the intersection of Atlantic Avenue and the LACV-30 Beach Access Road, as shown in Figure 1-3. The area consists of two nearly identical maintenance facilities, PN-43 to the southwest and PN-49 to the northwest. Each facility consists of storage and maintenance buildings and concrete paved parking lots for the LACV-30 vehicles. Inside each maintenance building, there are various types of shops (i.e., Sheet Metal Shop, Machinists Shop, and an Engine Shop) as well as a bay area where the LACV-30 vehicles are parked during the maintenance activities. Methyl ethyl ketone (MEK) and trichloroethene (TCE) were used in the Sheet Metal and Machinist Shops, and cleaning solvents were used in the Engine Shop (Bowker, 1982). The waste TCE and MEK were mixed with used oil from the LACV-30 vehicles and stored in a 400-gallon fuel pod (USATHAMA, 1988). The waste materials were removed off-site on a monthly basis for use by the City of Norfolk, Fire Training School or the Fort Story Fire Department for firefighter training exercises (USATHAMA, 1988). Paints are used in the bay area, and the bay area is equipped with a set of floor and trench drains to convey waste flows from the bay area to the oil/water separator prior to discharge to the sanitary sewer system. Additional materials used in each maintenance building includes turbine 23699 fuel, hydraulic fluid, and various grades of grease (Fredericks, 1992).

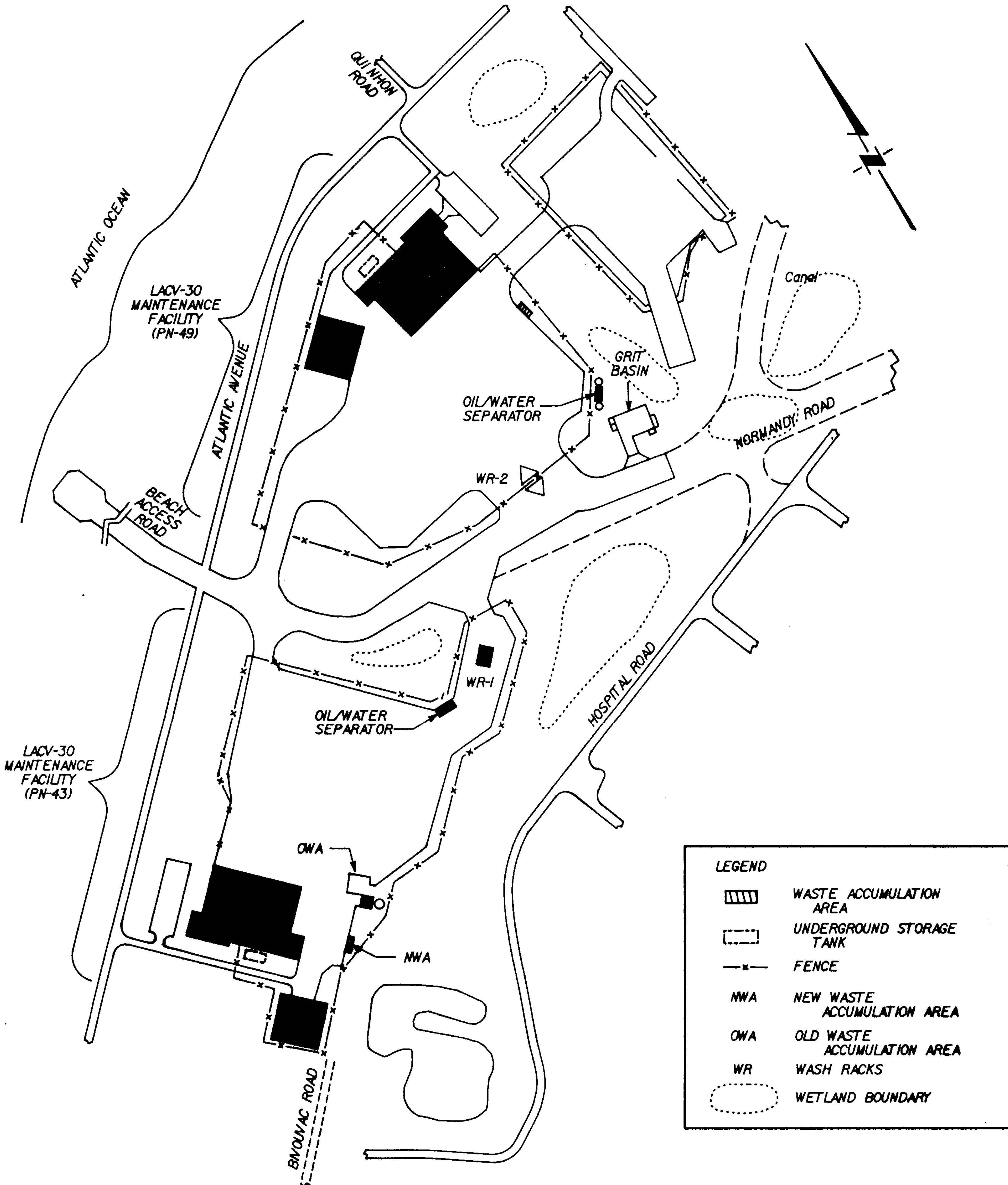
There are a variety of waste management structures associated with each site, including two oil/water separation units, an underground fuel oil storage tank, a hazardous waste storage area, a vehicle wash rack, a stormwater collection drain network and a stormwater detention pond. There are several low-lying wetland areas intermingled with the two facilities. These areas receive drainage from parking lot runoff which may be contaminated by vehicle washing and maintenance activities. A canal is also located along the site adjacent to one of the wetland areas.

### 1.2.1 Topography

Land features encountered at Fort Story consist of linear sand ridges, sand flats and wetland areas. The topography is dominated by a series of prominent linear, well-drained sand ridges that roughly bisect the Fort Story area. The central ridges trend parallel to the coastline and are characterized by maximum elevations in excess of 85 feet, National Geodetic Vertical Datum of 1929 (NGVD). A second series of sand ridges located on Fort Story are comprised of an active dune complex located adjacent to the coastline. The coastal sand ridges attain maximum elevations in excess of 25 feet NGVD. Broad, poorly drained sand flats are located adjacent to the sand ridge areas. Land surface elevations in the sand flat areas typically range between 5 and 10 feet, NGVD. Wetland areas, which are common features of the sand flats, occur locally in closed depressions. South of the central sand ridges, the Fort Story topography consists of an extensive, wooded, wetland area, formerly a back-bay, lagoonal feature. Most of the Installation's facilities and operations are confined to the sand ridge and sand flat areas.

### 1.2.2 Climate

The climate of the Fort Story area is a maritime-type climate characterized by an average annual temperature of 60 degrees Fahrenheit (° F). Winters are typically mild, with temperatures averaging 42° F. During the summer months, temperatures average 77° F and the maximum daily temperatures average 85° F. The average total annual precipitation is 45 inches; 25 inches of which is received during the months of April through September. Snowfall in the region averages 7.3 inches per year. A significant component of precipitation received during the summer months results from convective thunderstorm activity. Though the region lies north of the typical hurricane and tropical storm track, annual precipitation is occasionally augmented by the local passage of these storm events [Environmental Science and Engineering (ESE), 1988].




NOTE: THIS FIGURE NOT TO SCALE

PA/SI, FT. STORY, VA

SITE MAP
LACV-30 MAINTENANCE FACILITY

JMM James M. Montgomery

FIGURE 1-3

### 1.2.3 Hydrogeology

The Virginia Coastal Plain sediments consist of an eastward thickening wedge of generally unconsolidated, interbedded sands and clays with minor occurrences of gravel and shell fragments. Within the Fort Story area, the sediments are in excess of 3,500 feet thick and are underlain by crystalline basement rocks (Lloyd, et al., 1985). Utilizing well data from the region, Meng and Harsh (1988) determined the distribution of the principal aquifer units within these sediments. Their analyses indicated that the hydrogeologic framework of the coastal plain sediments within the Fort Story vicinity consists of a system of six aquifer units separated by intervening semi-confining units. In order of increasing depth from ground surface, these aquifers include (Meng and Harsh, 1988):

- The Columbia Aquifer, which is the water table aquifer, comprised of undifferentiated Holocene age sediments;

- The Yorktown-Eastover Aquifer, which occurs within the Yorktown and Eastover formations of Pliocene and Miocene Age, respectively;

- The Chickahominy - Piney Point Aquifer, which occurs within the Chickahominy and Piney Point formations of Eocene Age and the Old Church Formation of Oligocene Age, where present ; and

- The Upper, Middle, and Lower Potomac Aquifers, which occur within the Potomac Group of Cretaceous age.

The Columbia, Yorktown - Eastover, and Chickahominy - Piney Point Aquifers and intervening semi-confining units comprise roughly the upper one-quarter of the total thickness of the coastal plain sediments in the Fort Story area. The remaining sediment thickness, in turn, consists of the Upper, Middle and Lower Aquifers and intervening semi-confining units that comprise the Potomac Group. Groundwater chloride concentrations exceed 5,000 milligrams per liter (mg/l) at a depth of approximately 900 feet below land surface (bls) in the Fort Story vicinity (Lloyd et al., 1985). The shallower aquifers, including the Columbia, Yorktown - Eastover, Chickahominy - Piney Point, Aquia and Upper Potomac Aquifers, are characterized by transmissivities of less than 50,000 gallons per day per foot (gpd/ft). Transmissivities in the range of 50,000 to 100,000 gpd/ft are estimated for the Middle and Lower Potomac Aquifers (Lloyd et al, 1985).

Meng and Harsh (1988) indicate that the thickness of the Columbia Aquifer in the Fort Story area is approximately 120 feet and separated from the underlying Yorktown - Eastover Aquifer by the Yorktown semi-confining layer which has an approximate thickness of 40 feet. The lithology of the Columbia Aquifer is characterized primarily as Holocene beach sand and nearshore marine sand, which commonly contains pebbles, shell fragments and blocks of coquinite (Johnson, 1972). The underlying Yorktown semi-confining unit comprises the upper portion of the Yorktown formation. It is described as marine silt with occasional interbeds of fine sand and coquina (Johnson, 1972).

The Yorktown - Eastover Aquifer underlies the Yorktown confining unit and is encountered between the depths of approximately 160 and 440 feet (bls). The depths to the tops of the Chickahominy - Piney Point Aquifer and the Upper Potomac Aquifer are approximately 810 and 1,130 feet (bls), respectively. The respective thicknesses of these aquifers in the Fort Story area are 140 and 220 feet. Meng and Harsh (1988) indicate that insufficient data are available in the Fort Story vicinity for direct characterization of the thicknesses of the Middle and Lower Potomac Aquifers from well data.

The chief potable water supply in the region is the surface water reservoir system operated by the City of Norfolk. To a minor extent, potable water is obtained from groundwater sources. The Yorktown - Eastover Aquifer, occurring between the depths of 160 and 440 feet (bls), is the most significant groundwater source for potable supply [Sirrine Environmental Consultants (Sirrine), 1988]. Groundwater use at Fort Story is restricted to withdrawals from a single well located at Site 6, LARC Maintenance Area. The unavailability of construction data for this well precludes a determination of which aquifer unit provides the groundwater withdrawn from this well. Water is obtained from the well for nonpotable uses only.

Site-specific hydrogeologic characteristics of the LACV-30 Site are discussed later in Section 5.0 of this report.

## 1.3 SCOPE OF SERVICES

The scope of services for JMM's PA/SI project for the LACV-30 Site includes several different types of activities, including the site evaluation. These activities are described below.

### 1.3.1 Literature Search

JMM completed a literature search of past investigations at the LACV-30 Site to evaluate existing data. With the exception of preconstruction geotechnical borings and semi-quantitative environmental master planning studies, the site has not been previously investigated.

### 1.3.2 Site Visit

JMM visited the LACV-30 Site in August 1990 to visually inspect the facility for potentially hazardous sources that may be present. Information on site structures and topographical features were documented. This information is summarized in Section 1.2, Site Description. JMM personnel also completed a visual survey and reviewed construction drawings of drainage systems and buildings at the LACV-30 area. Following this review, it was determined that both the PN-43 and PN-49 areas contributed drainage to the wetland areas. Although the scope of services for Delivery Order 0014 was designed to investigate possible contamination at only the PN-43 area and wetlands area, JMM and the USACE expanded the field sampling plan to include additional sampling activities in the PN-49 area. This change allows for a comprehensive PA/SI at the LACV-30 Site.

### 1.3.3 Plan Preparation

JMM prepared a *Final Chemical Data Acquisition Plan (CDAP)* (JMM 1990a) prior to initiating the field program. This *CDAP* was prepared for JMM's work performed jointly under Delivery Order 0014 (LACV-30 Site) and Delivery Order 0015 [Atlantic Street Gas Station (ATGAS) Site]. The ATGAS site, also located at Fort Story, is a former WWII-era service station at which JMM is conducting additional investigations. The *CDAP* defines site conditions and previous site investigations; JMM's planned field operations, sampling and analytical procedures; data quality objectives; calibration and preventive maintenance programs; data reduction, validation, and reporting procedures; nonconformances and corrective action reporting requirements; performance audit procedures; and project organization, quality control responsibilities, and work schedules.

JMM prepared the *Final Site Safety and Health Plan (SSHP)* (JMM 1990b) to provide the field team, including subcontractors, with guidelines for ensuring a safe working environment during field activities. The intent of the *SSHP* was to stipulate measures for preventing and minimizing personal injuries and illnesses; as well as minimizing physical damage to equipment, supplies and property. The document emphasizes management responsibilities, pre-planning for all activities, medical surveillance, training, periodic work site evaluations and audits, accident investigations, record keeping, personal protective equipment (PPE), hazardous assessment criteria, site controls, decontamination procedures and general site safety requirements.

### 1.3.4 Field Investigation

JMM's LACV-30 field investigation occurred in January 1991. Soil, sediment, groundwater and surface water samples were collected at the LACV-30 Site to address environmental concerns at the PN-43 maintenance facility, PN-49 maintenance facility, bordering wetland areas and an isolated area along the beach receiving surface runoff discharges from the LACV-30 Site. The location of these sampling sites is indicated on Figure 1-4, and a description of the rationale for these locations may be found in Appendix A.

JMM drilled four soil borings and four hand auger borings at the LACV-30 Site, each having a maximum depth of 10 feet. Samples were collected from each boring and submitted to the laboratory for chemical analysis. Four monitoring wells were installed at the LACV-30 Site. One geotechnical soil sample and one groundwater sample were collected from each monitoring well location. In addition, five surface water and six sediment samples were collected from various wetland areas or surface water bodies located at the LACV-30 Site. These samples were also submitted for chemical analysis.

During the field investigation, JMM inspected the existing drainage structures of the LACV-30 Site to identify potential contaminant transport pathways to the bordering wetland areas. The qualitative assessment evaluated the operation of the drainage facilities with respect to efficiency, usefulness and appropriateness for transferring fluid media to correct disposal venues. The results of the drainage evaluations are presented in this *Preliminary Draft Site Investigation Report.*

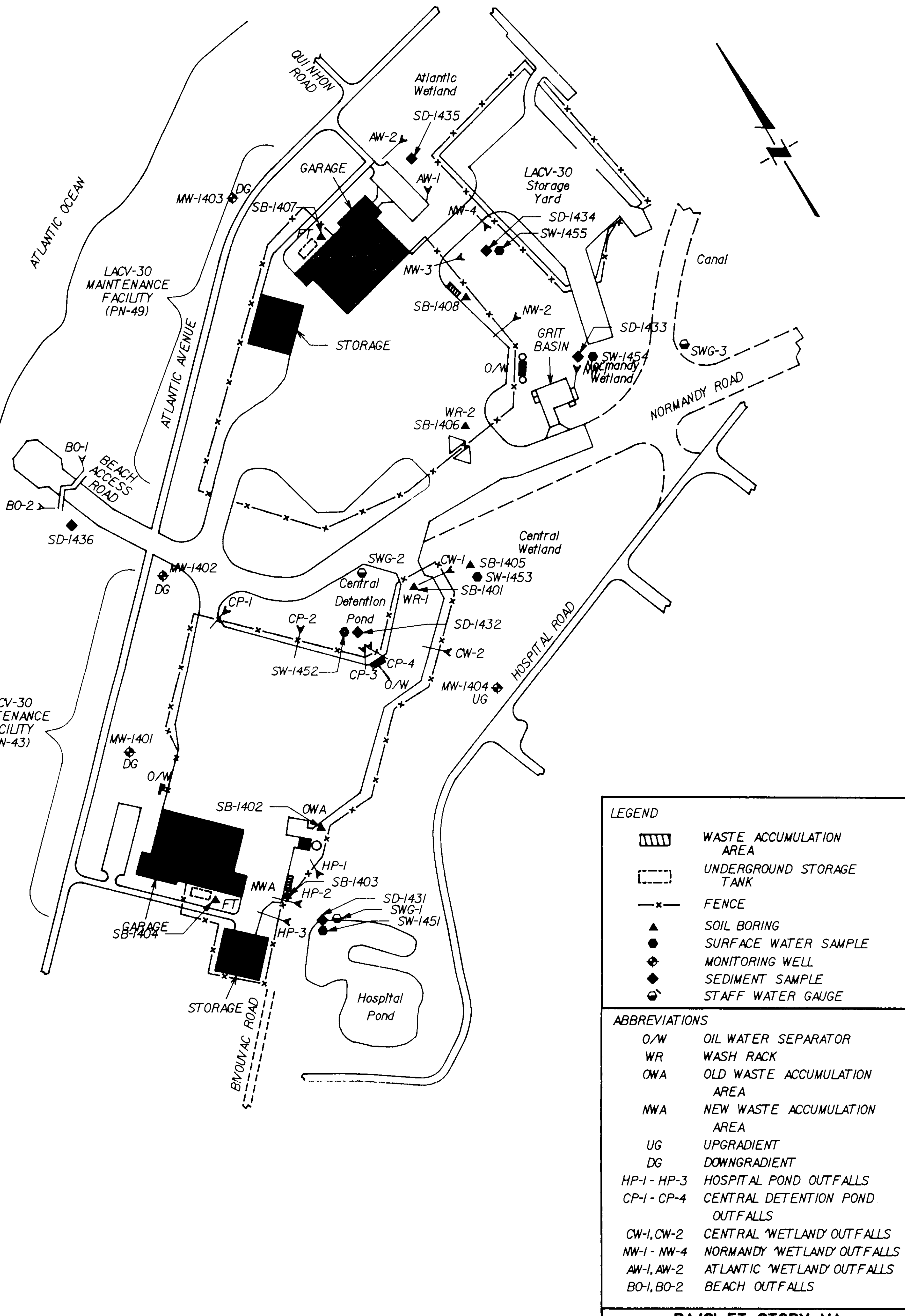
### 1.3.5 Quality Control Summary Report

JMM prepared a *Quality Control Summary Report* (*QCSR*) (JMM, 1991a) after completing the field investigative activities. The *QCSR* evaluates the effectiveness of JMM's sampling activities and discusses whether the data quality objectives (DQOs) of the field investigation were met. The term "data quality" refers to the level of uncertainty associated with the field or analytical program. DQOs are statements outlined in JMM's *CDAP* which specify the quality of data required to meet the goals of the site investigation and support decisions made during future phases of the LACV-30 PA/SI project.

DQOs are expressed in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC) and can be used to measure the performance of the sampling and analytical procedures. For example, the quality of data associated with environmental measurements can be considered a function of sampling variability, which includes the rationale of the sampling plan and procedures used to collect the samples; as well as analytical variability associated with each analytical method and the instrumentation used in making the measurements. Both sampling and analytical components include potential sources of uncertainty and biases which may affect the overall confidence in the analytical measurement. JMM's *QCSR* specifically addressed PARCC criteria associated with sampling activities.

### 1.3.6 Analytical Results Report

JMM prepared an *Analytical Results Report* (*ARR*) (JMM, 1991b) addressing the PARCC criteria associated with the analytical program. In addition, analytical data were presented in the *ARR*. Overall, JMM attained the DQOs outlined in the *CDAP*. A further discussion of the analytical program is provided in Section 3, Analytical Program Summary.




PA/SI, FT. STORY, VA

SAMPLING LOCATIONS
LACV-30 MAINTENANCE FACILITY

JMM James M. Montgomery

FIGURE 1-4

NOTE: THIS FIGURE NOT TO SCALE

## 1.4 REPORT ORGANIZATION

The field and analytical programs implemented during the project are summarized in Sections 2 and 3, respectively, of this PA/SI Report. Section 4 outlines the methodology which JMM used in conducting the PA/SI at the LACV-30 Site. Contaminant trigger levels are presented in this section, along with a matrix delineating the type of action required when contaminants exceed trigger levels. Section 5 of this PA/SI Report summarizes the site stratigraphy, groundwater flow direction, comparison of analytical results with trigger levels, site contaminant transport pathways, and LACV-30 Site drainage characteristics. Finally, Section 6 of the PA/SI Report presents conclusions regarding the significance of site contamination and recommendations for further investigative activity at the LACV-30 Site.

## 2.0 SUMMARY OF FIELD INVESTIGATION ACTIVITIES

A summary of JMM's field procedures for sampling soil, sediment, groundwater and surface water media at the LACV-30 site during the PA/SI field investigation is presented in the following sections. Additional field activities performed include in situ permeability testing, water level measurements in the four monitoring wells, and surveying to provide horizontal and vertical control for sampling locations. All samples were submitted to Montgomery Laboratories for analysis, with the exception of split samples. Split samples are external quality assurance (QA) samples which were submitted to the Missouri River Division (MRD) Laboratory, a designated Government QA laboratory. Further information regarding the collection and analysis of quality assurance and quality control samples is provided in JMM's *QCSR* and *ARR* developed for the LACV-30 Site.

## 2.1 SOIL INVESTIGATION PROGRAM

Eight soil borings were constructed at the LACV-30 Site and these are designated as SB-1401 through SB-1408. Analytical soil samples were collected from each soil boring and submitted to the laboratory for analysis of volatile organic compounds (VOCs), base/neutral/acid extractable compounds (BNAs), metals, total fuel hydrocarbons-heavy fraction (TFH-H) and pesticide/polychlorinated biphenyls (pesticide/PCBs). Four monitoring well borings were constructed at the site and these are designated as MW-1401 through MW-1404; soil samples for chemical analysis were not collected from the well borings. Instead, one geotechnical soil sample was collected from each monitoring well boring to characterize the physical properties of the soil. Soil boring construction and sampling procedures are described in the following sections.

### 2.1.1 Soil Boring Construction Procedures

Four soil borings (SB-1401, SB-1404, SB-1406 and SB-1407) were constructed using a truck mounted hollow-stem auger drill rig. Soil samples were collected from these borings using a standard stainless steel split-spoon sampler. The remaining four borings (SB-1402, SB-1403, SB-1405 and SB-1408) were advanced into the ground using a stainless steel hand auger. Soil samples were collected from these hand auger borings using a hammer drive sampler. With the exception of SB-1405, all borings were drilled to a depth of 10 feet. Boring SB-1405 was only drilled to a depth of 5 feet since the water table was encountered at this depth. All of the monitoring well borings (MW-1401, MW-1402, MW-1403 and MW-1404) were constructed using a truck-mounted hollow-stem auger drill rig.

To reconstruct the borehole lithology, JMM continuously collected down-hole soil samples for visual inspection in the field using a split-spoon sampler. Observations of these samples and characteristics of drill cuttings were recorded on "Drilling Logs." Subsurface material was described on these logs according to the Unified Soil Classification System (USCS). Samples were screened with a photoionization detector (PID) and readings were recorded on the log. Additional information documented on the Drilling Logs included drilling and sampling equipment, sample depths, depth to groundwater, a graphic log, difficulties encountered during drilling, and changes in drilling rates and conditions. Completed drilling logs for borings constructed at the LACV-30 Site are presented in Appendix C.

### 2.1.2 Soil Sampling Procedures

Soil samples were collected for chemical analysis from the following sampling depths within each boring: ground surface (i.e., from 0 to 1.5 feet), middle of the boring (i.e., 5 feet) and bottom of the boring (i.e., 10 feet). Samples from SB-1405 were only collected from the ground surface and bottom of the boring (i.e., 5 feet), since the water table was encountered at 5 feet.

For each sampling depth, the VOC sample was collected first. The VOC sample bottles were filled as completely as possible to minimize headspace in the container. Once the VOC field sample was packaged in the appropriate sample bottle, a 1-quart zip lock bag was filled half full with a subsample from the split-spoon. The bag was vigorously shaken to break up the sample, thereby exposing more surface area and facilitating transfer of volatiles into the headspace. After a 15-minute equilibration period, the seal was opened at one end, and a PID reading was taken and recorded on the Boring Log for the associated grab sample.

After the VOC and field screening samples were collected, samples for remaining analyses other than VOCs were composited in a stainless steel bowl using a stainless steel spatula. These samples were placed in appropriate glass containers and sealed with Teflon-lined caps. The portion of the split-spoon sample which represents slough was not submitted for analysis.

For each boring, only one soil sample was submitted for VOC analysis. The selection of this sample was made on the basis of PID readings; the sample with the highest associated PID reading was submitted to the laboratory. Those soil samples that were not submitted for analysis were discarded along with the drill cuttings generated during the drilling operations. A sample representing a composite of the three sampling depths (two depths for Boring SB-1405) was submitted for the analysis of BNAs, total metals, TFH-H and pesticide/PCBs.

In addition to the eight soil borings sampled for chemical analysis, four monitoring well soil borings, MW-1401, MW-1402, MW-1403 and MW-1404, were sampled for geotechnical analysis. Geotechnical soil samples were collected at a depth within the screened interval of the monitoring well. Analyses conducted on the geotechnical samples included soil particle gradation (by sieve and hydrometer), Atterburg limits, moisture content and soil classification according to the Unified Soil Classification System (USCS).

## 2.2 GROUNDWATER INVESTIGATION PROGRAM

Groundwater samples were collected from the four monitoring wells at the LACV-30 Site and were submitted to the laboratory for analysis of VOCs, BNAs, TFH-H, and total and dissolved metals. The construction, development, testing and sampling of the monitoring wells is summarized in the following sections. A detailed description of each of these procedures is given in JMM's *CDAP* (JMM, 1990a).

### 2.2.1 Monitoring Well Construction Procedures

JMM used a hollow stem auger rig to drill boreholes. Down-hole samples were continuously collected for visual inspection using a stainless steel split-spoon sampler. Observations of these soil samples and drill cuttings were recorded in drilling logs. Completed logs are provided in Appendix C. Monitoring wells were constructed in accordance with procedures outlined in JMM's *CDAP*. These procedures were developed to ensure that:

- Sloughing or caving of the well did not occur during installation;
- The top of the well screen was placed 2 feet higher than the depth at which groundwater was first encountered during drilling to intercept any potential floating product;
- The well screens were positioned without blank casing below the screen, thereby avoiding trapping a zone of contamination at the bottom of the well;
- Filter sand gradation was properly selected to prevent the entry of formation material into the well point;

- The filter pack, bentonite seal, and the grout seal are uniformly placed; and

- Wells are sealed properly to prevent contaminant infiltration into the well from the ground surface.

JMM documented construction procedures specific to each well on the Monitoring Well Construction Diagrams. These diagrams are presented in Appendix C.

### 2.2.2 Monitoring Well Development Procedures

Monitoring wells were developed by bailing and surging each well to remove fine aquifer material adjacent to the screened interval. A surge block was plunged up and down in the perforated casing to produce a surging effect. Groundwater and other material collected in the well was pumped out. At least as much water that was introduced into the well during drilling was removed during development.

Water temperature, pH, turbidity and specific conductance [i.e., electrical conductivity (EC)] were measured periodically during development. Results were documented on Well Development Logs. A copy of these logs is provided in Appendix C. All wells were developed for a minimum of four hours or until a minimum of five well volumes were removed from the well. The well was considered developed when the required time period had passed or well volumes were removed and the measured parameters stabilized. Upon completion of the development process, approximately one liter of water from the well was collected in a clear glass jar. The containerized water was labeled and photographed to show the water's degree of clarity. Photographs will be included in JMM's *Final Preliminary Assessment/Site Investigation Report.*

### 2.2.3 Permeability Tests

JMM determined the *in situ* permeability of soils within the four monitoring well borings following well development. The rising head slug test method was used to determine *in situ* permeability. This method involved the use of a transducer, a data logger, and a slug bar of known volume. The procedure involved placing a transducer in the well that measured pressure changes. The slug bar was introduced following the placement of the transducer, and the change in head in the well was measured by the transducer and recorded by the data logger over time until the water receded to the static level. The slug bar was then withdrawn and the change in head in the well was measured again by the transducer. Measurement continued until the water returned to the static level. Results of the permeability tests are presented in Appendix C.

### 2.2.4 Groundwater Level Measurement

Water level measurements were taken with an electronic, dual phase oil/water interface level meter. The water level was measured within an accuracy of 0.01 feet. The water level for each monitoring well was measured on four separate occasions using a dual phase oil/water interface level meter. Two water level measurements were recorded: the distance from the top of casing to the water interface and the distance from top of casing to the bottom of the monitoring well. The water level measurements were taken at the time the well was completed and then again 24 hours after completion. These depths were recorded on the Drilling Log (see Appendix C). Forty-eight hours after the fourth monitoring well was installed and developed, a complete round of water levels were measured within a 24-hour time period. These results were recorded in the field log book. Finally, the water level in each well was measured prior to sampling the well. Results were documented on the Well Development Logs (see Appendix C).

### 2.2.5 Groundwater Sampling Procedures

As discussed in Section 2.2.4, the water level was measured in each well prior to sampling. This depth was used to compute the amount of one well volume by subtracting the depth to water from the total depth of the monitoring well. A minimum of three well volumes of groundwater were purged from each well prior to sampling. Purging of wells was performed with a Teflon bailer.

Water temperature, pH, turbidity and EC were periodically measured during purging operations. These parameters were measured four to six times during purging. The purging process was terminated when a minimum of three well volumes were removed and the temperature, pH, turbidity and EC parameters stabilized.

The monitoring wells were sampled by slowly lowering the Teflon bailer attached to a nylon rope into the well. After the bailer was filled with water, the bailer was removed from the well and the water was transferred into the appropriate sample containers. Samples were submitted to the laboratory for the analysis of VOCs, BNAs, TFH-H, total metals and dissolved metals. VOC sample bottles were filled as completely as possible so no headspace was present. Dissolved metal samples were filtered in the field using a 45-micron filter and a peristaltic pump. A field duplicate, matrix spike (MS), matrix spike duplicate (MSD), rinsate blank (RB) sample, and associated field split samples were collected from MW-1401. A trip blank sample was included in each cooler that contained VOC samples to identify possible sample contamination introduced during sample transport, shipping and site storage conditions.

## 2.3 SEDIMENT SAMPLING PROGRAM

JMM collected sediment samples from six locations, designated as SD-1431 through SD-1436, at the LACV-30 Site. A stainless steel trowel was used to collect sediment grab samples. Three separate grabs of sediment within a 5-foot to 6-foot radius for each sample location were composited in a stainless steel bowl prior to transfer to the sample bottles. Composite samples submitted for analysis include BNAs, TFH-H, pesticide/PCBs and metals. A field duplicate and field split sample were collected from SD-1436.

## 2.4 SURFACE WATER SAMPLING PROGRAM

JMM collected surface water samples at five locations at the LACV-30 Site: SW-1451, SW-1452, SW-1453, SW-1454 and SW-1455. Surface water samples were collected by lowering an open, precleaned, glass sample bottle horizontally into the water at the designated sample collection point, or by using a peristaltic pump. Using the former technique, as water began to run into the bottle, the bottle was turned upright, keeping the lip just under the surface so only surface water was collected. If the water was not deep enough to turn the bottle upright, the bottle was held at an angle as steep as possible with the lip remaining just under the surface. After the glass sample bottle was filled, the surface water sample was transferred to appropriate sample bottles.

Surface water samples for dissolved metals analysis were collected using a battery-powered peristaltic pump. Prior to placement in the sample bottles, the collected surface water was filtered through an in-line 0.45-micron filter. Effluent water from the filter was suitable for dissolved metals analysis.

Samples were submitted to the laboratory for the analysis of total metals, dissolved metals and TFH-H. Duplicate, rinsate blank and associated split samples were collected from SW-1453. A trip blank sample was included with each cooler that contained VOC samples.

## 2.5 EQUIPMENT DECONTAMINATION PROCEDURES

JMM cleaned and decontaminated equipment used during drilling and sampling activities to prevent cross-contamination between sampling locations and sampling depths. The drill rig, drill pipes and drill tools were steam cleaned prior to drilling each boring. All equipment used during sampling was decontaminated with an Alconox wash, tap water rinse, 10 percent methanol (pesticide grade) rinse, and triple distilled water rinse prior to use. This equipment includes the split-spoon sampler, auger, stainless steel bowl, trowel and spoon, oil/water interface level meter, bailer and glass bottle used for surface water sampling.

The tap water and distilled water were sampled and submitted to the laboratory for chemical analysis to determine if target analytes were present in the water used for decontamination. These water samples are referred to as "source water" samples.

## 2.6 HEALTH AND SAFETY ACTIVITIES

This section details the health and safety measures that were used to protect project personnel during field investigation activities at the LACV-30 Site. The U.S. Occupational Safety and Health Administration (OSHA) requires employers involved in hazardous waste activities to comply with Title 29 (OSHA) of the Code of Federal Regulations, Part 1910, Section 120 (29 CFR 1910.120) ["Hazardous Waste Operations and Emergency Response"]. The *Final Site Safety and Health Plan (SSHP)* (JMM 1990b) was prepared prior to the start of all field work to stipulate measures for compliance with OSHA, U.S. EPA, and state and local health requirements pertaining to site investigatory activities (JMM, 1990b).

### 2.6.1 Site Safety and Health Plan

The *SSHP* (JMM, 1990b), approved by the USACE, stipulates measures for providing health and safety protection during field activities. The intent of the *SSHP* is to promote a safe working environment by stipulating measures for minimizing personal injuries and illness, as well as physical damage to equipment, supplies and property. The *SSHP* details several response plans to comply with the requirements outlined in COE 385-USACE-1-1 *Safety and Health Requirements Manual* (USACE, 1989). Personal protective equipment (PPE), including air monitoring devices and protective clothing, and action levels for upgrading PPE were also discussed in the *SSHP*. All plans and response actions met or exceeded State and Federal OSHA requirements. All personnel involved in the field activities were required to read and understand the *SSHP* and sign the final page as an acknowledgment.

### 2.6.2 Safety Meetings

A preliminary site health and safety meeting was conducted prior to commencement of field investigation activities. JMM's Project Safety Officer conducted the briefing to indoctrinate all field personnel participating in LACV-30 field activities. In addition to the project kick-off safety meeting, Field Investigation Team (FIT) Leaders presented health and safety briefings to the FIT members each day to discuss pertinent site specific safety topics, potential hazards or changes in site conditions which might affect hazard potential. These briefings were called Tailgate Safety Meetings. On a daily basis, field personnel were required to read and sign the Tailgate Safety Meeting forms before working at a project site.

## 2.7 SURVEYING

The four soil borings, four hand auger soil borings and four monitoring wells constructed at the LACV-30 Site were surveyed by Baldwin & Gregg, Ltd. The horizontal and vertical location of each point specified were determined. The horizontal control of each point was referenced to the

State Plane Coordinate System and the vertical control was referenced to the National Geodetic Vertical Datum (NGVD) of 1929. Surface water levels were surveyed at three surface water staff gauges. The survey activities for the surface water staff gauges only provided vertical control with respect to NGVD. Survey results are provided in Table 2-1.

## TABLE 2-1

## SURVEYING RESULTS - LACV-30 MONITORING WELLS
## FORT STORY, VIRGINIA

| Location | Ground Elevation (ft., NGVD)[c] | TOC[b] (ft., NGVD) | VSPCS[a] | |
|---|---|---|---|---|
| | | | Northing | Easting |
| MW-1401 | 17.33 | 20.11 | 225043.6740 | 2719373.1720 |
| MW-1402 | 23.69 | 26.20 | 225488.7030 | 2719811.0790 |
| MW-1403 | 21.14 | 23.67 | 226093.5510 | 2720560.7270 |
| MW-1404 | 9.9 | 13.04 | 224682.2840 | 2720269.6160 |
| SB-1401 | 13.09 | NA[d] | 225023.8640 | 2720202.6440 |
| SB-1402 | 19.04 | NA | 224740.7450 | 2719992.4460 |
| SB-1403 | 16.22 | NA | 224507.6910 | 2719523.9620 |
| SB-1404 | 17.32 | NA | 224627.4780 | 2719322.8400 |
| SB-1405 | 9.52 | NA | 224815.4300 | 2720243.5780 |
| SB-1406 | 12.59 | NA | 225307.0360 | 2720592.8710 |
| SB-1407 | 17.00 | NA | 225986.0090 | 2720533.6860 |
| SB-1408 | 18.30 | NA | 225696.7370 | 2720724.2930 |
| SWG-1 | 7.70 | NA | — | — |
| SWG-2 | 7.49 | NA | — | — |
| SWG-3 | 7.61 | NA | — | — |

(a) Commonwealth of Virginia State Plane Coordinate System (VSPCS)
(b) TOC = top of casing
(c) National Geodetic Vertical Datum of 1929 (NGVD)
(d) NA = not applicable

## 3.0 ANALYTICAL PROGRAM SUMMARY

The field investigation at the LACV-30 Site consisted of collecting soil, sediment, groundwater and surface water samples. Samples of the source waters (i.e., tap water and distilled water) used during decontamination were also collected for quality control purposes. Eight soil borings and four monitoring wells were constructed at the site. Soil samples were collected from each of the eight soil borings and submitted to the laboratory for chemical analysis. A geotechnical soil sample was the only soil sample collected from each of the monitoring well borings constructed at the site. Groundwater samples were collected from each of the four monitoring wells and submitted for chemical analysis. In addition, six sediment samples and five surface water samples were collected from various outfalls, ponds and wetland areas at the LACV-30 Site and submitted for chemical analysis. Quality control (QC) and quality assurance (QA) samples were collected as part of the field investigation activities. The frequency of QA/QC samples collected, which included duplicate, split, matrix spike, matrix spike duplicate, rinsate blank and trip blank samples, was documented in the *Quality Control Summary Report (QCSR)* (JMM, 1991a). The results of the field and QC samples, as well as a summary of analytical data quality, were presented in the *Analytical Results Report (ARR)* (JMM, 1991b). A review of the types of field samples collected at the LACV-30 Site, and the analyses performed on these samples, is provided in Table 3-1.

## 3.1 ANALYTICAL METHODS

Analytical methods used to analyze field and QC samples, with the exception of TFH-H analysis, are described in *Test Methods for Evaluating Solid Waste, EPA SW-846* (EPA, 1986a). The TFH-H analysis is a modified version of EPA Method 8015, described in the State of California's *Leaking Underground Fuel Tank Manual -- Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure* (State of California, 1989). Analytical methods used to evaluate LACV-30 project samples are referenced in Table 3-2. Method reporting limits (MRLs) are the minimum concentrations of analytes that can be detected with a known confidence level. The MRLs for VOC, BNA, pesticides/PCB, metals and TFH-H compounds within the water and soil matrices are presented in Tables 3-3 through 3-7, respectively.

Analytical results for the LACV-30 field samples are presented in Appendix D, Tables D-1 through D-15. Analytical results for QC samples (i.e., duplicate, matrix spike, matrix spike duplicate, rinsate blank and trip blank samples) were documented in JMM's *ARR* (JMM, 1991b). Compounds detected at concentrations greater than the MRL are designated in a boldface font. Tables D-1 and D-2 present VOC results for soil and groundwater samples, respectively. Tables D-3 through D-5 present BNA results for soil, sediment and groundwater samples, respectively. Tables D-6 and D-7 present pesticide/PCB results for soil and sediment samples, respectively. Tables D-8 through D-11 present metals results for soil, sediment, groundwater and surface water samples, respectively. Tables D-12 through D-15 present TFH-H results for soil, sediment, groundwater and surface water samples.

## 3.2 ANALYTICAL QUALITY CONTROL PROGRAM

A detailed review of the quality control data was presented in the *ARR* (JMM, 1991b). The results of QC samples were evaluated on the basis of data quality objectives (DQOs) established for the project. The DQOs are expressed in terms of precision, accuracy, representativeness, completeness and comparability (PARCC). Precision was evaluated using the results of the matrix spike/matrix spike duplicate (MS/MSD) sample pairs, laboratory control sample (LCS) pairs and field duplicate sample pairs. Accuracy was evaluated using the analytical results from MS, MSD, LCS and surrogate spike samples. The representativeness of the analytical data was evaluated by the results of method blank, trip blank and rinsate blank samples. Completeness was determined by holding time criteria and the acceptability of data following review. Comparability was

## TABLE 3-1

## SUMMARY OF CHEMICAL ANALYSES PERFORMED ON FIELD SAMPLES COLLECTED AT THE LACV-30 SITE

| Sample ID | Matrix | Chemical Parameter Analyzed per Sample[a] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | VOCs | BNAs | Total Metals | Dissolved Metals | Pest/PCBs | TFH-H | Geotechnical |
| SB-1401 | soil | X | X | X | | X | X | |
| SB-1402 | soil | X | X | X | | X | X | |
| SB-1403 | soil | X | X | X | | X | X | |
| SB-1404 | soil | X | X | X | | X | X | |
| SB-1405 | soil | X | X | X | | X | X | |
| SB-1406 | soil | X | X | X | | X | X | |
| SB-1407 | soil | X | X | X | | X | X | |
| SB-1408 | soil | X | X | X | | X | X | |
| MS-1401 | soil | | | | | | | X |
| MS-1402 | soil | | | | | | | X |
| MS-1403 | soil | | | | | | | X |
| MS-1404 | soil | | | | | | | X |
| MW-1401 | groundwater | X | X | X | X | | X | |
| MW-1402 | groundwater | X | X | X | X | | X | |
| MW-1403 | groundwater | X | X | X | X | | X | |
| MW-1404 | groundwater | X | X | X | X | | X | |
| SD-1431 | sediment | | X | X | | X | X | |
| SD-1432 | sediment | | X | X | | X | X | |
| SD-1433 | sediment | | X | X | | X | X | |
| SD-1434 | sediment | | X | X | | X | X | |
| SD-1435 | sediment | | X | X | | X | X | |
| SD-1436 | sediment | | X | X | | X | X | |
| SW-1451 | surface water | | | X | X | | X | |
| SW-1452 | surface water | | | X | X | | X | |
| SW-1453 | surface water | | | X | X | | X | |
| SW-1454 | surface water | | | X | X | | X | |
| SW-1455 | surface water | | | X | X | | X | |

(a) All samples collected, except for VOC samples, were composites of three sampling depths (two at Boring SB-1405). VOC samples were collected as grab samples.

VOCs - volatile organic compounds
BNAs - base/neutral/acid organic compounds
Pest/PCBs - pesticides/polychlorinated biphenyls
TFH-H - total fuel hydrocarbons - heavy fraction

**TABLE 3-2**

**ANALYTICAL METHOD REFERENCES**

| Analyte | Soil Matrix Method Number | Water Matrix Method Number | Reference |
|---|---|---|---|
| VOCs | 8240 | 8240 | SW-846[a] |
| BNAs | 3550/8270 | 3510/8270 | SW-846 |
| Pesticide/PCBs | 3550/8080 | 3510/8080 | SW-846 |
| TFH-H | 8015 (mod.) | 8015 (mod.) | CA LUFT[b] |
| Total and Dissolved Metals | | | |
| Antimony | 3050/6010 | 3005/6010 | SW-846 |
| Arsenic | 3050/6010 | 7060 | SW-846 |
| Barium | 3050/6010 | 3005/6010 | SW-846 |
| Beryllium | 3050/6010 | 3005/6010 | SW-846 |
| Cadmium | 3050/6010 | 3005/6010 | SW-846 |
| Chromium, Total | 3050/6010 | 3005/6010 | SW-846 |
| Copper | 3050/6010 | 3005/6010 | SW-846 |
| Lead | 3050/6010 | 7421 | SW-846 |
| Mercury | 7471 | 7470 | SW-846 |
| Nickel | 3050/6010 | 3005/6010 | SW-846 |
| Selenium | 3050/6010 | 7740 | SW-846 |
| Silver | 3050/6010 | 3005/6010 | SW-846 |
| Thallium | 3050/6010 | 7841 | SW-846 |
| Zinc | 3050/6010 | 3005/6010 | SW-846 |

(a) U.S. Environmental Protection Agency (EPA), 1986a. *Test Methods for Evaluating Solid Waste (SW-846): Physical/Chemical Methods*. Third Edition. Office of Solid Waste.

(b) State of California, 1989. *Leaking Underground Fuel Tank Manual -- Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure*. LUFT Task Force.

## TABLE 3-3

## METHOD REPORTING LEVELS FOR VOCS
## METHOD 8240

| Analyte | Water Matrix µg/L | Soil Matrix mg/kg |
|---|---|---|
| Acetone | 10 | 0.25 |
| Acrolein | 1 | 0.025 |
| Acrylonitrile | 1 | 0.025 |
| Benzene | 0.5 | 0.01 |
| Bromoform | 0.5 | 0.01 |
| 2-Butanone (MEK) | 1 | 0.025 |
| Carbon Disulfide | 0.5 | 0.01 |
| Carbon Tetrachloride | 0.5 | 0.01 |
| Chlorobenzene | 0.5 | 0.01 |
| Chloroethane | 1 | 0.025 |
| 2-Chloroethylvinylether | 1 | 0.025 |
| Chloroform | 0.5 | 0.01 |
| Dibromochloromethane | 0.5 | 0.01 |
| 1,2-Dichlorobenzene | 0.5 | 0.01 |
| 1,3-Dichlorobenzene | 0.5 | 0.01 |
| 1,4-Dichloroethene | 0.5 | 0.01 |
| Dichlorobromomethane | 0.5 | 0.01 |
| 1,1-Dichloroethane | 0.5 | 0.01 |
| 1,2-Dichloroethane | 0.5 | 0.01 |
| 1,1-Dichloroethene | 0.5 | 0.01 |
| cis-1,2-Dichloroethene | 0.5 | 0.01 |
| trans-1,2-Dichloroethene | 0.5 | 0.01 |
| 1,2-Dichloropropane | 0.5 | 0.01 |
| cis-1,3-Dichloropropene | 0.5 | 0.01 |
| trans-1,3-Dichloropropene | 0.5 | 0.01 |
| Ethylbenzene | 0.5 | 0.01 |
| 2-Hexanone | 1 | 0.025 |
| Methyl Bromide | 1 | 0.025 |
| Methyl Chloride | 1 | 0.025 |
| 4-Methyl-2-Pentanone (MIBK) | 1 | 0.025 |
| Methylene Chloride | 5 | 0.1 |
| Styrene | 0.5 | 0.01 |
| 1,1,2,2-Tetrachloroethane | 0.5 | 0.01 |
| Tetrachloroethene | 0.5 | 0.01 |
| Tetrahydrofuran | 10 | 0.25 |
| Toluene | 0.5 | 0.01 |
| 1,1,1-Trichloroethane | 0.5 | 0.01 |
| 1,1,2-Trichloroethane | 0.5 | 0.01 |
| Trichloroethene | 0.5 | 0.01 |
| Trichlorofluoromethane | 1 | 0.025 |
| Vinyl Acetate | 5 | 0.1 |
| Vinyl Chloride | 1 | 0.025 |
| m,p-Xylenes | 0.5 | 0.01 |
| o-Xylene | 0.5 | 0.01 |

## TABLE 3-4

## METHOD REPORTING LEVELS FOR BNA EXTRACTABLE ORGANICS METHOD 8270

| Analyte | Water Matrix µg/L | Soil Matrix mg/kg |
|---|---|---|
| Acenaphthene | 5 | 1 |
| Acenaphthylene | 5 | 1 |
| Aniline | 5 | 1 |
| Anthracene | 5 | 1 |
| Benzidine | 50 | 10 |
| Benzo(a)anthracene | 5 | 1 |
| Benzo(a)pyrene | 5 | 1 |
| Benzo(b)fluoranthene | 5 | 1 |
| Benzo(g,h,i)perylene | 10 | 2 |
| Benzo(k)fluoranthene | 5 | 1 |
| Benzoic Acid | 50 | 10 |
| Benzyl Alcohol | 5 | 1 |
| bis(2-Chloroethoxy)methane | 10 | 2 |
| bis(2-Chloroisopropyl)ether | 10 | 2 |
| bix(2-Chloroethyl)ether | 10 | 2 |
| bis(2-Ethylhexyl)phthalate | 20 | 4 |
| 4-Bromophenylphenylether | 5 | 1 |
| Butylbenzylphthalate | 5 | 1 |
| 4-Chloroaniline | 5 | 1 |
| 2-Chloronaphthalene | 5 | 1 |
| 2-Chlorophenol | 5 | 1 |
| 4-Chlorophenylphenylether | 5 | 1 |
| Chrysene | 5 | 1 |
| Di-n-butylphthalate | 10 | 2 |
| Di-n-octylphthalate | 10 | 2 |
| Dibenzo(a,h)anthracene | 10 | 2 |
| Dibenzofuran | 5 | 1 |
| 1,2-Dichlorobenzene | 5 | 1 |
| 1,3-Dichlorobenzene | 5 | 1 |
| 1,4-Dichlorobenzene | 5 | 1 |
| 3,3-Dichlorbenzidine | 50 | 10 |
| 2,4-Dichlorophenol | 5 | 1 |
| Diethylphthalate | 5 | 1 |
| 2,4-Dimethylphenol | 5 | 1 |
| Dimethylphthalate | 5 | 1 |
| 4,6-Dinitro-o-cresol | 50 | 10 |
| 2,4-Dinitrophenol | 50 | 10 |
| 2,4-Dinitrotoluene | 5 | 1 |
| 2,6-Dinitrotoluene | 5 | 1 |
| Diphenylhydrazine | 10 | 2 |
| Fluoranthene | 5 | 1 |
| Fluorene | 5 | 1 |
| Hexachlorobenzene | 5 | 1 |
| Hexachlorobutadiene | 10 | 2 |
| Hexachlorocyclopentadiene | 10 | 2 |
| Hexachloroethane | 5 | 1 |
| Indeno (1,2,3-c,d) pyrene | 10 | 2 |
| Isophorone | 5 | 1 |

**TABLE 3-4**
**(Continued)**

**METHOD REPORTING LEVELS FOR BNA EXTRACTABLE ORGANICS METHOD 8270**

| Analyte | Water Matrix µg/L | Soil Matrix mg/kg |
|---|---|---|
| 2-Methylnaphthalene | 5 | 1 |
| 2-Methylphenol | 5 | 1 |
| 4-Methylphenol | 5 | 1 |
| N-Nitrosodi-N-propylamine | 5 | 1 |
| N-Nitrosodimethylamine | 5 | 1 |
| N-Nitrosodiphenylamine | 5 | 1 |
| Naphthalene | 5 | 1 |
| 2-Nitroaniline | 10 | 2 |
| 3-Nitroaniline | 20 | 4 |
| 4-Nitroaniline | 20 | 4 |
| Nitrobenzene | 5 | 1 |
| 2-Nitrophenol | 5 | 1 |
| 4-Nitrophenol | 10 | 2 |
| p-Chloro-m-cresol | 5 | 1 |
| Pentachlorophenol | 10 | 2 |
| Phenanthrene | 5 | 1 |
| Phenol | 5 | 1 |
| Pyrene | 5 | 1 |
| 1,2,4-Trichlorobenzene | 5 | 1 |
| 2,4,5-Trichlorophenol | 5 | 1 |
| 2,4,6-Trichlorophenol | 5 | 1 |

## TABLE 3-5

## METHOD REPORTING LEVELS FOR ORGANOCHLORINE PESTICIDES/PCBS METHOD 8080

| Analyte | Water Matrix µg/L | Soil Matrix mg/kg |
|---|---|---|
| Aldrin | 0.02 | 0.02 |
| Arochlor 1016 | 0.1 | 0.02 |
| Arochlor 1221 | 0.2 | 0.04 |
| Arochlor 1232 | 0.1 | 0.02 |
| Arochlor 1242 | 0.1 | 0.02 |
| Arochlor 1248 | 0.1 | 0.02 |
| Arochlor 1254 | 0.1 | 0.02 |
| Arochlor 1260 | 0.1 | 0.02 |
| BHC, alpha- | 0.02 | 0.02 |
| BHC, gamma- (Lindane) | 0.02 | 0.02 |
| BHC, beta- | 0.02 | 0.02 |
| BHC, delta- | 0.02 | 0.02 |
| Chlordane | 0.2 | 0.04 |
| DDD p,p'- | 0.02 | 0.02 |
| DDE p,p'- | 0.02 | 0.02 |
| DDT p,p'- | 0.02 | 0.02 |
| Dieldrin | 0.02 | 0.02 |
| Encosulfan I (alpha) | 0.02 | 0.02 |
| Endosulfan II (beta) | 0.02 | 0.02 |
| Endosulfan sulfate | 0.02 | 0.02 |
| Endrin | 0.01 | 0.01 |
| Endrin Aldehyde | 0.02 | 0.02 |
| Endrin ketone | 0.02 | 0.02 |
| Heptachlor | 0.01 | 0.01 |
| Heptachlor Epoxide | 0.01 | 0.01 |
| Methoxychlor | 0.5 | 0.5 |
| Toxaphene | 0.5 | 0.5 |
| Kepone | 0.5 | 0.5 |

TABLE 3-6

METHOD REPORTING LEVELS
METALS

| Method Technique | Analyte | Water Matrix µg/L | Soil Matrix mg/kg |
|---|---|---|---|
| ICP | | | |
| 6010 | Silver | 10 | 1.0 |
| 6010 | Arsenic | NA | 10 |
| 6010 | Barium | 100 | 10 |
| 6010 | Beryllium | 5 | 0.5 |
| 6010 | Cadmium | 5 | 0.5 |
| 6010 | Chromium | 10 | 1.0 |
| 6010 | Copper | 10 | 1.0 |
| 6010 | Lead | NA | 10 |
| 6010 | Nickel | 40 | 4.0 |
| 6010 | Antimony | 50 | 5.0 |
| 6010 | Selenium | NA | 5.0 |
| 6010 | Thallium | NA | 10 |
| 6010 | Zinc | 20 | 2.0 |
| Cold Vapor AA | | | |
| 7470/7471 | Mercury | 0.2 | 0.02 |
| Furnace AA | | | |
| 7060 | Arsenic | 5(a) | NA |
| 7740 | Selenium | 5(a) | NA |
| 7421 | Lead | 2(a) | NA |
| 7841 | Thallium | 10(a) | NA |

NA - Not applicable

(a) Unfiltered samples (i.e., total metals analysis) have detection limits that are 5 times the detection limit indicated.

TABLE 3-7

METHOD REPORTING LEVELS
FOR TFH-H COMPOUNDS USING
MODIFIED 8015 METHOD

| Analyte | Water Matrix mg/L | Soil Matrix mg/kg |
|---|---|---|
| TFH-Heavy | 0.1 | 10 |

maximized by using standard analytical methods and units of measurement. The results of the QC sample evaluation are used to determine the acceptability of the associated field data for use in future project phases.

Based on the results of the QC sample analyses, JMM attained the precision and accuracy goal of the LACV-30 Site PA/SI project. Results from the method blank, trip blank and rinsate blank samples indicate that the data for the LACV-30 project are representative of environmental conditions at the site. The detection of chloroform and copper in SLCVMW1401 may be considered as suspect results, since these compounds were detected in the associated rinsate blank sample at approximately the same concentrations. The degree of completeness for acceptable data, which is based on QC sample results and holding time criteria, was greater than the 90 percent goal for the project. Standard methods of analysis and units of measure were used throughout the project to maximize data comparability.

Overall, JMM attained the DQOs outlined in the *Chemical Data Acquisition Plan* (JMM, 1990a). The project data are considered acceptable and may be used with a high degree of confidence to evaluate environmental conditions at the LACV-30 Site.

## 4.0 PRELIMINARY ASSESSMENT/SITE INVESTIGATION METHODOLOGY

Analytical results from the LACV-30 field investigation were used to confirm the presence or absence of significant contamination in site soils, sediments, groundwater and surface waters; assess the potential for contaminant migration into the surrounding wetland areas; and define future investigations or other actions required. To provide a basis for evaluating the data, media-specific trigger levels were developed for each analyte detected in the field samples. The trigger levels are based on statistically-significant site background data, or on regulatory standards promulgated by the EPA or the Commonwealth of Virginia for the compounds of concern.

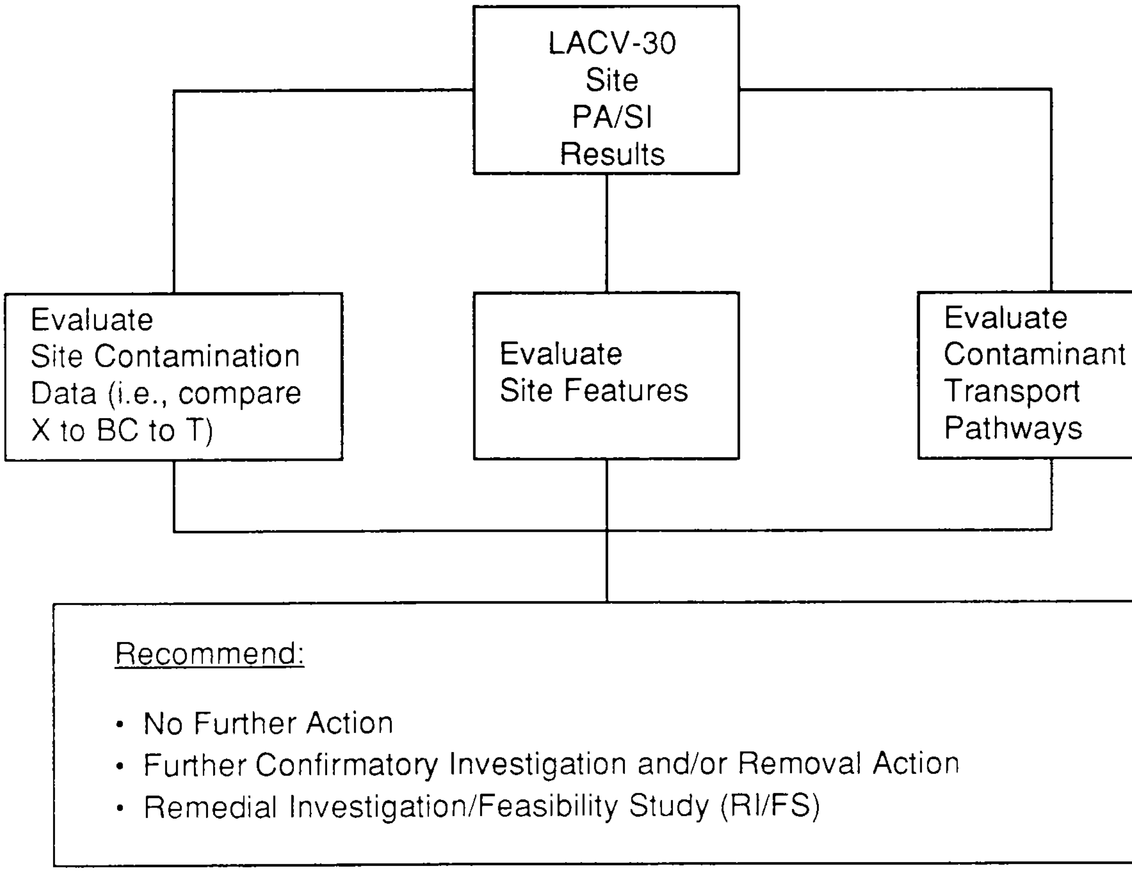
The selection of the type of further investigation that is appropriate for the LACV-30 Site is based on comparison of analytical results to trigger levels for compounds of concern, evaluation of site contaminant transport pathways for compounds of concern, and consideration of pertinent site features. The assessment of site contamination data involves comparison of contaminant concentrations measured in site media to appropriate background concentrations and/or trigger levels. This interpretation is not strictly quantitative, however. For example, if one contaminant is detected at a level above the trigger level in the groundwater from an isolated monitoring well, this factor would not necessarily constitute recommending further investigative activity. However, if the presence of this contaminant in the groundwater was indicative of the presence of a plume or a source at the site, further study would be recommended. Other data, such as site features and contaminant transport pathways, are relevant for consideration in this context and in those instances where multiple site contaminants are present in site media at levels above background but below trigger levels. Figure 4-1 is a matrix showing the decision and recommendation process for the LACV-30 Site PA/SI project. The possible additional site activities presented in order of increasing levels of effort required are:

- **No Further Action**: This option may be recommended when analyte concentrations in site environmental media are at or below typical background concentrations. In this instance, trace levels of compounds in environmental media are probably not related to site operations or discharges.

- **Further Confirmatory Investigation and/or Removal Action**: This option may be recommended when concentrations of a limited number of compounds of concern in site environmental media are above the trigger levels. Additional confirmatory investigations might focus on particular media, compounds of concern or site locations in an attempt to verify existing data. Removal action denotes mitigation of possibly contaminated material or media present at the site to reduce or eliminate potential contaminant transport.

- **Remedial Investigation/Feasibility Study (RI/FS)**: This option may be recommended when concentrations of many compounds of concern in site environmental media are above the corresponding trigger levels or when data possibly indicate the presence of a contaminated groundwater plume. An RI involves focused additional investigation to confirm source areas and delineate the nature and extent of environmental contamination. A public health/environmental assessment to characterize risk associated with site contaminants may also be a component of the RI/FS process. An FS identifies, evaluates and recommends appropriate remedial alternatives.

Trigger levels are used as a mechanism to screen the LACV-30 analytical results to determine whether there is sufficient cause to warrant further inquiry into site conditions. As such, they are generally not intended to be action levels in a regulatory sense. The following sections outline the steps taken by JMM in developing trigger levels for compounds detected in the LACV-30 field samples.




X = Detected Concentration of Analyte
BC = Background Concentration of Analyte
T = Trigger Level Concentration of Analyte

**PA/SI, LACV-30 Site**
**Ft. Story, VA**

**Decision Matrix**

JMM James M. Montgomery Consulting Engineers, Inc.

**Figure 4-1**

## 4.1 SOIL/SEDIMENT TRIGGER LEVELS

Dieldrin, DDT, DDE, toluene, total fuel hydrocarbons - heavy fraction (TFH-H), cadmium, chromium, copper, mercury and zinc were detected in LACV-30 soil/sediment samples collected during the LACV-30 Site PA/SI project. Of these compounds, TFH in soil/sediment is the only parameter for which a trigger level has been developed based on relevant regulations. Trigger levels for metals in soil/sediment detected in soil/sediment samples have been derived from a statistical analysis of the metals concentrations in background borings at Fort Story. Trigger levels have not been developed for DDE and Dieldrin in soil/sediment; these compounds were commonly used for pest control throughout the Installation in the past and warrant special consideration which is discussed in Sections 4.1.2 and 4.1.3. Trigger levels have not been developed for volatile organic compounds (VOCs) in soil/sediment media.

### 4.1.1 Total Fuel Hydrocarbon (TFH) Trigger Level

Contaminant-specific guidelines for hydrocarbons in soil are provided in *Underground Storage Tanks: Technical Standards and Corrective Action Requirements VR-680-13-02* (Commonwealth of Virginia, 1989). Based on these regulations, any contaminated soil exhibiting a total fuel hydrocarbon level in excess of 100 parts per million (ppm) or 100 milligrams per kilogram (mg/kg) must be disposed of in accordance with state and federal guidelines. Although this criterion is disposal related, the specified concentration level (100 mg/kg) was adopted for this evaluation as a relevant regulatory-based trigger level for TFH in soil.

### 4.1.2 DDE Trigger Level

JMM's review of previous investigations conducted at Fort Story suggests that DDT, DDD, DDE and Chlordane were widely used at Fort Story as these analytes were detected during past sampling activities (USAEHA, 1987; ESE, 1988). Pesticide service was supplied to Fort Story through an Inter Service Support Agreement (ISSA) with the U.S. Navy Public Works Center (PWC), Norfolk, Virginia, and the PWC used Building 755 at Fort Sotry as a mixing facility (Astore, 1987). JMM determined through contacts with Commonwealth of Virginia employees associated with Virginia Polytechnic Institute and State University and Consolidated Laboratory Services, Pesticide Lab, that the concentrations of DDT and its metabolites, DDD and DDE, and Chlordane present at the soil sampling sites at Fort Story were not unusual compared to other areas in Virginia, given that DDT and Chlordane have been extensively used at the Installation in the past. Both contacts considered JMM's analyte concentrations to be within a reasonable range for concentrations of DDT and its metabolites, as well as Chlordane, within the soils in the area of the project sites (Personal Communication, Young, Chase, July 1991). Subsequently, JMM has not established trigger levels for DDT, DDT metabolites and Chlordane, because their concentrations are considered to be within expected background ranges (Personal Communication, Young, Chase, July 1991).

### 4.1.3 Dieldrin Trigger Level

Dieldrin is an insecticide which was used during the 1950s to 1970s for soil treatment, seed treatment and mosquito control (Duffy and Wang, 1967). Although Dieldrin has not been used for over 20 years, some residual concentration may still be apparent in soils. Since the LACV-30 facilities were constructed less than 10 year years ago, the Dieldrin detected in soils does not appear to have originated from activities at the LACV-30 Site. After reviewing the highest concentration of Dieldrin detected in LACV-30 soil samples (i.e., 0.011 mg/kg), it was suggested that this concentration is within background levels (Personal Communication, Young, Chase, August 1991). Subsequently, JMM has not established a trigger level for Dieldrin because the concentrations of Dieldrin detected at the site are considered to be within background concentrations.

### 4.1.4 Statistical Evaluation of Background Soil Analytical Data

Using soil data collected from background boring locations, JMM performed a statistical evaluation of the data to develop an estimate of background concentrations for metals present in native soils (i.e., areas where anthropogenic activities were not expected to have occurred). Three background soil borings were drilled and sampled during previous investigations at Fort Story to provide the data necessary for this evaluation (JMM, 1991c). Figure 1-2 presented earlier identifies the three background boringlocations (SB-134, SB-135 and SB-136). Soil Boring SB-134 was located near the eastern perimeter of Fort Story and is representative of conditions in the sand flat area. Soil Boring SB-135 was located adjacent to the western boundary of Fort Story and is representative of conditions in the central sand ridge area. Located in the north-central perimeter of Fort Story, SB-136 is representative of conditions in the coastal dune complex.

Two soil samples were collected from each background boring for analytical characterization. A total of seven analytical samples, including one field duplicate sample, were collected from the three background borings. The analytical soil samples were collected from the ground surface and at the total depth of each boring. Table 4-1 summarizes the soil sampling depths for the samples collected from the three background borings. The laboratory analyses performed on each of the analytical soil samples collected included pesticides/PCBs, VOCs, BNAs, total metals, EP Toxicity metals and total solids. Results of these analyses are presented in Appendix E.

The single background concentration for each metal analyte is equivalent to the upper one-sided 95 percent confidence limit of the mean concentration of each metal, using a standard statistical procedure described in a standard engineering statistics textbook (Devore, 1982). This statistical method is based on the assumption that the metals concentrations are distributed according to the t-distribution, which is a distribution for a limited number of sample sizes such as those for background boring metals concentrations at Fort Story. The method involves estimating the upper limit of the range within which lies the true mean soil concentration of a metal at Fort Story, based upon the characteristics of data from background borings and a confidence criterion. In this case, that upper limit is called the upper one-sided (1-a) percent confidence limit ($\mu_{u,a}$) where a represents the confidence criterion. For this analysis, a is set equal to 0.05 for a 95 percent confidence limit.

The value of the upper one-sided confidence limit of the mean is given by:

$$m_{ua} = \overline{x} + t_{a/2},\ df\ \left(\frac{S}{\sqrt{n}}\right) \qquad (1)$$

where: $\overline{x}$ is the computed mean concentration in soil background samples; the quantity ($t_{a/2}$,df) is the "t value" (obtained from standard statistics tables) for a given confidence criterion (a) and number of degrees of freedom (df), which is defined as the sample size (n) minus one; and S is the standard deviation of the set of concentration data.

TABLE 4-1

SUMMARY OF SOIL BACKGROUND BORING SAMPLING DEPTHS

| Boring Number | Total Depth[a] (ft.) | Samples Logged | Samples Analyzed | Depth of Soil Samples[b] (ft.) |
|---|---|---|---|---|
| SB-134 | 15 | 4 | 2 | 0,4,9,13 |
| SB-135 | 42 | 9 | 2 | 0,5,10,15,20,25,30,35,40 |
| SB-136 | 22 | 6 | 2 | 0,4,9,13,15,20 |

(a) Total depth relative to ground surface.
(b) An underlined number (e.g., 0) indicates depth at which an analytical sample was collected. Lithologic samples were collected at all depths shown.

At Fort Story, seven background soil samples were analyzed for metals. Therefore, for a 95 percent confidence limit (a = 0.05) and seven data points (n = 7, d.f. = 6), Equation (1) becomes:

$$m_u, 0.05 = \bar{x} + 2.447 \left(\frac{S}{\sqrt{7}}\right), \text{ or}$$

$$m_u, 0.05 = \bar{x} + 0.9249 (S) \tag{2}$$

Thus, the upper confidence limit values for metals at Fort Story were calculated using Equation (2) and the mean ( $\bar{x}$ ) and standard deviation (S) of the set of concentrations obtained for each metal. To calculate the mean and standard deviation for each metal, a value had to be assigned to samples that had no detectable concentration (ND) to include their occurrence in the statistical evaluation. One method is to assign ND concentrations a value equal to the detection limit (DL) divided by two (DL/2). This method assumes that the data below the detection limit are uniformly distributed; i.e., every value between zero and the detection limit has an equal probability of occurrence. Hornung and Reed of the National Institute for Occupational Safety and Health (NIOSH) present another approach to estimating ND values in which they assume that the ND values are distributed lognormally between the detection limit and zero. This assumption is probably more accurate than the assumption that the ND values are distributed normally because it weights the distribution of the ND values toward the detection limit. If all the data (above and below the detection limit) is distributed normally, such as in the t-distribution in this case, then the ND values would also be weighted toward the detection limit. By using a value equal to the detection limit divided by the square root of two ($DL/\sqrt{2}$), a more accurate representation of lognormal values below the detection limit can be achieved (Hornung and Reed, 1990). This technique ($DL/\sqrt{2}$) has been used in this *Preliminary Draft Site Investigation Report.*

Arsenic, chromium, copper, lead, zinc and DDT were detected in Fort Story background soil boring samples, as indicated in Appendix E. Of these compounds, cadmium, chromium, copper, mercury and zinc were detected in LACV-30 soil and/or sediment samples. Table 4-2 presents the results of the statistical analysis for metals detected in Fort Story background boring samples and LACV-30 soil/sediment samples (i.e., chromium, copper and zinc).

Identification of any particular metal analyte at concentrations greater than the 95 percent confidence interval concentration should not automatically result in a recommendation for further investigation at the LACV-30 Site. A trigger level has been established for soils that realistically reflects a situation at any given site where anthropogenic activities have most likely resulted in contamination that requires further investigation. As a result of these considerations, JMM considers that additional investigation may be warranted when any metal analyte exceeds the 95 percent confidence interval for background concentration by an order of magnitude (10 times background). The EPA's Department of Site Assessment further approved the use of 10 times background upon discussion with JMM and indicated that this was the best approach to take, given the lack of regulatory guidance (EPA, 1988; Personal Communication, Grubbs, 1991). Therefore, values of 10 times the 95 percent confidence interval concentrations are used as trigger levels for chromium, copper, lead, and zinc in soil.

### 4.1.5 Analytes Not Detected in Background Samples

The background soil samples collected at Fort Story were analyzed for pesticides/PCBs, VOCs, BNAs, total metals and EP Toxicity metals. Only DDT, arsenic, chromium, copper, lead and zinc were found in concentrations greater than the Method Reporting Level (MRL). Some analytes not detected in the background boring samples were detected in the LACV-30 field samples. Identification of any analyte greater than the MRL should not automatically result in

TABLE 4-2

FORT STORY BACKGROUND BORING DATA STATISTICS[(a)]

| Analyte | Number of Samples Collected | Samples Above Detection Limit | Detection Limit | Assigned ND Value[(b)] | Mean | Standard Deviation | Upper 95% Confidence Limit Value |
|---|---|---|---|---|---|---|---|
| Chromium | 7 | 7 | 1 | 0.71 | 2.2 | 0.69 | 2.8 |
| Copper | 7 | 3 | 1 | 0.71 | 1.0 | 0.46 | 1.4 |
| Zinc | 7 | 4 | 2 | 1.4 | 3.2 | 2.7 | 5.7 |

(a) All values given in (mg/kg).
(b) ND = Not detected.

recommendation for further action. Subsequently, evaluation of these compounds will be based upon a specific evaluation of all media sampled.

To provide some supporting information to complement background boring analytical data, especially for trace metals not detected in background soil borings, JMM attempted to determine the native concentrations of trace metals in the area of Fort Story.

Although it is clear that soils are derived from parent geologic materials as a result of physical, chemical and biological weathering processes, the range of natural or background metal concentrations is extremely large, with the composition of the parent material being the principal factor influencing the concentrations of metals in pristine soils. It was found that while there is some published information about typical ranges of concentrations for the United States as a whole (Shaklette and Boernegen, 1986, Kabata-Pendias and Pendias, 1984), no specific information was found that would help to determine native concentrations. JMM contacted representatives of the United States and Commonwealth of Virginia Departments of Agriculture (Personal Communication, Wenthouse, 1991) and the United States Geological Survey (Personal Communication, McNeil, 1991), along with professors from the Department of Crop and Environmental Sciences, Virginia Polytechnic Institute (Personal Communication, Daniels, Martins, 1991). No specific information was acquired from these contacts. JMM determined that while the background metal concentration levels were within the typical ranges for U.S. soils, a more specific determination could not be made for the Fort Story area.

### 4.1.6 Recommended Trigger Levels

Table 4-3 presents the MRL, background 95 percent confidence interval concentration levels, and the trigger level for each analyte detected in LACV-30 soil and sediment samples. The trigger levels, as herein defined, provide conservative guidance for determination of whether further investigative activity is required at a given site.

The trigger levels determined for compounds of concern detected at the LACV-30 Site are intended as a quantitative indicator whether further investigatory action may be appropriate for the site. The trigger levels are derived based on statistically-significant background concentrations of compounds of concern, or regulatory standards as may be appropriate. The trigger levels do not necessarily constitute applicable or relevant and appropriate requirements (ARARs). ARARs are developed while a project site is undergoing an RI/FS evaluation and the magnitude and extent of environmental contamination is being assessed. ARARs then serve as potential clean-up standards for contaminated site media.

## 4.2 GROUNDWATER TRIGGER LEVELS

Benzene, carbon disulfide, chloroform, 1,1-dichloroethane, 1,1-dichloroethene, xylenes, arsenic, chromium, copper, lead and zinc were detected in LACV-30 groundwater samples. USEPA Maximum Contaminant Levels (MCLs), Commonwealth of Virginia Groundwater Protection Levels (VGWPLs), Virginia Water Quality Criteria for Groundwater and EPA Water Quality Criteria have been established for most of these analytes, as indicated in Table 4-4.

MCLs are enforceable standards, promulgated under the Safe Drinking Water Act of 1986 (EPA, 1991). MCLs are set at levels that are determined to be protective of human health and are as close as feasible to the Maximum Contaminant Level Goals (MCLGs), which are strictly health-based levels. MCLs address the use of the best available water treatment technology, treatment cost and other non-health considerations. Generally, EPA considers MCLs as potentially applicable or relevant and appropriate requirements for groundwater that is a current or potential source of drinking water.

## TABLE 4-3

## SOIL TRIGGER LEVELS
## PRELIMINARY ASSESSMENT/SITE INVESTIGATION
## FORT STORY, VA

| Parameter | Method Reporting Level[a] (mg/kg) | Background 95% Confidence Interval[b] (mg/kg) | Trigger Level[c] (mg/kg) |
|---|---|---|---|
| Pesticides/PCBs | | | |
| p,p'DDE | 0.02 | ND | (d) |
| p,p'DDT | 0.02 | 0.0041 | (d) |
| Dieldrin | 0.02 | ND | (d) |
| VOCs | | | |
| Toluene | 0.01 | ND | - |
| TFH-H | 10 | ND | 100[f] |
| Metals | | | |
| Cadmium | 0.5 | ND | - |
| Chromium | 1.0 | 2.8 | 28 |
| Copper | 1.0 | 1.4 | 14 |
| Mercury | 0.02 | ND | - |
| Zinc | 7.0 | 5.7 | 57 |

(a) Method Reporting Level (MRL) represents the minimum concentration of an analyte that can be reported with a known confidence level.
(b) Upper bound of the 95 percent confidence interval on the population mean concentrations for background soil borings at Fort Story.
(c) For metal analytes detected in the background borings, the trigger levels are set at 10 times the 95 percent confidence interval.
(d) All DDT, DDE and Dieldrin levels detected at Fort Story are within the expected background range (Personal Communication, Young, Chase, July 1991 and August 1991).
(e) EPA, 1987, *Toxic Substances Control Act (TSCA) PCB Spill Cleanup Policy 40 CFR Section 761 Subpart G.*
(f) Commonwealth of Virginia, State Water Control Board, 1989 VR-680-13-02

ND = Not Detected in the background borings.

The VGWPLs are health-based standards derived from Federal Resource Conservation and Recovery Act (RCRA) groundwater protection standards (EPA, 1990) and Commonwealth of Virginia State Water Control Board Regulations VR 680-21-00 (Commonwealth of Virginia, 1990). The VGWPLs are health-based in nature and were developed in the 1970s as standards to protect groundwater quality. In addition, the VGWPLs are most appropriate as guidelines for groundwater protection associated with existing solid waste management units, such as surface impoundments, landfills or waste piles.

Virginia Groundwater Quality Criteria are generally aquatic life - based standards that were developed in the early 1970s to, "... prevent the entry of pollutants into groundwater ..." In addition, the natural quality of a constituent in groundwater must be maintained, even if the concentration is lower than that which is designated in the standards, as explained in the Anti-Degradation Policy for Groundwater. Currently, Virginia Groundwater Quality Criteria are only enforceable when citing a new facility that discharges wastes to the groundwater, resulting in a mixing zone. The Virginia State Water Control Board is currently updating these standards to reflect a broader range of application. In addition, the Anti-Degradation Policy is being revised for clarification purposes. In the interim, however, the State recommends that the standards are not to be used as clean-up standards (Personal Communication, Wagner, 1991). Therefore, JMM believes that it is not appropriate to use Virginia Groundwater Quality Criteria to develop trigger levels for compounds detected in LACV-30 groundwater samples at this time.

EPA Ambient Water Quality Criteria (WQC) for Protection of Human Health are non-enforceable standards intended to be protective of human health from exposures associated with fish consumption, or drinking water ingestion, or both. EPA Ambient WQC for Protection of Aquatic Life are non-enforceable standards intended to be protective of chronic effects in freshwater organisms. JMM is considering use of EPA Ambient WQC in the development of groundwater trigger levels because of the likely interaction of site groundwater with nearby surface water bodies. Generally in the vicinity of Fort Story, groundwater may be discharging into surface water bodies.

The presence of wetlands adjacent to a site, the possibility that a nonpotable aquifer could be used for supplying drinking water in the future, or significant interaction of groundwater with surface waters could prompt MCLs to be selected by governing regulatory agencies as site clean-up goals. Therefore, considering the nature of the LACV-30 project site, the basis of regulatory standards, and consideration of these regulatory preferences as conveyed to JMM by the Commonwealth of Virginia Water Control Board and Department of Waste Management, JMM considers the MCLs to be pertinent for use as trigger levels for this PA/SI project. Therefore, for a compound of concern that has an MCL and a VGWPL, the MCL will be used as a trigger level. The VGWPLs are most pertinent for groundwater quality considerations associated with solid waste management units. For those compounds where MCLs are not provided, the VGWPLs will be used as trigger levels since they are protective of groundwater quality. Table 4-4 presents the trigger levels developed for groundwater media at the LACV-30 Site.

For those compounds detected in site groundwater for which neither MCLs nor VGWPLs are available, JMM will consider the EPA WQC or the Virginia Groundwater Quality Criteria for use as trigger levels because of the groundwater/surface water interaction noted earlier.

If available, the MCLs and VGWPLs serve as conservative standards for developing groundwater contamination trigger levels, since use of the water table (Columbia) aquifer as a potable water source is presently restricted by the Commonwealth of Virginia State Department of Health. Table 4-4 cites trigger level values for compounds detected in LACV-30 Site groundwater.

Groundwater samples were collected for total and dissolved metals analyses. When a groundwater sample is collected from a well, a fraction of the sample mass is associated with fine particles suspended within the water sample. These particles are usually colloidal in nature, and the relative

TABLE 4-4

FEDERAL AND STATE CRITERIA/REGULATIONS USED TO DEVELOP PA/SI GROUNDWATER TRIGGER LEVELS FOR THE LACV-30 SITE

| Compound of Concern | Method Reporting Level | EPA Primary MCL | VA Groundwater Protection Level | VA Groundwater Quality Criteria | EPA Water Quality Criteria for Protection of Human Health[c] | | EPA Ambient Water Quality Criteria for Protection of Aquatic Life (Freshwater, Chronic)[c] | LACV-30 Trigger Level |
|---|---|---|---|---|---|---|---|---|
| | | | | | Fish Consumption Only | Water and Fish Ingestion | | |
| chloroform | 0.5 µg/l | — | 5 µg/l | — | 15.7 µg/l | 0.19 µg/l | 1,240 µg/l | 5 µg/l |
| carbon disulfide | 0.5 µg/l | — | 1,000 µg/l | — | — | — | — | 1,000 µg/l |
| benzene | 0.5 µg/l | 5 µg/l | 5 µg/l | — | 40 µg/l | 0.66 µg/l | — | 5 µg/l |
| 1,1-dichloroethane | 0.5 µg/l | — | — | — | — | — | — | — |
| total xylenes | 0.5 µg/l | 10,000 µg/l | — | — | — | — | — | 10,000 µg/l |
| 1,1-dichloroethene | 0.5 µg/l | 7 µg/l | 7 µg/l | — | 1.85 µg/l | 0.033 µg/l | — | 7 µg/l |
| chromium, total | 0.010 mg/l | 0.1 mg/l | — | — | — | — | — | 0.1 mg/l |
| copper, total | 0.010 mg/l | — | — | — | — | — | 12 µg/l | 12 µg/l |
| lead, total | 0.010 mg/l | — | — | — | — | — | — | — |
| lead, dissolved | 0.002 mg/l | 0.015 mg/l[a] | 0.05 mg/l | 0.05 mg/l | — | 50 µg/l | 3.2 µg/l | 0.015 mg/l |
| zinc, total | 0.020 mg/l | — | — | — | — | — | — | — |
| zinc, dissolved | 0.020 mg/l | 5 mg/l[b] | 0.05 mg/l | 0.05 mg/l | — | — | 47 µg/l | 5 mg/l |
| arsenic, dissolved | 0.005 mg/l | 0.05 mg/l | — | 0.05 mg/l | 17.5 ng/l | 2.2 ng/l | — | 0.05 mg/l |

(a) This value is an action level that replaces the existing interim MCL for lead of 0.05 mg/l. This new rule was published in the June 7, 1991, *Federal Register* and takes effect in January 1992 for large treatment systems (>50,000 customers).
(b) This is a secondary standard. EPA secondary standards are recommended but not enforceable.
(c) EPA Ambient Water Quality Criteria were interpreted as pertaining to dissolved metals.

mass amount present is reflected in the turbidity level (i.e., high turbidity, is primarily due to colloidal content). The colloids present in groundwater are typically negatively charged which attract positively charged contaminants such as metals analytes to their surface. The total metals data provides levels of metals present in the dissolved and suspended form. The dissolved metal sample are filtered in the field to remove the colloids and provide a better understanding of what is truly dissolved in the groundwater. Currently accepted EPA protocol is to utilize a 0.45-micron filter, as required by the *CDAP* (JMM, 1990a). The Virginia Department of Waste Management requires the signifcance of contamination in groundwater to consider levels of total and dissolved metals. Based on this understanding, JMM will refer to with the dissolved metal results,and total metal results, when assessing the significance of contamination present in site groundwater.

## 4.3 SURFACE WATER TRIGGER LEVELS

TFH-H, cadmium, chromium, copper, lead and zinc were detected in LACV-30 surface water samples. Available regulations or standards pertinent to surface water quality include EPA Ambient Water Quality Criteria for Protection of Human Health, EPA Ambient Water Quality Criteria for Protection of Aquatic Life (freshwater, chronic), Commonwealth of Virginia Water Quality Criteria for Surface Water, and EPA MCLs. EPA Ambient Water Quality Criteria for Protection of Human Health are intended to be protective of human health from exposures associated with fish consumption or drinking water ingestion, or both (EPA, 1986b). EPA's Ambient Water Quality Criteria for Protection of Aquatic Life are intended to be protective of aquatic life. The Virginia Water Quality Criteria for Surface Water are enforceable standards promulgated by the State Water Control Board as part of an anti-degradation program for protection of surface water and aquatic organisms (Commonwealth of Virginia, 1990). EPA MCLs were described earlier in Section 4.2.

JMM believes that, of the regulatory standards and criteria available, the Virginia Water Quality Criteria for Surface Water are most relevant in developing surface water trigger levels for the LACV-30 PA/SI project for several reasons. First, these criteria are enforceable. Second, the criteria were developed based on exposure of ecological systems to compounds of concern. Run-off water from the LACV-30 Site flows either to a pond (Central Detention Pond or Hospital Pond) and then to the wetlands or flows directly to the wetlands area. Either runoff pathway could adversely affect aquatic life and ecological systems in the ponds and wetlands.

At this time, there is a controversy at the state and federal levels on whether surface water criteria cited for metals correlate with samples that are filtered or not filtered (i.e., dissolved or total metals). At the state level, several committees are researching this issue and findings should be made available to the public at the beginning of 1992. In the interim, the Virginia Water Control Board considers that the majority of the toxicity to aquatic life and ecological systems evolves from the dissolved fraction; therefore, the Virginia Water Control Board recommends that metals cited in the Virginia Water Quality Criteria for Surface Water should currently be interpreted as dissolved metals, until a legal interpretation becomes available (Personal Communication, Barron, 1991).

EPA MCLs, when available for a detected compound, were considered in development of surface water trigger levels because of the likelihood that groundwater in the shallow aquifer is discharging into nearby surface water bodies.

The following regulations or standards were considered in descending order of preference during the development of LACV-30 site surface water trigger levels:

- Virginia Water Quality Criteria for Surface Water (freshwater, chronic);
- EPA Ambient Water Quality Criteria for Protection of Aquatic Life (freshwater, chronic);

- EPA Ambient Water Quality Criteria for Protection of Human Health (fish consumption only or water and fish ingestion); or

- EPA MCLs.

For dissolved chromium, lead and zinc, the Virginia Water Quality Criteria for Surface Water and EPA's Ambient Water Quality Criteria for Protection of Aquatic Life are equivalent values.

Table 4-5 presents the regulatory standards or criteria considered and the selected values for LACV-30 Site surface water trigger levels. All trigger levels cited in Table 4-5 exceed the Method Reporting Levels for the respective analytes.

TABLE 4-5

FEDERAL AND STATE CRITERIA/REGULATIONS USED TO DEVELOP PA/SI SURFACE WATER TRIGGER LEVELS FOR THE LACV-30 SITE

| Compound of Concern | EPA Primary MCL | EPA Ambient Water Quality Criteria for Protection of Human Health[c] | | EPA Ambient Water Quality Criteria for Protection of Aquatic Life (Freshwater, Chronic)[c] | VA Water Quality Criteria for Surface Water (Fresh, Chronic Criteria) | LACV-30 Trigger Level |
|---|---|---|---|---|---|---|
| | | Water and Fish Ingestion | Fish Consumption Only | | | |
| TFH-H | — | — | — | — | — | — |
| chromium, total | 0.1 mg/l | — | — | — | — | — |
| chromium, dissolved | — | 0.050 mg/l[a] | — | 0.011 mg/l[a] | 0.011 mg/l[a] | 0.011 mg/l[a] |
| lead, total | — | — | — | — | — | — |
| lead, dissolved | 0.015 mg/l[b] | 0.050 mg/l | — | 0.0032 mg/l | 0.0032 mg/l | 0.0032 mg/l |
| zinc, total | — | — | — | — | — | — |
| zinc, dissolved | 5 mg/l | — | — | 0.047 mg/l | 0.047 mg/l | 0.047 mg/l |
| cadmium, total | — | — | — | — | — | — |
| copper, total | — | — | — | — | — | — |

(a) These values correspond to hexavalent chromium. Water quality criteria for chromium is broken down into hexavalent chromium and trivalent chromium. LACV-30 surface water samples were analyzed for chromium which includes hexavalent and trivalent chromium. Water quality criteria is more conservative for hexavalent chromium. Therefore, it is assumed that all of the chromium in the LACV-30 surface water samples exists as hexavalent chromium in the dissolved state.
(b) This criterion is a function of hardness. This hardness value is assumed to be 100 mg/l which is consistent with EPA's approach (EPA, 1986b).
(c) EPA Ambient Water Quality Criteria were interpreted as pertaining to dissolved metals.

## 5.0 RESULTS OF PRELIMINARY ASSESSMENT/SITE INVESTIGATION EVALUATION

Results of the LACV-30 Preliminary Assessment/Site Investigation evaluation are presented in this section. Initially, site stratigraphy and groundwater flow directions are discussed. Then, analytical results from sampling and analysis of site environmental media are compared with trigger levels. A general discussion of the contaminant transport pathways associated with the LACV-30 Site is also provided. Finally, the results of the drainage evaluation are presented. Each of these evaluations will be considered in determining whether further action at the site may be required, and, if so, what type of action is most appropriate. This is discussed further in Section 6, Conclusions and Recommendations.

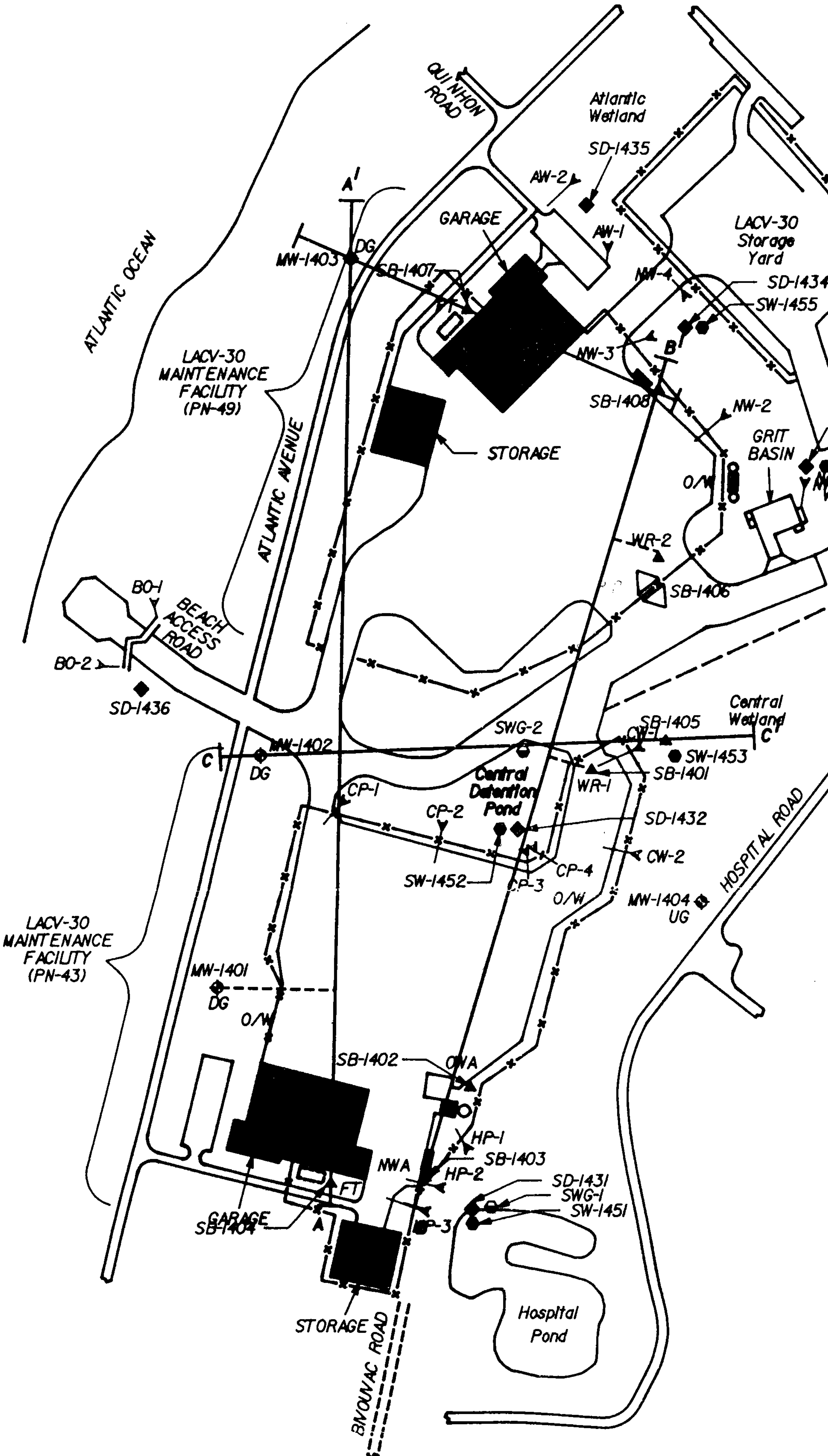
### 5.1 SITE STRATIGRAPHY

The LACV-30 Site is underlain by Holocene Age sand deposits. Based upon soil and monitoring well borings, the sand deposits are medium grained, subrounded and mostly well sorted with some poorly sorted lenses. In the northeast section of the LACV-30 Site approaching the Normandy Wetland, a lense of organic material mixed with fine grained sand can be found from ground surface to a approximate depth of 3 feet. Some borings located near buildings show a shallow silty medium grained sand unit; however, field observations indicate that these deposits are naturally occurring and not fill material. Utilizing the data available from boring logs and surface water gauges, JMM prepared cross sections of the LACV-30 Site to illustrate the general site stratigraphy. The locations of the cross sections are presented in Figure 5-1, and four cross sections of the site are presented in Figures 5-2 and 5-3. Grain size distribution graphs from analyses performed on samples from the screened interval of site monitoring wells are presented in Appendix C.

### 5.2 GROUNDWATER FLOW DIRECTION AND AQUIFER CHARACTERISTICS

Table 5-1 presents the depth-to-water measurements that JMM obtained on January 29, 1991 from the four monitoring wells installed at the LACV-30 Site. These measurements indicate that the Columbia Aquifer is a water table aquifer with flow directed to the north towards the coastline. Three standing water gauges were also measured on January 29, 1991 in the surrounding surface water bodies to check for possible groundwater-surface water interaction. Based upon these measurements, the surface water body elevations approximate the water table elevations measured from the four monitoring wells. Because the surface water elevations closely correlate with the overall water table configuration, it is likely that the surface water bodies are areas of groundwater discharge. This view also is based on the knowledge that the water elevation readings are from an unconfined, water table aquifer and the topographic relief appears to provide a significant slope that controls the hydraulic head gradient. Since these observations are based only on one water level reading event, further information is needed to confirm the assumption that the surface water bodies are areas of groundwater discharge. A single water-level reading event does not account for possible tidal fluctuations, seasonal changes and other outside variables related to infiltration and groundwater flow. It is possible that the surface waters are areas of groundwater discharge and recharge, which vary according to seasonal water table fluctuations. In Appendix C, Table C-1 presents pertinent well construction and water level data.

*In situ* permeability tests were performed on four groundwater monitoring wells installed at the LACV-30 Site which comprise the upper portion of the Columbia Aquifer. The Bouwer and Rice method was used to calculate hydraulic conductivity (K) as it is valid for slug tests performed in partially penetrating wells in unconfined aquifers (Jones, 1986). Table 5-2 summarizes the slug test results. The calculated values for the four wells range from 112 to 219 feet per day, with an




NOTE: THIS FIGURE NOT TO SCALE

**LEGEND**

| Symbol | Description |
|---|---|
| (hatched box) | WASTE ACCUMULATION AREA |
| (open box) | UNDERGROUND STORAGE TANK |
| —x— | FENCE |
| ▲ | SOIL BORING |
| ● | SURFACE WATER SAMPLE |
| ◈ | MONITORING WELL |
| ◆ | SEDIMENT SAMPLE |
| (gauge symbol) | STAFF WATER GAUGE |

**ABBREVIATIONS**

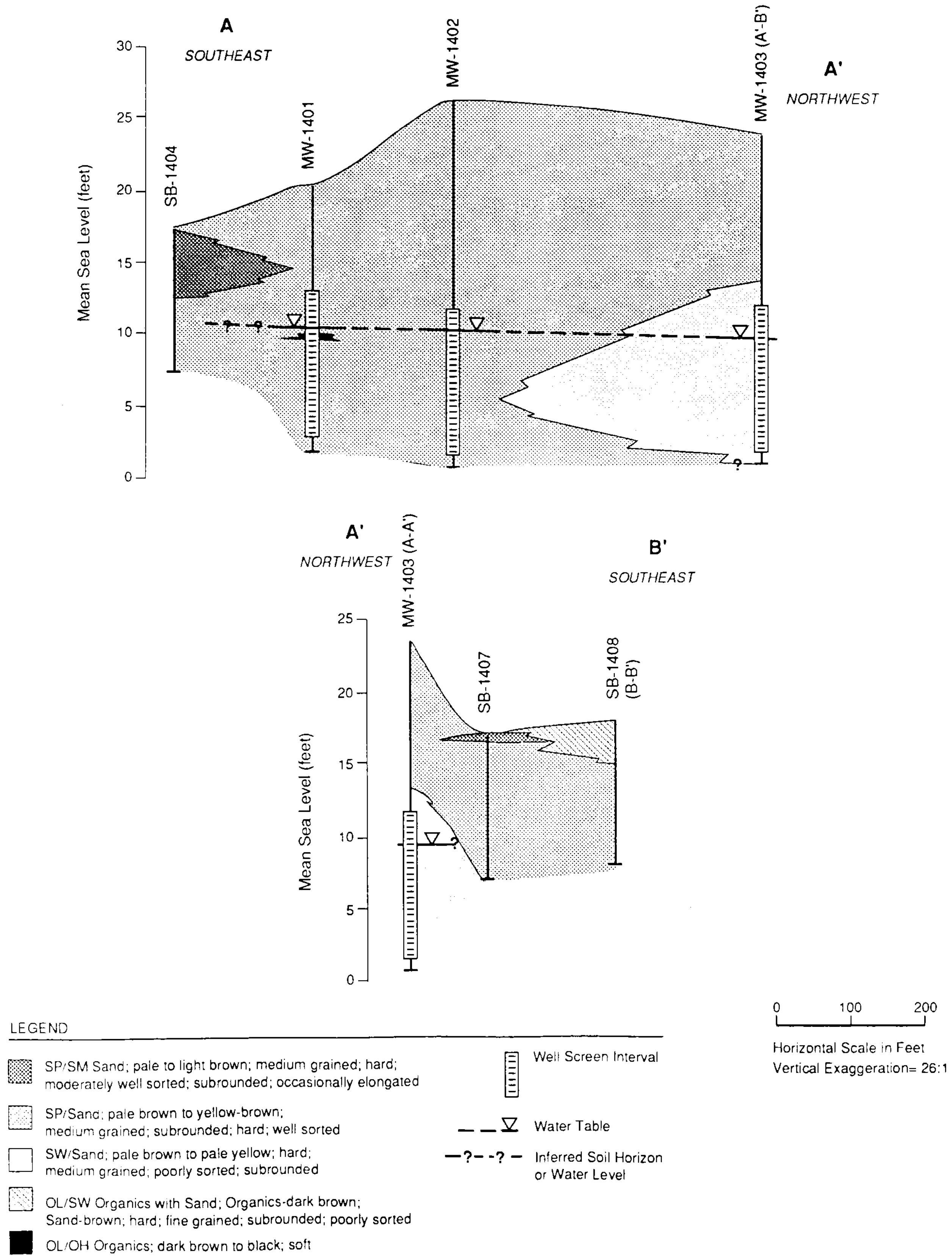
| | |
|---|---|
| O/W | OIL WATER SEPARATOR |
| WR | WASH RACK |
| OWA | OLD WASTE ACCUMULATION AREA |
| NWA | NEW WASTE ACCUMULATION AREA |
| UG | UPGRADIENT |
| DG | DOWNGRADIENT |
| HP-1 - HP-3 | HOSPITAL POND OUTFALLS |
| CP-1 - CP-4 | CENTRAL DETENTION POND OUTFALLS |
| CW-1, CW-2 | CENTRAL 'WETLAND' OUTFALLS |
| NW-1 - NW-4 | NORMANDY 'WETLAND' OUTFALLS |
| AW-1, AW-2 | ATLANTIC 'WETLAND' OUTFALLS |
| BO-1, BO-2 | BEACH OUTFALLS |

**PA/SI, FT. STORY, VA**

**GEOLOGIC CROSS-SECTION LOCATIONS LACV-30 MAINTENANCE FACILITY**

James M. Montgomery

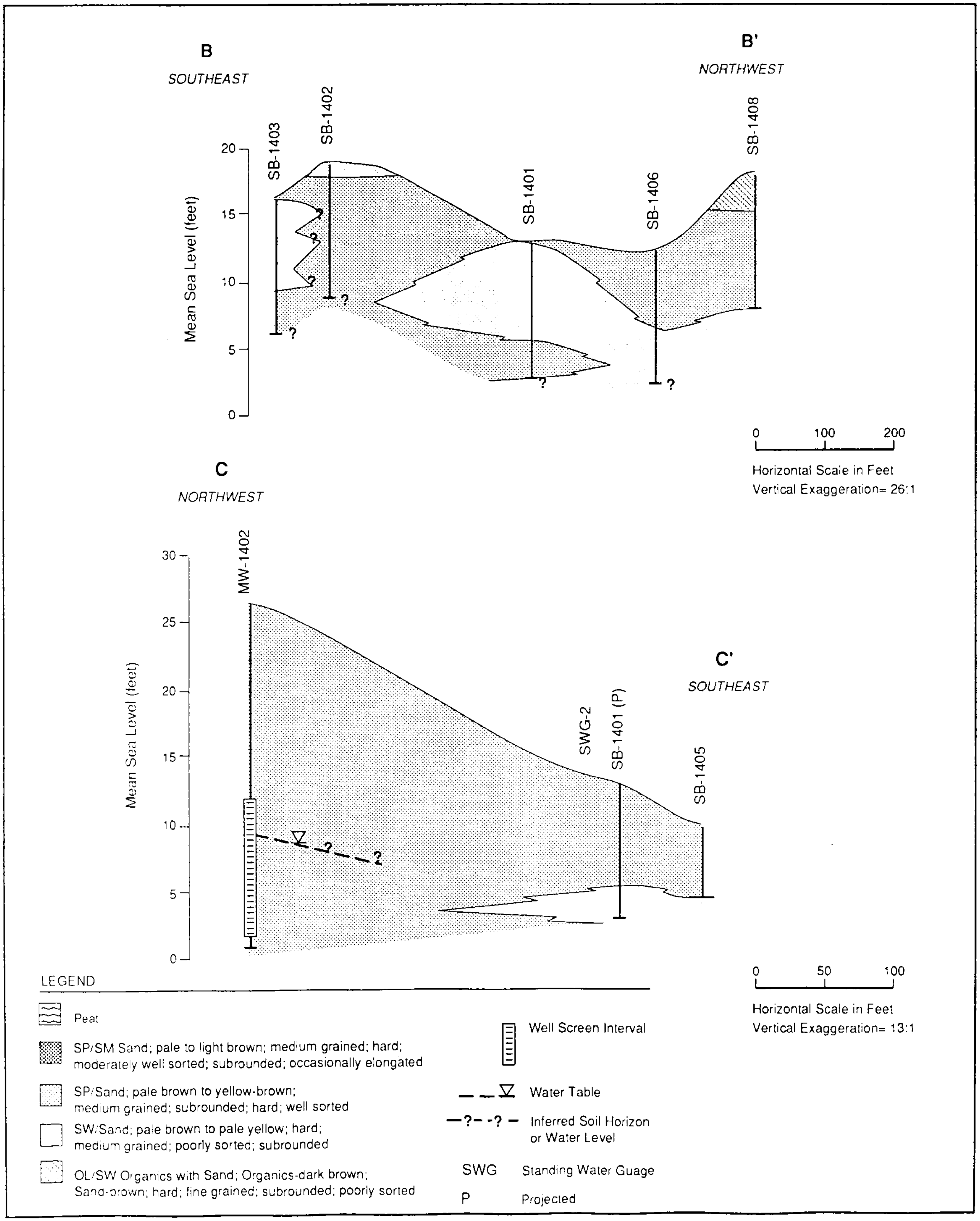
**FIGURE 5-1**




JMM

Cross Sections A-A' and A'-B' at LACV-30 Site
Ft. Story, VA

Figure 5-2




Cross Sections B-B' and C-C' at LACV-30 Site
Ft. Story, VA

Figure 5-3

## TABLE 5-1

## GROUNDWATER ELEVATION SUMMARY

| Location Number | TOC Elevation (ft., NGVD) | Depth to Water (ft., BTOC) | Water Elevation (ft., NGVD) | Date Water Level Measured |
|---|---|---|---|---|
| MW-1401 | 20.11 | 12.97 | 7.14 | 1/29/91 |
| MW-1402 | 26.20 | 19.31 | 6.89 | 1/29/91 |
| MW-1403 | 23.67 | 17.43 | 6.24 | 1/29/91 |
| MW-1404 | 13.04 | 5.04 | 8.00 | 1/29/91 |
| SWG-01 | — | — | 7.70 | 1/29/91 |
| SWG-02 | — | — | 7.49 | 1/29/91 |
| SWG-03 | — | — | 7.61 | 1/29/91 |

NGVD - National Geodetic Vertical Datum of 1929
TOC - Top of Casing
BTOC - Below Top of Casing
BLS - Below Land Surface

TABLE 5-2

SLUG TEST RESULTS SUMMARY
LACV-30 SITE, FORT STORY, VA

| Well Number | Hydraulic Conductivity (ft/min) | (ft/day) | (m/day) |
|---|---|---|---|
| MW-1401 | 0.0778 | 112.10 | 34.17 |
| MW-1402 | 0.0817 | 117.65 | 35.86 |
| MW-1403 | 0.152 | 218.88 | 66.71 |
| MW-1404 | 0.0848 | 122.16 | 37.23 |

average value of 143 feet per day. However, due to the very limited amount of drawdown produced by slug testing and the very fast recovery, the values of hydraulic conductivity for the wells are only qualitative indicators of the aquifer characteristics in the immediate vicinity of the wells. Therefore, each individual value for a well does not necessarily reflect area-wide aquifer properties. As anticipated, JMM's estimated values for hydraulic conductivity at the LACV-30 Site are consistent with ranges estimated for typical unconsolidated sand (Sevee 1991; Kruseman and de Ridder, 1983; Fetter, 1980).

Slug test supporting data for the four wells installed at the LACV-30 Site, including raw data, parameter values, graphs and calculations, are provided in Appendix C. A summary of geological data also is included in Appendix C.

## 5.3 COMPARISON OF ANALYTICAL RESULTS WITH TRIGGER LEVELS

In this section, JMM compares the LACV-30 Site analytical results to the trigger levels developed in Section 4.1. As previously mentioned, analytical results are presented in Appendix D. This comparison is segregated by site medium as follows: soil, groundwater and surface water/sediment. Compounds detected above trigger levels are presented in Figure 5-4 at the respective sampling location.

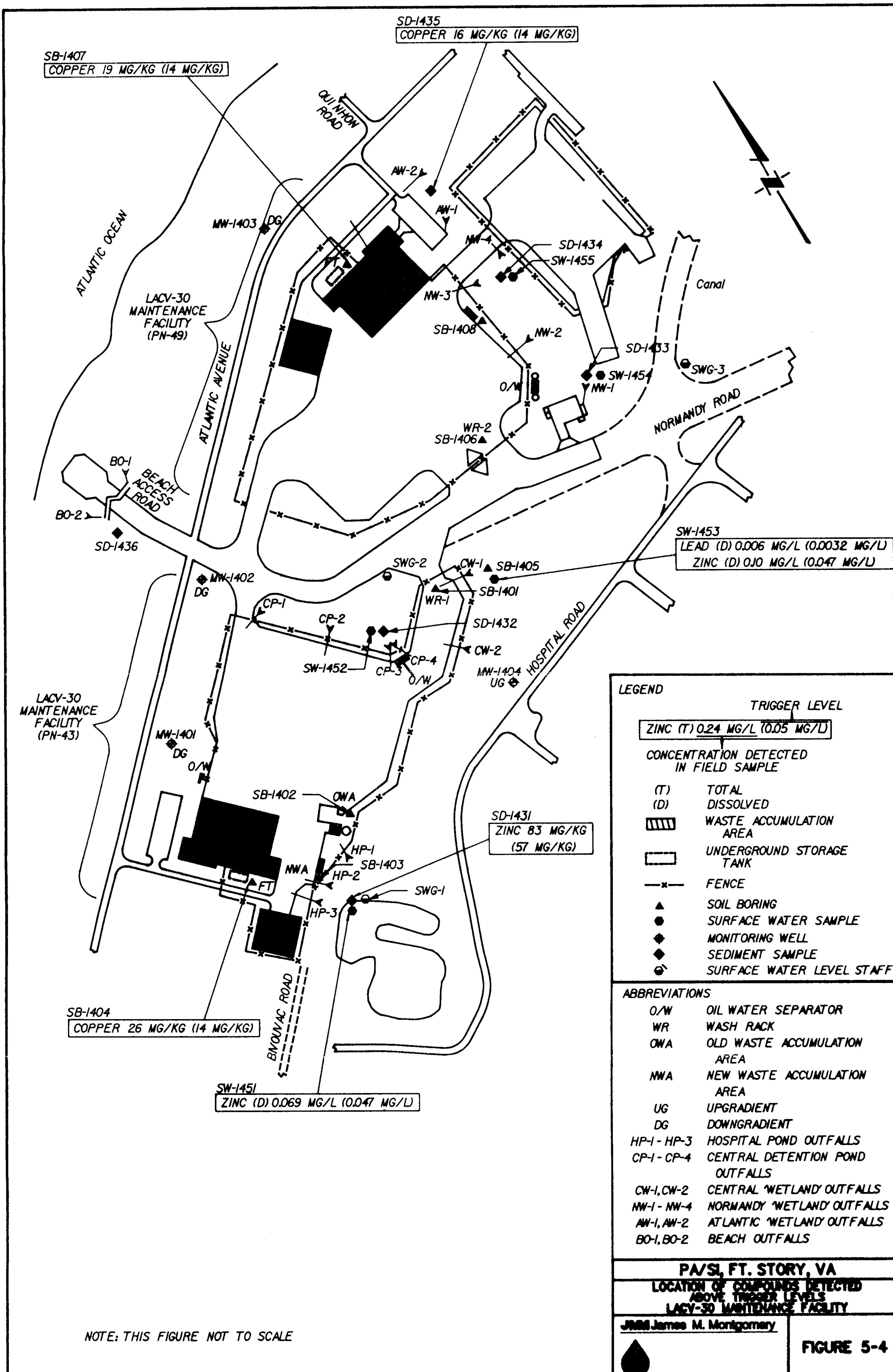
### 5.3.1 Site Soil

The majority of compounds detected in LACV-30 soil samples were metals. Most of the metals were near background levels, except for copper. Copper was detected in two of the eight soil samples at concentrations greater than the 14 mg/kg trigger level. In addition, the locations where copper was detected at these elevated concentrations were similar for each maintenance facility, i.e., in soil near the fuel oil USTs, as indicated in Figure 5-4. SB-1404, located adjacent to the PN-43 fuel oil UST, had a copper concentration of 26 mg/kg; whereas SB-1407, located adjacent to the PN-47 fuel oil UST, had a copper concentration of 19 mg/kg.

Several other metals were detected in soil samples including cadmium, chromium and zinc. Cadmium was detected at a concentration of 0.7 mg/kg from a boring located near outfalls that receive run off from the Central Detention Pond and the PN-43 wash rack. No trigger level exists for cadmium since this compound was not detected in any of the background boring samples. Chromium was detected in six of the eight soil samples, whereas zinc was detected in all eight samples. As indicated in Table 4-2, chromium was detected in all seven background soil samples and zinc was detected in four of the seven samples. Based on a statistical analysis, trigger levels for chromium and zinc were set at 28 mg/l and 57 mg/l, respectively. The concentrations of chromium and zinc were below trigger level concentrations.

Toluene was the only VOC compound detected in JMM's LACV-30 soil samples. Toluene was detected in borings installed in the PN-43 and PN-49 concrete pads located near the wash racks. No trigger level was established for toluene because this compound was not detected in any of the background soil boring samples. Toluene was detected in samples collected from SB-1401 and SB-1406 at concentrations of 0.03 mg/kg and 0.2 mg/kg, respectively. Both samples were field-screened grab samples collected at a depth of zero feet.

Only two pesticides were detected in LACV-30 field soil samples, Dieldrin and DDT. Dieldrin was detected at a concentration of 0.011 mg/kg in SB-1407, whereas Dieldrin and DDT were detected at concentrations of 0.007 mg/kg and 0.005 mg/kg, respectively, in SB-1408. As discussed in Section 4.0, these concentrations are within expected background levels for Dieldrin and DDT in soil. There were no total fuel hydrocarbons, heavy fraction (TFH-H) detected in soil media.




PA/SI, FT. STORY, VA

LOCATION OF COMPOUNDS DETECTED ABOVE TRIGGER LEVELS LACV-30 MAINTENANCE FACILITY

FIGURE 5-4

NOTE: THIS FIGURE NOT TO SCALE

### 5.3.2 Site Groundwater

JMM evaluated groundwater quality at the LACV-30 Wetlands Area facility by installing four monitoring wells at the site. Monitoring well MW-1404 was installed hydraulically upgradient from the PN-43 and PN-49 Maintenance Facilities. Groundwater samples collected from this well are intended to provide an indication of background groundwater quality. Monitoring wells MW-1401, MW-1402, and MW-1403 were installed downgradient of the PN-43 Maintenance Facility, Central Detention Pond, and PN-49 Maintenance Facility, respectively. Groundwater samples collected from these wells are intended to possibly indicate the presence of contaminants that have been introduced into the groundwater from operations at these LACV-30 facility areas. Figure 5-3 presented earlier denotes the locations of compounds detected above trigger levels in site groundwater at the LACV-30 Site. Groundwater samples were analyzed for VOCs, BNAs, TFH-H, total metals, and dissolved metals. The results for the BNA and TFH-H analysis reported all compounds below detection limits.

**5.3.2.1 Metals.** The groundwater at the LACV-30 Site is characterized by the presence of metals in both upgradient and downgradient wells. Chromium is present in comparable concentrations in the groundwater in all four site wells. The total chromium concentration in the upgradient well, MW-1404, was measured at 0.013 mg/l. Downgradient total chromium concentrations in the groundwater ranged from 0.019 to 0.024 mg/l, with the highest concentration found downgradient of the Central Detention Pond. All total chromium concentrations are below total chromium's trigger level of 0.1 mg/l.

Dissolved lead was found in the downgradient well MW-1401 at a concentration of 0.009 mg/l. The dissolved lead concentration is below the trigger level of 0.015 mg/l, which was established for lead in groundwater. The levels of total lead in groundwater ranged from 0.020 mg/l to 0.035 mg/l with the highest levels of total lead detected in the updradient monitoring well. As a result the levels of total lead detected during the sampling activities are considered unrelated to past site activities.

Dissolved arsenic was found in the upgradient well, MW-1404, at a groundwater concentration of 0.005 mg/l; and downgradient dissolved arsenic concentrations for two wells (MW-1401 and MW-1402) ranged from 0.005 to 0.009 mg/l. Dissolved arsenic was not detected in MW-1403, located downgradient of the PN-49 Maintenance Facility. All detected dissolved arsenic concentrations are below dissolved arsenic's trigger level of 0.05 mg/l.

Total copper was detected in two downgradient wells only, specifically in MW-1401 and MW-1402. Total copper concentrations in the groundwater were 0.016 mg/l in MW-1402, located downgradient of the Central Detention Pond, and 0.019 mg/l in MW-1401, located downgradient of the PN-43 Maintenance Facility. Although a trigger level for total copper was not established, the relatively low concentration of copper is not considered significant. In addition, JMM regards the presence of copper in MW-1401 as not detected due to associated field contamination. Total copper was measured at 0.014 mg/l in the MW-1401 rinsate blank associated with the MW-1401 groundwater samples ( JMM, 1991b).

Total and dissolved zinc were measured at concentrations ranging from 0.026 mg/l to 0.24 mg/l in the four groundwater samples. All of these groundwater concentrations are below the trigger level of 5 mg/l established for zinc.

**5.3.2.2 Volatile Organic Compounds.** Solvent constituents including benzene, 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene, and xylenes were detected in groundwater samples collected from downgradient well MW-1403, located north of the PN-49 Maintenance Facility. None of these organic compounds were detected elsewhere in site groundwater samples.

The compound 1,1-DCA is known to be a breakdown product of 1,1,1-trichloroethane, which is a common solvent. Except for 1,1-DCA, which has no MCL and therefore no established trigger level, these organic compounds were detected at concentrations below their respective trigger levels.

Chloroform was detected only in MW-1401, located downgradient of the PN-43 Maintenance Facility in the western portion of the site, at a concentration of 2.6 µg/l. This concentration is below chloroform's trigger level of 5 µg/l. However, JMM regards the presence of chloroform at this concentration in groundwater as not detected due to field contamination. Chloroform was measured at 49 µg/l in the MW-1401 rinsate blank associated with the MW-1401 groundwater samples (JMM, 1991b). Carbon disulfide was detected in MW-1401 at a concentration of 0.6 µg/l. This concentration is below the established carbon disulfide trigger level of 1,000 µg/l.

### 5.3.3 Site Surface Water/Sediment

JMM collected field samples from surface water and sediment media to identify possible contamination within the various wetland and drainage areas at the LACV-30 Site. Several metal compounds were detected at levels above trigger levels in the surface water and sediment samples. The trigger levels for surface water and sediments were discussed in detail in Section 4.0. The surface water trigger levels are based on Virginia Water Quality Standards for the protection of aquatic life (Table 4-5). JMM has applied the trigger levels established for site soil to the site sediment at the LACV-30 Site. Figure 5-3 presented earlier denotes locations of compounds detected above trigger levels at the LACV-30 Site.

Sediment sample SD-1431, located at the Hospital Road Lake, receives surface water runoff from the Maintenance Garage at the PN-43 facility. This sample contained 83 mg/kg of zinc, exceeding the 57 mg/kg trigger level for zinc. Concentrations of copper were also detected above trigger levels in sediment sample SD-1435, which receives surface water runoff from an area behind the PN-49 Maintenance Garage.

Dissolved zinc and dissolved lead were detected in surface water samples at levels higher than the trigger level assigned for each compound. The surface water sample collected from Hospital Pond (SW-1451) contained 0.069 mg/l of zinc, which exceeds the 0.047 mg/l trigger level. In addition, the lead and zinc concentrations detected in surface water sample collected from the Central Wetland area (SW-1453) were 0.006 mg/l and 0.10 mg/l, respectively. These concentrations are higher than the 0.0032 mg/l trigger level for dissolved lead and the 0.047 mg/l trigger level for dissolved zinc.

Several analytes without trigger levels were detected at concentrations above the MRL in sediment and surface water media. At SD-1432 and SD-1433, cadmium was detected at concentrations of 2.5 mg/kg and 0.7 mg/kg, respectively. Mercury was detected at SD-1455 at a concentration of 0.04 mg/kg. In surface water, TFH-H was detected in concentrations greater than the MRL in two of the five surface water samples collected at the LACV-30 Site. The TFH-H concentration in the surface water sample collected from the Central Detention Pond (SW-1452) was 0.8 mg/l and the concentration of TFH-H compounds in the Normandy Wetland surface water sample (SW-1454) was 56 mg/l. At the Normandy Wetland surface water sampling location, a storm outlet discharges flows originating from the PN-49 grit basin.

The significance of TFH-H concentrations measured in environmental site media at the LACV-30 Site is difficult to assess because a TFH-H trigger level in surface water has not been established, due to the absence of ambient water quality criteria or an MCL for total petroleum hydrocarbon compounds. When addressing the surface water contamination, it is important to consider the interaction of the surface water and groundwater regimes. As discussed in Section 5.2, surface waters could be recharging the surrounding groundwater table aquifer during periods of increased surface water volumes such as heavy rains and runoff from LACV-30 cleaning operations. Therefore, the established trigger levels for groundwater should also be relevant for use in evaluating surface water concentrations. The Virginia groundwater protection standard for total petroleum hydrocarbons is 1.0 mg/l. If this level is adopted as a surface water trigger level, then the 56 mg/l TFH-H concentration in surface water sample SW-1454 exceeds the trigger level. The 1.0 mg/l total petroleum hydrocarbon trigger level is considered sufficiently conservative to reflect the possible presence of a petroleum liquid sheen on surface water. The reportable quantity for petroleum liquids on surface water is a sheen.

In addition, use of a groundwater trigger level for total petroleum hydrocarbons in surface water is conservative considering the pathways by which compounds in surface water could migrate into groundwater. If contaminated surface water infiltrates into the subsurface, compound concentrations could be reduced by partitioning of the compounds to the soil, and by dilutional effects. Dilutional effects could be associated with infiltration occurring near the base of the water column, while the majority of hydrocarbon compounds tends to concentrate near the top of the water column.

Sediment samples were also collected to identify the presence of contamination in these two drainage areas. TFH-H was detected in the sediment sample (35 mg/kg) from the Central Detention Pond (SD-1432) at a concentration below the trigger level of 100 mg/kg. TFH-H compounds were not detected above the MRL in the sediment sample from the Normandy Wetland area (SD-1433), which was collected in the same area as SW-1454.

## 5.4 CONTAMINANT PATHWAYS

Three basic pathways exist through which contaminants could migrate across the LACV-30 Site or beyond site boundaries. Contaminants resulting from spills or other releases of hazardous substances could migrate via atmospheric, surface or subsurface transport pathways, as discussed in this section.

### 5.4.1 Atmospheric Transport

Any release of hazardous substances from a contaminant source at the LACV-30 Site could result in release of contaminants to ambient air. Compounds released into ambient air could include contaminated dust particles or volatile organic vapors. Site sources could include maintenance facilities, underground storage tanks, detention ponds, grit basins, vehicle wash racks, oil/water separator units, stormwater collection drains, miscellaneous spills or discharges associated with waste management systems and practices, contaminated soil or sediment, or contaminated groundwater.

The direction of transport and degree of dispersion of contaminants would depend on local meteorological conditions, the type of compound, and the contaminant transport medium (e.g., soil, dust). The climate of the Fort Story area, which was described earlier in Section 1.2.2, is a humid sub-tropical climate (influenced by the Atlantic Ocean and Chesapeake Bay) characterized by an average annual temperature of 60 degrees Fahrenheit (60° F). Winters are typically mild, while summers are relatively cool. Most precipitation is received during the months of April through September. Moderate snowfall (averaging 7.3 inches per year) is received during the winter months. Convective thunderstorm activity significantly contributes to precipitation received during the summer months. Annual precipitation is occasionally augmented by the local passage of these storms. Winds in the Fort Story area are usually light to moderate but on occasion may be gusty, thereby resulting in greater migration of any airborne chemical vapors or particulates.

### 5.4.2 Subsurface Transport

Any spills or other releases of hazardous substances from sources at the LACV-30 Site could adversely affect soil, surface water/sediments, and groundwater. Compounds discharged to the subsurface could migrate downward and reach the water table. This potential migration, however, would be limited to some extent by adsorption and dispersion processes in the unsaturated zone. The degree of this attenuation would depend on site-specific hydrogeologic conditions.

As was discussed in detail in Section 2.0, the subsurface at Fort Story generally consists of unconsolidated, interbedded sands and clays with minor occurrences of gravel and shell fragments. The hydrogeologic framework within the Fort Story vicinity consists of a system of seven aquifer units separated by intervening semi-confining units.

The chief potable water supply in the region is the surface water reservoir system operated by the City of Norfolk. Potable water is reportedly obtained from groundwater sources only to a minor extent. Groundwater use at Fort Story is restricted to withdrawals from a single well located at Site 6, LARC Maintenance Area. Water obtained from this well is used for nonpotable applications only.

The water table below Fort Story is encountered at relatively shallow depths ranging from approximately 10 feet in low-lying areas to approximately 40 feet (bls) in high ridge areas. In coastal sand ridges to the north, however, groundwater is encountered at approximately 4 feet (bls). Water table contours within the Fort Story area are generally characterized by the presence of a localized groundwater divide in the vicinity of the central sand ridge complex. Ambient groundwater flow directions are generally northward toward the coastline and southward toward the wooded wetland, respectively, from the central sand ridge area. Therefore, contaminants released to the subsurface could migrate through the unconsolidated overburden material into the groundwater. Subsequently, contaminants could discharge into the wetland areas or the Chesapeake Bay.

### 5.4.3 Surface Transport

The sandy surface soils characteristic of the Fort Story area promote efficient infiltration of precipitation received at the Installation. Overland surface runoff is collected in ponds or wetland areas or is routed through Fort Story's storm sewer system to one of three outfalls discharging to either the Atlantic Ocean or Chesapeake Bay. Contaminants adsorbed to affected soils at Fort Story could be carried by surface water runoff and discharged into ponds, wetland areas or the storm sewer system. Subsequently, contaminants could potentially be discharged into the ocean or bay.

## 5.5 DRAINAGE EVALUATION

JMM qualitatively evaluated the existing drainage structures at the LACV-30 site for efficiency, usefulness, and appropriateness for transferring surface water runoff to correct disposal structures. As was discussed in Section 1.0, the LACV-30 Site consists of two nearly identical adjacent maintenance facilities, PN-43 to the southwest and PN-49 to the northwest. Each area consists of storage and maintenance buildings and expansive, concrete paved parking lots for the LACV-30 vehicles. This drainage evaluation is based on JMM's field observations and a capacity analysis for a design storm event. The capacity analysis will incorporate data available on as-built design drawings, site records, and an estimate of the storm water volume as the result of rain events.

### 5.5.1 Drainage Structures

After review of site maps and compilation of information collected during the Literature Search task, JMM identified eighteen structures within the LACV-30 storm drainage system that warranted additional field investigation. The relative location of each of these areas is provided in Figure 5-5. JMM completed the assessment of the drainage structures in January 1991.

Area No. 1

The first area investigated consists of a catch basin located north of the Maintenance Building in the PN-43 area of the site. There are two propane storage tanks located approximately 10 feet away from the catch basin. During JMM's inspection, there was no evidence of problems in this area.

Area No. 2

The second area investigated is the fuel oil UST behind the PN-43 Maintenance Building. The relative location of the UST was verified in the field, but there was no indication of surface piping or the size of the UST. Based on field observations, there is no apparent relationship between the UST locations and the drainage system.

Area No. 3

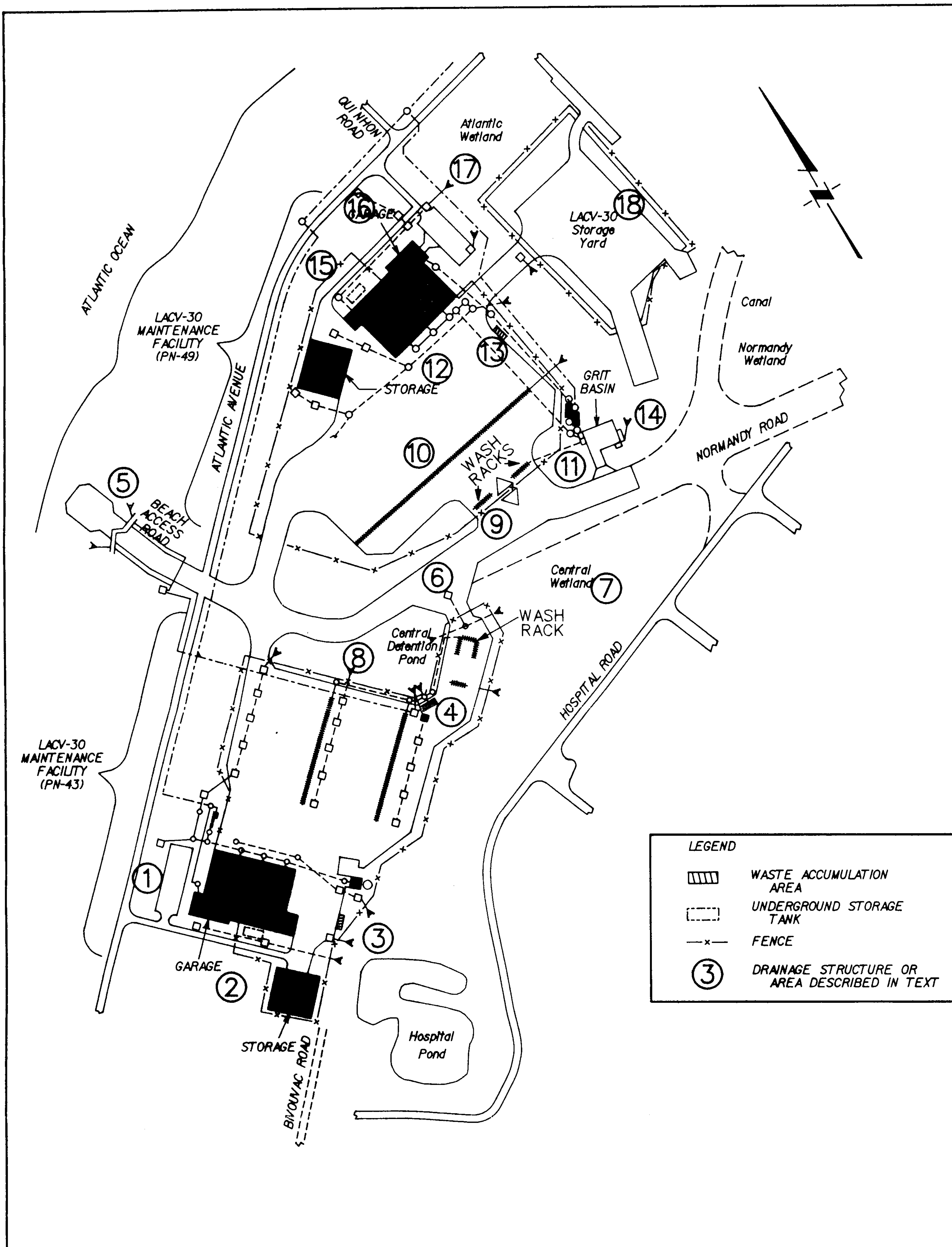
The storm outfall to the Hospital Pond was the third area investigated. The field survey confirmed that the outfalls were present and that the storm water flows run overland to the pond.

Area No. 4

The fourth area of concern is the operation of the oil/water separator adjacent to the Central Detention Pond. Through the information available during the literature search and JMM's field survey, JMM determined that the oil/water separator receives flows from the wash rack adjacent to the Central Detention Pond. There is a manhole having a 6-inch outlet to this oil/water separator. This outlet is located 6 inches below the outlet to the detention pond. This configuration allows normal washrack flow and initial runoff from pavement during rain events to be routed through the oil/water separator and lift station to the sanitary sewer. The capacity of the oil/water separator is 150 gallons per minute. Flow to the oil water separator is restricted by the incoming 6-inch line. All flows that exceed the oil/water separator inlet pipe capacity are routed to the Central Detention Pond through the 21-inch storm line.

Area No. 5

The fifth area of investigation is the Beach Outfalls along the Beach Access Road. These locations are suspected to receive discharge from the lift station adjacent to the Central Detention Pond. JMM's field survey, however, was unable to field verify these locations. This area was also the site for a planned sediment sample (SD-1436). After additional review of the as-built drawings, JMM determined that the flow from the lift station is routed to the sanitary sewer system or to a storage tank, which in turn feeds a sprinkler system located along Beach Access Road. As a result of this review, the location of sample SD-1436 was moved to within the area fed by the sprinkler system.




NOTE: THIS FIGURE NOT TO SCALE

PA/SI, FT. STORY, VA

DRAINAGE AREAS
LACV-30 MAINTENANCE FACILITY

JMM James M. Montgomery

FIGURE 5-5

Area No. 6

The sixth area of investigation is a catch basin located north of the PN-43 Wash Racks. During JMM's site visit in August 1990, this storm line was observed to contain stagnant water. During the drainage survey, JMM found evidence of sediment being present, but the storm sewer line did not appear to be blocked.

Area No. 7

The seventh area investigated is the Central Wetlands area. JMM examined the extent of the wetland boundaries. The survey indicated that there is approximately 8 to 16 inches of water in this area. This area receives overflow from the Central Detention Pond during periods of high volume in the Central Detention Pond.

Area No. 8

The drainage to the Central Detention Pond is the eighth area investigated. At the time of the drainage survey, the surface area of the water in the pond was approximately 60 by 40 feet. The number of outfalls to the pond, four, was also confirmed.

Area No. 9

The ninth area investigated is the wash rack area for the PN-49 facility. The wash rack area is served by trench drains that convey washwater to the grit basin. The drains appear to be adequate for transporting the required flows.

Area No. 10

The tenth area investigated is the trench drain system that collects surface runoff in the PN-49 area where LACV-30 vehicles are parked. The trench drain runs west to east towards the Normandy Wetland area. The trench drain appeared to have been recently cleaned.

Area No. 11

The eleventh area investigated is the grit basin, which is part of the PN-49 facility. The grit basin serves as a holding tank for flows originating from the wash rack area. An oil skimmer was installed at the grit basin to remove oil from the water surface prior to discharging flows through the storm outlet.

Area No. 12

The twelfth area of investigation is the catch basin system the serves the PN-49 Maintenance Building and Garage. The review determined that the catch basin system appeared to be adequate for serving this area of the site. There were areas in which sediment had collected in the bottom of the catch basin structures.

Area No. 13

The thirteenth area investigated is the PN-49 Waste Accumulation Area. This area stores lubricating oil, petroleum waste products, and gasoline containers on wooden pallets located outdoors.

Area No. 14

The fourteenth area investigated is the wetland area where the outlet from PN-49 grit basin discharges. This area is characterized by light vegetation and surface water that appeared stagnant.

Area No. 15

The fifteenth area investigated is the fuel oil UST behind the PN-49 Maintenance Building. The relative location of the UST was verified as part of the field evaluation, and based on visual inspection, there is no evidence of problems in the areas of the UST and the storm drainage system.

Area No. 16

The sixteenth area investigated is the catch basin system between the PN-49 Maintenance Building and Atlantic Avenue. JMM inspected the catch basin system to determine if the structure adequately conveys storm runoff. There was no evidence of capacity problems in this area.

Area No. 17

The seventeenth area investigated is the Atlantic Wetland area. JMM confirmed that two storm outlets route flow to this area. This area consists of dunes and ponded water. Although the water appeared stagnant during JMM's field survey, there was no evidence of a sheen on the water surface.

Area No. 18

The eighteenth area investigated is the PN-49 LACV-30 Storage Yard. The surface water runoff in this area is towards the Normandy Wetlands. Although there were no catch basins apparent in this area, JMM noted that the topography appears appropriate to sufficiently drain the concrete area during rain events to the adjacent wetlands.

### 5.5.2 Drainage Volumes

The rational method was used to calculate the flow of storm water flow during rain events. This method expresses storm runoff as follows (Merrit, 1983):

$$Q = C \times I \times A$$

where,

Q = peak discharge or runoff in cubic feet per second
C = runoff coefficient (dimensionless)
I = rainfall intensity in inches per hour (i.e., design storm)
A = drainage area in acres

Although the rational formula contains certain inherent limitations, it has gained widespread use in the design of small drainage systems. The use of this method for detailed drainage analysis is limited by the assumptions used to calculate the parameters in the discharge equation. For example, the runoff coefficient characterizes runoff as a single value that combines complex factors such as soil moisture, topography, and infiltration. In addition, the equation assumes that the time of concentration for storm flows in the drainage area is less than the design storm duration. Considering the relatively small size of the drainage area and the presence of predominantly paved areas at the LACV-30 Site, the time of concentration for storm flows should be relatively fast. Therefore, the limiting assumptions of the rational formula seem appropriate for application in this LACV-30 Site drainage evaluation..

**5.5.2.1 Runoff Coefficient.** The runoff coefficient is used to estimate the percentage of the design storm that appears as direct runoff. The quantity of rain that results in storm runoff is related to the permeability of the site. Areas with high permeability will allow rainfall to infiltrate into the subsurface rather than run overland to storm sewer system. Areas with low permeability, such as paved surfaces, will contribute a much higher percentage of rainfall as surface runoff. The two maintenance areas at the LACV-30 Site, PN-43 and PN-49, are predominantly large concrete areas. The runoff coefficient is conservatively assumed to be 0.95 for the paved areas at the LACV-30 Site. The runoff coefficient considers infiltration, evapotranspiraton, and interception uptakes of the total volume of rainfall.

**5.5.2.2 Design Storm.** The rational method requires an assumption that a constant uniform rainfall exists across the entire area during the time of concentration. Due to the relatively small size of the LACV-30 area, JMM considers this assumption to be valid. To evaluate the existing drainage system, a design storm was selected.

The Department of the Army has published guidelines for drainage design in a publication entitled, "Drainage For Areas Other Than Airfields, Army TM 5-824-4" (Department of the Army and the Air Force, 1983). In this document, a design storm of one-hour duration at a 10-year frequency is recommended for the design of military installations such as administrative, industrial, and housing areas. Such a storm would produce a rainfall intensity of about 2.7 inches per hour. This is considerably higher than the rainfall suggested in the Virginia Solid Waste Management Regulations. Since the guidelines provided in the TM 5-824-4 design document are specifically developed for military installations, JMM utilized the one-hour 10 year storm for this analysis.

**5.5.2.3 Drainage Area Segmentation**. Drainage of the PN-43 and PN-49 areas at the LACV-30 area is accomplished by routing storm water flows to seven receptor areas. These receptors consist of surface water bodies, wetland areas, or oil/water separators. The two surface water bodies that receive surface runoff are the Hospital Pond and the Central Detention Pond. The PN-43 and PN-49 Wash Racks have a limited drainage area that is designed to collect washwater from the vehicle cleaning operations, and then route these flows to the oil/water separator. Surface runoff is also routed to wetland areas, which JMM has designated as the Central Wetland, Normandy Wetland and Atlantic Wetland for the purposes of differentiating each area.

The Hospital Pond receives runoff from the PN-43 facility. In particular, the roof leaders from the Maintenance Building are routed to the outfalls, and there are several catch basins that receive flows near the New Waste Accumulation and the vehicle parking area. Since this is a paved area, the runoff coefficient for computational purposes would be 0.95. The estimated drainage area to the Hospital pond is approximately 2.8 acres.

The Central Detention Pond receives drainage from the paved concrete area bounded by the PN-43 Maintenance Building to the south and the Central Detention Pond to the north. The estimated drainage area for storm flows tributary to the Central Detention Pond is 6.13 acres.

The oil/water separator, which is adjacent to the Central Detention Pond, receives surface runoff from the concrete pad bounded by the PN-43 Maintenance Building to the south and the Central Detention Pond to the north. This allows runoff from the LACV-30 vehicles to be routed to a suitable disposal area. The oil/water separator also receives washwater from the wash rack area. The PN-43 LACV-30 vehicles are cleaned at the wash rack adjacent to the Central Detention Pond. The normal time required for cleaning each LACV-30 vehicle is an hour to an hour and a half. The capacity of the oil/water separator, which is 150 gallons per minute (gpm), was designed to meet the demand from the wash-down activities (Hayes, Seay, Mattern and Mattern, 1982). Wastewater generated from the vehicle wash-down operations and parking area are routed through a oil/water separator and force main system to the Hampton Roads Sanitation District (HRSD) sanitary sewer. The drainage area for the paved surfaces tributary to the oil/water separator is 2.3 acres.

The PN-49 wash rack, which is located at the intersection of Normandy Road and the entrance of the controlled access area to the facility, discharges flows to the grit basin. The grit basin serves as a holding tank for washwater or surface runoff before the flows are discharged to the storm outfall. The grit basin has an oil skimmer which is intended to removal oil products based on the phase separation of oil and water. The oil/water separator receives flow from the PN-49 Maintenance Garage and discharges flow to the HRSD sanitary sewer. The drainage area for the paved surfaces tributary to the oil/water separator is an estimated 4.0 acres.

Surface runoff from the LACV-30 Site is also routed to one of three wetland areas. The Atlantic Wetlands receive surface runoff form the parking lot for the PN-49 Maintenance Building and the roof drains for the Maintenance Building. The estimated area for this drainage basin is 1.9 acres. The Normandy Wetland receives surface water runoff from the paved area between the PN-49 wash racks and the PN-49 Maintenance Building. The estimated area for this drainage basin is 3.2 acres. The Central Wetland receives surface water runoff from the concrete pad north of the Central Detention Pond, and those areas south of the Central Detention Pond which are not impacted by the wash rack area. The estimated area for this drainage basin is 2.0 acres.

**5.5.2.4 Summary of Peak Flows.** The results of the rational method are presented in Table 5-3. These flows are based on a runoff coefficient of 0.95, a design storm of 2.7 inches, and a drainage area that was specific to each of the seven receptors of surface water runoff.

## TABLE 5-3

## SUMMARY OF RATIONAL METHOD RESULTS

| | Drainage Area (Ac) | Peak Runoff (cfs) |
|---|---|---|
| Hospital Pond | 2.8 | 7.2 |
| Central Detention Pond | 6.13 | 15.7 |
| PN-43 Oil/Water Separator | 2.3 | 5.9 |
| PN-49 Grit Basin | 4.0 | 10.3 |
| Central Wetlands | 2.0 | 5.2 |
| Atlantic Wetlands | 1.9 | 4.9 |
| Normandy Wetlands | 3.2 | 8.2 |

Ac - Acres
cfs - cubic feet per second

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

The purpose of JMM's Preliminary Assessment/Site Investigation (PA/SI) at the LACV-30 Site is to confirm the presence or absence of significant contamination in site soils, sediments, groundwater and surface waters; assess the potential for contaminant migration into the surrounding wetland areas; evaluate the effectiveness of existing oil/water separation and transfer systems to manage stormflow runoff, and; define future investigations or other actions required. Based on the results of the PA/SI evaluation discussed in Section 5.0, JMM has developed the following conclusions and recommendations.

## 6.1 CONCLUSIONS

The presence or absence of significant contamination in soil, sediment, groundwater and surface water media at the LACV-30 Site, as a result of the PA/SI investigation, is discussed in this section. Soil and groundwater conclusions are discussed in Sections 6.1.1 and 6.1.2, respectively; surface water and sediment conclusions are discussed in Section 6.1.3. The potential for contaminant migration into the surrounding wetland areas is discussed in Section 6.1.4, Drainage Evaluation.

### 6.1.1 Soil Medium

JMM's investigation at the LACV-30 Site confirmed the presence of metal analytes in site soils. Chromium, copper, cadmium, and zinc were detected across the site. Chromium and zinc were detected below trigger level concentrations. Copper was found at concentrations above trigger level in two borings located near the fuel oil underground storage tanks (USTs). However, the presence of elevated levels of copper in soil near the USTs is not necessarily indicative of UST releases, especially since no total fuel hydrocarbons - heavy fraction (TFH-H) compounds were detected in site soil. Therefore, the levels of metals were considered representative of the background concentrations for each analyte.

In addition, toluene was the only volatile organic compound (VOC) detected in site soil. However, toluene levels ranged from 0.03 to 0.20 mg/kg in only two borings located near the PN-43 and PN-49 wash racks. Although a trigger level is not established for toluene in soil, these low levels are potential laboratory contaminants and JMM does not consider these isolated levels as indicative of a source at the LACV-30 Site.

JMM detected pesticide compounds, Dieldrin and DDT, in two soil boring locations at the LACV-30 Site. However, the concentrations are within anticipated background levels for Dieldrin and DDT in soil.

Based on a review of soil data, JMM concludes that there is no evidence indicating that LACV-30 Site operations have caused significant hazardous substance releases to the soil.

### 6.1.2 Groundwater Medium

JMM's PA/SI evaluation of LACV-30 Site groundwater confirmed the presence of metal analytes in both upgradient and downgradient locations. Although total zinc was found at concentrations above trigger level, the highest levels of total zinc were detected in the upgradient montoring well, so this is not considered an indication of zinc contamination due past use of the LACV-30 Site. JMM regards the presence of total copper in groundwater samples from downgradient monitoring wells (MW-1401 and MW-1402) as suspect because total copper was found in the associated rinsate blanks. The concentrations of chloroform and carbon disulfide in samples MW-3401 and MW-3401D were below the established trigger levels. Dissolved metals, including arsenic, lead, chromium, and zinc, were detected at concentrations below trigger levels.

Levels of solvent related constituents were detected in site groundwater in MW-1403, which is located downgradient of the PN-49 Maintenance Facility. The levels of benzene, 1,1-dichloroethene, m,p-xylenes, and o-xylenes were all found at concentrations below trigger levels. Threrefore, no further investigatory action is warranted due to the presence of solvent constituents in groundwater.

### 6.1.3 Surface Water/Sediment Medium

The results of JMM's surface water sampling and analysis during the PA/SI evaluation have established the presence of dissolved lead and zinc. Zinc was detected above trigger level in two of the five surface water samples. Lead was detected above trigger level in one of the surface water samples. JMM's evaluation of site information has established a possible interrelationship between the site surface water and groundwater. JMM's groundwater data indicate that dissolved zinc was present in all four groundwater samples collected for the project.

The surface water analyses also identified total fuel hydrocarbons - heavy fraction (TFH-H) at concentrations exceeding the trigger level. However, the TFH-H trigger level for surface water is a conservative standard (1.0 mg/l) adopted from Virginia Groundwater Protection Standards, due to the interrelationship of site surface water and groundwater. SW-1454 was collected near the discharge from the PN-49 grit basin and 56 mg/l of TFH-H constituents were detected in this sample. The grit basin is equipped with oil skimming equipment to remove fuel products prior to discharge to the storm outlet. Based on inspection of this equipment, the oil skimming device is operating properly. Therefore, the detection of TFH-H constituents in sample SW-1454 is considered a non-point source resulting from the LACV-30 vehicles use of the adjacent area for beach access.

JMM's analysis of sediment samples has confirmed the presence of metals in the pond and wetland sediments. Specifically, the following metals were detected in the sediment samples: cadmium, chromium, copper, mercury and zinc. The concentration of copper in SD-1435 was measured to be above the trigger level, and is potentially related to the runoff generated near SB-1407. Zinc was found at a concentration exceeding trigger level in SD-1431, which is located in Hospital Pond. This determination should consider the possibility that relatively low concentrations of zinc may be prevalent throughout the site, and that zinc may have been adsorbed to the pond sediments.

Trigger levels are not available for cadmium and mercury in sediments. The concentrations of cadmium at the two locations where concentrations were above the Method Reporting Level (MRL) were 0.7 mg/kg and 2.5 mg/kg. It does not appear that there is a problem with excessive cadmium contamination in the sediments. Similarly, mercury was detected at 0.04 mg/kg, which is slightly above the detection limit of 0.02 mg/kg. Therefore, there does not appear to be a problem with significant mercury contamination at the site.

### 6.1.4 Drainage Evaluation

A drainage evaluation was completed to determine the quantity of surface water runoff generated from the paved area of the LACV-30 Site for a design storm. This task included document drainage patterns at the site into adjacent wetland areas. The drainage evaluation identified the following seven receptors for surface water runoff during storm events: Hospital Pond, Central Detention Pond, PN-43 Oil/Water Separator, PN-49 grit basin, Central Wetlands, Atlantic Wetlands, and Normandy Wetlands. A detailed description of each drainage area was presented in Section 5.5.

JMM inspected the existing storm sewerage system and oil/water separators to identify potential capacity problems. This investigation did not identify specific structures where apparent capacity problems existed. The capacities of the PN-43 oil/water separator and PN-49 grit basin were designed based on the wash water requirements from the two LACV-30 wash-down areas (HSMM, 1983).

The PN-43 Oil/Water Separator is designed so that excess flows will be routed to the Central Detention Pond rather than causing operational problems at the oil/water separator. This was accomplished by restricting the inlet pipe capacity to the oil/water separator. Once the capacity of the inlet pipe is exceeded, it causes flows in the first manhole upstream of the oil/water separator to surcharge so that the excess flows will be diverted to the Central Detention Pond. During rain events, initial runoff flows from the pavement in the wash rack area are also routed through the separator before flows begin to overflow to the Central Detention Pond.

At the PN-49 wash racks, washwater is routed to the grit basin which serves as a holding basin. This provides the incoming oil/water mixture sufficient time for phase separation so that the lighter oil phase will be on top of the water phase. The grit basin is equipped with an oil skimmer in front of the storm water outlet to the Normandy Wetlands. The oil skimmer is designed to remove oil from the top of the water surface prior to discharge.

The Maintenance Garages and wash racks are the primary areas for potential spills at the LACV-30 Site. All of these areas contain oil/water separators or oil skimmers. As part of the Drainage Evaluation, JMM also addressed the potential for contaminant migration into the surrounding wetland areas. The three principal wetland areas have been identified as Normandy, Central, and Atlantic Wetlands for the purpose of this report. The wetland areas receive storm water runoff from paved areas of the LACV-30 Site. In addition, the Hospital Pond area also receives surface water runoff from the site.

There are several areas where the potential exists for contaminant migration into the wetlands areas. For example, surface runoff from the paved area located in front of the PN-43 and PN-49 Waste Accumulation Areas could migrate to the Hospital Pond or Normandy Wetlands areas. As a second example, the Central Detention Pond contains an overflow structure where the maximum elevation in the pond can not exceed 18.5 ft with respect to the National Geodetic Vertical Datum (NGVD). The overflow structure routes flows to the Central Wetlands when the volume in the pond exceeds the design limit. If this occurs, potentially contaminated surface water from the Central Detention Pond could migrate into the adjacent wetlands. Finally, the outlet structure from the PN-49 grit basin may be a source of contaminant migration to the surrounding wetlands.

## 6.2 RECOMMENDATIONS

Based on all data collected during this PA/SI evaluation, JMM concludes that there is no evidence indicating that LACV-30 Site operations have contributed significant hazardous substance releases to environmental media, which include soil, surface water/sediment, and groundwater. In accordance with the Site Evaluation and Recommendation Decision Matrix presented in Section 2.0 of this document, JMM considers the "No Further Action" alternative to be appropriate for the LACV-30 Site.

# APPENDIX A

## RATIONALE FOR LOCATING SOIL BORINGS, MONITORING WELLS, SEDIMENT AND SURFACE WATER SAMPLES AT THE LACV-30 SITE

**SB-1401** is located in the PN-43 wash rack concrete pad. Wastewater from the wash rack drains to an oil/water separator. Samples collected from SB-1401 should provide an indication of whether wastewater from washing operations may be contaminating subsurface soils.

**SB-1402** is located near the former or "old" PN-43 waste accumulation area. Samples collected from this boring should provide an indication of whether waste accumulated in this area has contaminated subsurface soils.

**SB-1403** is located near the current or "new" PN-43 waste accumulation area. Drums of waste fluids and portable gas cans are stored in a shed whereas drums containing waste oils and spent absorbent booms are stored on wooden pallets outside the shed. Samples collected from SB-1403 should provide an indication of whether contents stored in these drums may have leaked or spilled and contaminated subsurface soils.

**SB-1404** is located near a fuel oil UST at the PN-43 Maintenance Facility. Samples from this boring should provide an indication of whether fuel oil contents have contaminated subsurface soils.

**SB-1405** is located near Outfalls CW-1 and CW-2 which discharge to the nearby Central Wetland Area. Samples collected from SB-1405 should provide an indication of whether surface runoff from the Central Detention Pond and concrete pad located upstream of the PN-43 wash rack may be contaminating subsurface soils.

**SB-1406** is located in the PN-49 wash rack concrete pad. Wastewater from this wash rack apparently drains to the grit basin where it is then discharged via outfall NW-1 to the Normandy Wetland Area. Samples collected from SB-1406 should provide an indication of whether wastewater from washing operations may be contaminating subsurface soils.

**SB-1407** is located near a fuel oil UST at the PN-49 Maintenance Facility. Samples from this boring should provide an indication of whether the fuel oil contents have contaminated subsurface soils.

**SB-1408** is located in the PN-49 waste accumulation area. Drums of flammable fluids and waste fluids are reportedly stored in the shed. Samples from this boring should provide an indication of whether waste stored in this area has contaminated subsurface soils.

**MW-1401, MW-1402, MW-1403** and **MW-1404** were installed at locations that may provide an effective groundwater monitoring system. MW-1404 was installed hydraulically upgradient from the PN-43 and PN-49 Maintenance Facilities. Groundwater samples from this well should provide an indication of the background water quality. MW-1401, MW-1402 and MW-1403 were installed downgradient of the PN-43 Maintenance Facility, Central Detention Pond and PN-49 Maintenance Facility, respectively. Groundwater samples from these wells should provide an indication of possible contaminants that may be migrating off site.

**SD-1431** was collected from Hospital Pond sediments, near Outfalls HP-2 and HP-3. This sample should provide an indication of whether surface runoff, roof drainage and pump house generator blowdown water from the PN-43 Maintenance Facility may be contaminating Hospital Pond sediments.

**SD-1432** was collected from Central Detention Pond sediments near Outfalls CP-3 and CP-4. This sample should provide an indication of whether surface runoff and wash rack oil/water separator overflow from the PN-43 Maintenance Facility may be contaminating Central Detention Pond sediments.

**SD-1433** was collected from the area receiving discharge from Outfall NW-1 at the PN-49 Maintenance Facility, which discharges into the Normandy Wetland Area. This sample should provide an indication of whether the grit basin overflow may be contaminating sediments at Outfall NW-1 and possibly sediments at the Normandy Wetland Area.

**SD-1434** was collected from a location near the discharge points of Outfalls NW-3 and NW-4 at the PN-49 Maintenance Facility, which discharges into the Normandy Wetland Area. This sample should provide an indication of whether surface drainage from the storage building area, roof drainage, potentially floor drainage, and surface drainage from the causeway connecting the storage yard and parking lot may be contaminating surface sediments at Outfalls NW-3 and NW-4, and possibly sediments at the Normandy Wetland Area.

**SD-1435** was collected from Outfall AW-1 and Outfall AW-2 and composited into one sample. This sample should provide an indication of whether roof and surface drainage from the east and north areas of the PN-49 maintenance garage may be contaminating sediments at Outfalls AW-1 and AW-2 and possibly sediments at the Atlantic Wetland Area.

**SD-1436** was collected from a narrow, shallow ditch created by runoff water from an irrigation and sprinkler system that runs along Beach Access Road. The discharge from the oil/water separator is routed to a storage tank which feeds the irrigation and sprinkler system. This sample should provide an indication of whether the discharge from the oil/water separator may be contaminating surface soils along Beach Access Road.

**SW-1451** was collected from within Hospital Pond, near Outfalls HP-2 and HP-3. This sample should provide an indication of whether surface runoff, roof drainage and pump house generator blowdown water from the PN-43 Maintenance Facility may be contaminating surface water in the Hospital Pond.

**SW-1452** was collected from within the Central Detention Pond, near Outfalls CP-3 and CP-4. This sample should provide an indication of whether surface runoff and wash rack oil/water separator overflow from the PN-43 Maintenance Facility may be contaminating surface water in the Central Detention Pond.

**SW-1453** was collected from within the Central Wetland Area, near Outfall CW-1. This sample should provide an indication of whether surface runoff from the Central Detention Pond and concrete pad located upstream of the PN-43 was rack may be contaminating the Central Wetland Area.

**SW-1454** was collected from the area receiving discharge from Outfall NW-1 at the PN-49 Maintenance Facility, which discharges to the Normandy Wetland Area. This sample should provide an indication of whether the grit basin overflow may be contaminating surface water at Outfall NW-1 and possibly water in the Normandy Wetland Area.

**SW-1455** was collected from a location near the discharge points of Outfall NW-3 and NW-4 at the PN-49 Maintenance Facility, which discharges into the Normandy Wetland Area. This sample should provide an indication of whether surface drainage from storage building area, roof drainage, potentially floor drainage, and surface drainage from the causeway connecting the storage yard and parking lot may be contaminating surface water at Outfalls NW-3 and NW-4, and possibly water in the Normandy Wetland Area.

# APPENDIX B
# SAMPLE NUMBER IDENTIFICATION SYSTEM

Each field or quality control (QC) sample is assigned a unique identifier to distinguish the origin of the sample point. The first four digits of the identifier specifies the installation at which the sample was collected (i.e., "S" for Fort Story) and the site designation (i.e., "LCV" for LACV-30 samples). The subsequent portion of the sample identifier specifies the matrix type and the sample number. A summary of designators for sample matrix types assigned to project samples is presented in Table B-1. The sample matrix type is followed by the designation of the delivery order number under which the sample was collected and the assigned sample number. For example, SB-1401 is the first soil boring collected for the LACV-30 project, which was authorized under Delivery Order 0014.

The next part of the sample identifier is used for soil and sediment samples. An identifier was required to distinguish between grab samples, which represent a discrete depth at which the sample was collected; and composite samples, which are collected at multiple sample depths within the same boring. Samples collected from three depths and composited into a single sample are identified with a "(C3)" notation following the sample number. Otherwise, the sample depth is reported within the parentheses. For example, the sample SLCVSB1401(C3) was a soil sample collected from three depths and composited into a single sample, whereas SLCVSB1409(5) was a soil sample collected at a depth of 5 feet.

The subsequent portion of the sample identifier provides information specific to quality assurance/quality control (QA/QC) samples. The collection of field duplicate, field split, rinsate blanks, trip blanks, matrix spike, and matrix spike duplicate samples were identified as "D," "S," "RB," "TB," "MS," and "MSD," respectively. Duplicate and split samples were collected concurrently at the field sampling location. Duplicate samples are QC samples submitted to Montgomery Laboratories for analysis, whereas split samples are QA samples submitted to the project QA laboratory, Missouri River Division Laboratory, for analysis. The samples SLCVMW1401D and SLCVMW1401S are the duplicate and split samples, respectively, associated with field sample SLCVMW1401.

## TABLE B-1

## SUMMARY OF MATRIX IDENTIFIERS

| Identifier | Type of Sample |
|---|---|
| SB | Soil sample collected from a soil boring |
| SD | Sediment sample |
| MW | Groundwater sample from a monitoring well |
| SW | Surface water sample |
| DI | Distilled water used as source water |
| IW | Water sample collected from Installation tap for use as source water |

# APPENDIX C

## SUMMARY OF GEOTECHNICAL INFORMATION

Appendix C contains a compilation of geotechnical information for the LACV-30 PA/SI project. The information is organized as follows:

- Soil Sampling and Well Construction Summary Tables;
- Soil and Monitoring Well Boring Drilling Logs;
- Geotechnical Grain Size Analyses;
- Monitoring Well Construction Diagrams;
- Monitoring Well Development Sheets;
- Groundwater Sampling Logs; and,
- In Situ Permeability Data

## TABLE C-1

## WELL CONSTRUCTION SUMMARY
## LACV-30 SITE, FORT STORY, VA

| Well Number | TOC Elevation (ft., NGVD) | Ground Elevation (ft., NGVD) | Total Boring Depth (ft., BLS) | Top of Screen (ft., BLS) | Bottom of Screen (ft., BLS) |
|---|---|---|---|---|---|
| MW-1401 | 20.11 | 17.33 | 18.5 | 7.5 | 17.5 |
| MW-1402 | 26.20 | 23.69 | 25.5 | 14.5 | 24.5 |
| MW-1403 | 23.67 | 21.14 | 23.0 | 12.0 | 22 |
| MW-1404 | 13.04 | 9.9 | 12.0 | 1.0 | 11 |

NGVD - National Geodetic Vertical Datum of 1929
TOC - Top of Casing
BLS - Below Land Surface

## TABLE C-2

## SUMMARY OF SOIL SAMPLING DEPTHS SENT FOR ANALYSES
## LACV-30 SITE, FORT STORY, VA

| Location Number | Ground Elevation (ft., NGVD) | Total Boring Depth (ft., BLS) | VOC Sample Depth (ft., BLS) | Interval Depths of Composite Soil Samples (ft., BLS) | Interval Depth of Geotechnical Sample (ft., BLS) |
|---|---|---|---|---|---|
| MW-1401 | 17.33 | 18.5 | — | — | 7.5 |
| MW-1402 | 23.69 | 25.5 | — | — | 14.5 |
| MW-1403 | 21.14 | 23.0 | — | — | 12 |
| MW-1404 | 9.9 | 12.0 | — | — | 1 |
| SB-1401 | 13.09 | 10.0 | 0 | 0-2, 4-6, 8-10 | — |
| SB-1402 | 19.04 | 10.0 | 10 | | — |
| SB-1403 | 16.22 | 10.0 | 0 | | — |
| SB-1404 | 17.32 | 10.0 | 5 | 0-2, 4-6, 8-10 | — |
| SB-1405 | 9.52 | 5.0 | 0 | | — |
| SB-1406 | 12.59 | 10.0 | 0 | 0-2, 4-6, 8-10 | — |
| SB-1407 | 17.00 | 10.0 | 5 | 0-2, 4-6, 8-10 | — |
| SB-1408 | 18.30 | 10.0 | 5 | | — |

NGVD - National Geodetic Vertical Datum of 1929
BLS - Below Land Surface

# Soil and Monitoring Well Boring Drilling Logs

# DRILLING LOG

HOLE NO. 1401

SHEET 1 OF 1 SHEETS

| | |
|---|---|
| 1. COMPANY NAME: JAMES M. MONTGOMERY | 2. DRILLING SUBCONTRACTOR: HARDIN-HUBER, INC. |
| 3. PROJECT: USACE - LACV 30 | 4. LOCATION: LACV 30 PN-43 |
| 5. NAME OF DRILLER: HENRY SEALS | 6. MANUFACTURER'S DESIGNATION OF DRILL: MOBIL DRILL B-57 |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Augers: 3 1/4" ID; 6" OD; 2" DIA. LITH SPOONS; 3" DIA. SAMPLING Spoons | 8. HOLE LOCATION: SB 1401 NE Section of PN-43 |
| | 9. SURFACE ELEVATION: |
| | 10. DATE STARTED: 1/25/91 |
| | 11. DATE COMPLETED: 1/25/91 |
| 12. OVERBURDEN THICKNESS: N/A | 15. DEPTH GROUNDWATER ENCOUNTERED: 5.0' |
| 13. DEPTH DRILLED INTO ROCK: 0' | 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: |
| 14. TOTAL DEPTH OF HOLE: 10.0 FEET | 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A |
| 18. GEOTECHNICAL SAMPLES: NONE — DISTURBED: — ; UNDISTURBED: — | 19. TOTAL NUMBER OF CORE BOXES: NONE |

| 20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY) | 21. TOTAL CORE RECOVERY |
|---|---|---|---|---|---|---|
| 5 | YES | YES | | | | 95 % |

| 22. DISPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY) | 23. SIGNATURE OF INSPECTOR |
|---|---|---|---|---|
| GROUTED TO L.S. | YES | NO | | M. Ginenburg |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANALYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0-7.5 Sand - 100% (SW); quartz, subrounded, medium grained, hard, well sorted, clean, pale to light brown | OVM = 0 | | 0-2 | 27, 38, 51/5 | JACK HAMMERED THROUGH CONCRETE |
| | | | OVM = 0 | 2-4 | | 9, 22, 37, 34 | |
| | | | OVM = 0 | | 4-6 | 33, 48, 51/3 | |
| | | 7.5 - 10.0 Sand (SP) - 100%; quartz, subrounded, medium to fine grained, occasionally silty, hard, poorly sorted, light brown to gray. | OVM = 0 | 6-8 | | 5, 9, 8, 9 | |
| | | | OVM = 0 | | 8-10 | 23, 38, 34, 51/3 | |

PROJECT: LACV 30

HOLE NO.: SLCV SB 1401

# DRILLING LOG

| | |
|---|---|
| HOLE NO. | 1402 |
| 1. COMPANY NAME | JAMES M. MONTGOMERY |
| 2. DRILLING SUBCONTRACTOR | HAND AUGERED (JMM) |
| SHEET | 1 OF 1 SHEETS |
| 3. PROJECT | USACE - LACV |
| 4. LOCATION | LACV 30 |
| 5. NAME OF DRILLER | — |
| 6. MANUFACTURER'S DESIGNATION OF DRILL | — |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT | Hand augered: 3½" OD |
| 8. HOLE LOCATION | SB 1402 |
| 9. SURFACE ELEVATION | |
| 10. DATE STARTED | 1/26/91 |
| 11. DATE COMPLETED | 1/26/91 |
| 12. OVERBURDEN THICKNESS | N/A |
| 13. DEPTH DRILLED INTO ROCK | 0 |
| 14. TOTAL DEPTH OF HOLE | 10.0 FEET |
| 15. DEPTH GROUNDWATER ENCOUNTERED | — |
| 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED | — |
| 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) | — |
| 18. GEOTECHNICAL SAMPLES | NONE; DISTURBED: —; UNDISTURBED: — |
| 19. TOTAL NUMBER OF CORE BOXES | — |
| 20. SAMPLES FOR CHEMICAL ANALYSIS | 5; VOC: YES; METALS: YES; OTHER (SPECIFY): ; OTHER (SPECIFY): ; OTHER (SPECIFY): |
| 21. TOTAL CORE RECOVERY | — % |
| 22. DISPOSITION OF HOLE | GROUTED TO L.S.; BACKFILLED: YES; MONITORING WELL: NO; OTHER (SPECIFY): |
| 23. SIGNATURE OF INSPECTOR | M. Greenberg |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANALYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0-1.0 Sand with Organics (SP/OL) - Sand, 70%, quartz, subangular, fine to medium grained, hard, poorly sorted, dark grayish brown; Organics, 30%, organic material, dark grayish brown. Trace clay. | | | | | Hand augered |
| | | 1.0-10.0 Sand (SW) - 100%, quartz, subrounded, medium grained, hard, well sorted, grayish brown. | | | | | |

PROJECT: LACV 30

HOLE NO.: SB 1402

# DRILLING LOG

HOLE NO. 1403

| | |
|---|---|
| 1. COMPANY NAME: JAMES M. MONTGOMERY | 2. DRILLING SUBCONTRACTOR: HAND AUGERED (JMM) |
| SHEET 1 OF 1 SHEETS | |
| 3. PROJECT: USACE - LACV | 4. LOCATION: LACV 30 |
| 5. NAME OF DRILLER: — | 6. MANUFACTURER'S DESIGNATION OF DRILL: — |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand auger: 3½" ID | 8. HOLE LOCATION: SB 1403 |
| | 9. SURFACE ELEVATION |
| | 10. DATE STARTED: 1/26/91 — 11. DATE COMPLETED: 1/26/91 |
| 12. OVERBURDEN THICKNESS: N/A | 15. DEPTH GROUNDWATER ENCOUNTERED: — |
| 13. DEPTH DRILLED INTO ROCK: 0 | 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: — |
| 14. TOTAL DEPTH OF HOLE: 10.0 FEET | 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): — |

| 18. GEOTECHNICAL SAMPLES | DISTURBED | UNDISTURBED | 19. TOTAL NUMBER OF CORE BOXES |
|---|---|---|---|
| NONE | — | — | — |

| 20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY) | 21. TOTAL CORE RECOVERY |
|---|---|---|---|---|---|---|
| 5 | YES | YES | | | | — % |

| 22. DISPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY) | 23. SIGNATURE OF INSPECTOR |
|---|---|---|---|---|
| GROUTED TO L.S. | YES | NO | | M. Pijnenburg |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANAYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0 - 7.0 Sand - (SP), 100%, quartz, subrounded, medium to fine grained, hard, poorly sorted, light reddish brown to gray. | OVM = 0 | | | | Hand augered |
| | | 7.0 - 10.0 Sand (SW) - 100%, quartz, subrounded, medium to fine grained, well sorted, dark brown. | OVM = 0 | | | | |
| | | | OVM = 0 | | | | |

PROJECT: LACV 30 — HOLE NO.: SB 1403

# DRILLING LOG

HOLE NO. 1404

| Field | Entry |
|---|---|
| 1. COMPANY NAME | JAMES M MONTGOMERY |
| 2. DRILLING SUBCONTRACTOR | HARDIN - HUBER INC. |
| SHEET | 1 OF 1 SHEETS |
| 3. PROJECT | USACE - LACV 30 |
| 4. LOCATION | LACV 30 PN-43 |
| 5. NAME OF DRILLER | HENRY SEALS |
| 6. MANUFACTURER'S DESIGNATION OF DRILL | MOBIL DRILL |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT | Augers: 3 1/4" ID, 6" OD; 2" DIA. LITH SPOONS; 3" DIA. SAMPLING SPOONS |
| 8. HOLE LOCATION | SB 1404 SE section of PN-43 |
| 9. SURFACE ELEVATION | |
| 10. DATE STARTED | 1/24/91 |
| 11. DATE COMPLETED | 1/24/91 |
| 12. OVERBURDEN THICKNESS | N/A |
| 13. DEPTH DRILLED INTO ROCK | 0' |
| 14. TOTAL DEPTH OF HOLE | 10.0 FEET |
| 15. DEPTH GROUNDWATER ENCOUNTERED | 9.0' |
| 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED | |
| 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) | N/A |
| 18. GEOTECHNICAL SAMPLES | NONE (DISTURBED: —; UNDISTURBED: —) |
| 19. TOTAL NUMBER OF CORE BOXES | NONE |
| 20. SAMPLES FOR CHEMICAL ANALYSIS | 5 (VOC: YES; METALS: YES; OTHER (SPECIFY): —) |
| 21. TOTAL CORE RECOVERY | 95 % |
| 22. DISPOSITION OF HOLE | GROUTED TO L.S. (BACKFILLED: YES; MONITORING WELL: NO; OTHER (SPECIFY): —) |
| 23. SIGNATURE OF INSPECTOR | M. Birenburg |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E (LITH SAMPLE) | ANALYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0-0.5 Poorly graded sand with Silt (SP-SM) - Sand 85%, quartz, subrounded, occasionally elongated, medium grained, hard, moderately well sorted, pale to light brown; Silt 15%, quartz, subangular to subrounded, flat, nonplastic, very dark gray, low dry strength, firm and dry | OVM = 2.0 | | 0-2 | 1,1,1,1 | |
| | | | OVM = 1.4 | 2-4 | | 1,1,1,1 | |
| | | 0.5-7.0 Sand (SW) - 100%, quartz, subrounded, medium grained, hard, well sorted, pale to light brown. | OVM = 2.7 | | 4-6 | 1,1,2,2 | |
| | | | | | | 2,2,7,12 | |
| | | 7.0-10.0 Sand (SW) - 100%, quartz, subrounded, coarse grained, hard, well sorted, pale to light brown. | OVM = 0.4 | 6-8 | | | |
| | | | | | 8-10 | 14,16,22,22 | |
| | | | OVM = 0.4 | | | | |

PROJECT: LACV 30

HOLE NO.: SLCV SB 1404

# DRILLING LOG

| | | |
|---|---|---|
| HOLE NO. 1405 | SHEET 1 OF 1 SHEETS | |
| 1. COMPANY NAME: JAMES M MONTGOMERY | 2. DRILLING SUBCONTRACTOR: HAND AUGERED (JMM) | |
| 3. PROJECT: USACE - LACV | 4. LOCATION: LACV 30 | |
| 5. NAME OF DRILLER: — | 6. MANUFACTURER'S DESIGNATION OF DRILL: — | |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand auger: 3½" ID | 8. HOLE LOCATION: SB 1405 | |
| | 9. SURFACE ELEVATION: — | |
| | 10. DATE STARTED: 1/26/91 | 11. DATE COMPLETED: 1/26/91 |
| 12. OVERBURDEN THICKNESS: N/A | 15. DEPTH GROUNDWATER ENCOUNTERED: 5.0' | |
| 13. DEPTH DRILLED INTO ROCK: 0' | 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: — | |
| 14. TOTAL DEPTH OF HOLE: 5.0 FEET | 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): — | |

| 18. GEOTECHNICAL SAMPLES | DISTURBED | UNDISTURBED | 19. TOTAL NUMBER OF CORE BOXES | | | |
|---|---|---|---|---|---|---|
| NONE | — | — | | | | |
| **20. SAMPLES FOR CHEMICAL ANALYSIS** | **VOC** | **METALS** | **OTHER (SPECIFY)** | **OTHER (SPECIFY)** | **OTHER (SPECIFY)** | **21. TOTAL CORE RECOVERY** |
| 5 | YES | YES | | | | — % |
| **22. DISPOSITION OF HOLE** | **BACKFILLED** | **MONITORING WELL** | **OTHER (SPECIFY)** | **23. SIGNATURE OF INSPECTOR** | | |
| GROUTED TO L.S. | YES | No | | M Birenburg | | |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANALYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0-5.0 Sand (SW) - 100%, quartz, subrounded, medium grained, hard, well sorted, dark brown. | OVM = 0<br>OVM = 0 | | | | Hand augered |

PROJECT: LACV 30

HOLE NO.: SB 1405

# DRILLING LOG

HOLE NO. 1406

| | | |
|---|---|---|
| 1. COMPANY NAME: JAMES M. MONTGOMERY | 2. DRILLING SUBCONTRACTOR: HARDIN - HUBER, INC. | SHEET 1 OF 1 SHEETS |
| 3. PROJECT: USACE - LACV 30 | 4. LOCATION: LACV 30 PN-49 | |
| 5. NAME OF DRILLER: HENRY SEALS | 6. MANUFACTURER'S DESIGNATION OF DRILL: MOBIL DRILL B-57 | |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Augers: 3¼" ID; 6" OD; 2" DIA LITH SPOONS; 3" DIA SAMPLING SPOONS | 8. HOLE LOCATION: SB 1406 SE section of PN-49 | |
| | 9. SURFACE ELEVATION: | |
| | 10. DATE STARTED: 1/25/91 | 11. DATE COMPLETED: 1/25/91 |
| 12. OVERBURDEN THICKNESS: N/A | 15. DEPTH GROUNDWATER ENCOUNTERED: 4.5' | |
| 13. DEPTH DRILLED INTO ROCK: 0' | 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: | |
| 14. TOTAL DEPTH OF HOLE: 10.0 FEET | 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A | |

| 18. GEOTECHNICAL SAMPLES | DISTURBED | UNDISTURBED | 19. TOTAL NUMBER OF CORE BOXES | | | |
|---|---|---|---|---|---|---|
| NONE | — | — | NONE | | | |
| 20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY) | 21. TOTAL CORE RECOVERY |
| 5 | YES | YES | | | | 97 % |
| 22. DISPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY) | 23. SIGNATURE OF INSPECTOR | | |
| GROUTED TO L.S. | YES | NO | | M. Pinenburg | | |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANALYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0-6.0 Sand (SW) - 100% quartz, subrounded, medium to fine grained, hard, well sorted, pale to light brown to very pale yellow. | OVM=0 | | 0-2 | 5,16 42,44 | JACK HAMMERED THROUGH CONCRETE |
| | | | OVM=0 | 2-4 | | 16,24 26,30 | |
| | | | OVM=0 | | 4-6 | 30,44 51/5 | |
| | | 6.0-10.0 Sand (SP) - 100%, quartz, subrounded, medium to fine grained, occasionally silty, hard, poorly sorted, very pale brown to gray. Trace - wood, organics. | OVM=0 | | 6-8 | 9,16, 20,22 | |
| | | | OVM=0 | | 8-10 | 77, 100/5 | |

PROJECT: LACV 30 | HOLE NO.: SLCV SB 1406

# DRILLING LOG

| | |
|---|---|
| HOLE NO. | 1407 |
| SHEET | 1 OF 1 SHEETS |
| 1. COMPANY NAME | JAMES M. MONTGOMERY |
| 2. DRILLING SUBCONTRACTOR | HARDIN - HUBER INC. |
| 3. PROJECT | USACE - LACV 30 |
| 4. LOCATION | LACV 30 PN-49 |
| 5. NAME OF DRILLER | HENRY SEALS |
| 6. MANUFACTURER'S DESIGNATION OF DRILL | MOBIL DRILL |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT | Augers: 3¼" ID; 6" OD<br>2" DIA. LITH SPOONS<br>3" DIA. SAMPLING SPOONS |
| 8. HOLE LOCATION | SB 1407 NE section of PN-49 |
| 9. SURFACE ELEVATION | |
| 10. DATE STARTED | 1/24/91 |
| 11. DATE COMPLETED | 1/24/91 |
| 12. OVERBURDEN THICKNESS | N/A |
| 13. DEPTH DRILLED INTO ROCK | 0' |
| 14. TOTAL DEPTH OF HOLE | 10 FEET |
| 15. DEPTH GROUNDWATER ENCOUNTERED | 9.5' |
| 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED | |
| 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) | N/A |
| 18. GEOTECHNICAL SAMPLES | NONE |
| DISTURBED | |
| UNDISTURBED | |
| 19. TOTAL NUMBER OF CORE BOXES | NONE |

| 20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY) | 21. TOTAL CORE RECOVERY |
|---|---|---|---|---|---|---|
| 5 | YES | YES | | | | 95 % |

| 22. DISPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY) | 23. SIGNATURE OF INSPECTOR |
|---|---|---|---|---|
| GROUTED TO L.S. | YES | NO | | M. Pinenburg |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANALYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0-0.5 Poorly graded sand with Silt (SP-SM) - Sand 85%, quartz, subrounded, occasionally elongated, medium grained, hard, moderately well sorted, pale to light brown; Silt 15%, quartz, subangular to subrounded, flat, nonplastic, very dark gray, low dry strength, firm and dry. | OVM = 0.7 | | 0 - 2 | 5,7,8,9 | |
| | | | OVM = 0 | 2 - 4 | | 4,4,8,9 | |
| | | | OVM = 0 | | 4 - 6 | 6,6,8,8 | |
| | | | OVM = 0 | 6 - 8 | | 2,5,4,6 | |
| | | | OVM = 0 | | 8 - 10 | 4,4,6,8 | |
| | | 0.5-9.5 Sand (SW) - 100%, quartz, subrounded, medium grained, hard, well sorted, pale to light brown. | | | | | |
| | | 9.5-10.0 Sand (SW) - 100%, quartz, subrounded, coarse grained hard well solted, pale to light brown. | | | | | |

PROJECT: LACV 30

HOLE NO.: SLCV SB 1407

# DRILLING LOG

| | | |
|---|---|---|
| 1. COMPANY NAME: JAMES M. MONTGOMERY | 2. DRILLING SUBCONTRACTOR: HAND AUGERED (JMM) | HOLE NO. 1408 — SHEET 1 OF 1 SHEETS |
| 3. PROJECT: USACE - LACV | 4. LOCATION: LACV 30 | |
| 5. NAME OF DRILLER: | 6. MANUFACTURER'S DESIGNATION OF DRILL: | |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand auger: 3½" OD | 8. HOLE LOCATION: SB 1408 | |
| | 9. SURFACE ELEVATION: | |
| | 10. DATE STARTED: 1/26/91 | 11. DATE COMPLETED: 1/26/91 |
| 12. OVERBURDEN THICKNESS: N/A | 15. DEPTH GROUNDWATER ENCOUNTERED: | |
| 13. DEPTH DRILLED INTO ROCK: 0 | 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: | |
| 14. TOTAL DEPTH OF HOLE: 10.0 FEET | 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): | |

| 18. GEOTECHNICAL SAMPLES | DISTURBED | UNDISTURBED | 19. TOTAL NUMBER OF CORE BOXES |
|---|---|---|---|
| NONE | | | |

| 20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY) | 21. TOTAL CORE RECOVERY |
|---|---|---|---|---|---|---|
| 5 | YES | YES | | | | % |

| 22. DISPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY) | 23. SIGNATURE OF INSPECTOR |
|---|---|---|---|---|
| GROUTED TO L.S. | YES | NO | | M. Greenburg |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANAYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0 - 3.0 - Organics with Sand (OL/SP) - 80% organic material, very dark brown; Sand, 20%, quartz, subrounded, fine grained, hard, poorly sorted, brown. | | | | | Hand augered |
| | | 3.0 - 10.0 Sand (SW) - 100% quartz, subrounded, medium grained, hard, well sorted, very pale brown. | | | | | |

PROJECT: LACV 30 — HOLE NO. SB 1408

# DRILLING LOG

HOLE NO. 1401 | SHEET 1 OF 1 SHEETS

| | |
|---|---|
| 1. COMPANY NAME: JAMES M. MONTGOMERY | 2. DRILLING SUBCONTRACTOR: HARDIN - HUBER INC. |
| 3. PROJECT: USACE - LACV 30 | 4. LOCATION: LACV 30 PN-43 |
| 5. NAME OF DRILLER: HENRY SEALS | 6. MANUFACTURER'S DESIGNATION OF DRILL: MOBIL DRILL B-57 |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Augers: 4 1/4" ID, 7" OD; 2" DIA. LTH SPOONS | 8. HOLE LOCATION: MW 1401 SE section of PN-43 |
| | 9. SURFACE ELEVATION: |
| | 10. DATE STARTED: 1/26/91 — 11. DATE COMPLETED: 1/27/91 |
| 12. OVERBURDEN THICKNESS: N/A | 15. DEPTH GROUNDWATER ENCOUNTERED: 9.6' |
| 13. DEPTH DRILLED INTO ROCK: 0' | 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: |
| 14. TOTAL DEPTH OF HOLE: 18.5 FEET | 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): |

| 18. GEOTECHNICAL SAMPLES | DISTURBED | UNDISTURBED | 19. TOTAL NUMBER OF CORE BOXES |
|---|---|---|---|
| 1 (15-17) | — | YES | NONE |

| 20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY) | 21. TOTAL CORE RECOVERY |
|---|---|---|---|---|---|---|
| NONE | No | No | | | | 100 % |

| 22. DISPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY) | 23. SIGNATURE OF INSPECTOR |
|---|---|---|---|---|
| | | YES | | |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANAYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0-10.5 Sand (SP/SW) - 100%, quartz, subrounded, medium to fine grained, hard, moderately well sorted, very pale brown | OVM = 0; OVM = 0 | | | 10, 20, 22, 21 | |
| | | 10.5 - 10.7 Peat (OL/OH), woody, organic fibers, soft, dark brown | | | | 5, 7, 8, 8 | |
| | | 10.7 - 18.5 Sand (SW) - 100%, quartz, subrounded, medium grained, hard, well sorted, gray. | OVM = 0 | 15-17 | | 13, 15, 17, 8 | |

PROJECT: LACV 30 — HOLE NO. MW 1401

# DRILLING LOG

HOLE NO. 1402

| | |
|---|---|
| 1. COMPANY NAME: James M. Montgomery | 2. DRILLING SUBCONTRACTOR: Hardin - Huber, Inc. |
| SHEET 1 OF 1 SHEETS | |
| 3. PROJECT: USACE - LACV 30 | 4. LOCATION: LACV 30 PN-49 |
| 5. NAME OF DRILLER: Henry Sells | 6. MANUFACTURER'S DESIGNATION OF DRILL: Mobil Drill B-57 |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Augers: 4¼" ID, 7" OD; 2" dia. LTH Spoons | 8. HOLE LOCATION: MW 1402 SE section of PN-49 |
| | 9. SURFACE ELEVATION |
| | 10. DATE STARTED: 1/27/91 — 11. DATE COMPLETED |
| 12. OVERBURDEN THICKNESS: 0 | 15. DEPTH GROUNDWATER ENCOUNTERED: 16.6' |
| 13. DEPTH DRILLED INTO ROCK: 0' | 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED |
| 14. TOTAL DEPTH OF HOLE: 25.5 FEET | 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) |

| 18. GEOTECHNICAL SAMPLES | DISTURBED | UNDISTURBED | 19. TOTAL NUMBER OF CORE BOXES |
|---|---|---|---|
| 1 (20-22) | — | YES | |

| 20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY) | 21. TOTAL CORE RECOVERY |
|---|---|---|---|---|---|---|
| NONE | No | No | | | | 100 % |

| 22. DISPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY) | 23. SIGNATURE OF INSPECTOR |
|---|---|---|---|---|
| | No | Yes | | |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANAYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0 - 25.5 Sand (SW) - 100%, quartz, sub rounded, medium grained, hard, well sorted, clean, very pale brown to yellowish brown. | OVM = 0 | | | | |
| | | | OVM = 0 | | | 5, 5, 7, 9 | |
| | | | OVM = 0 | | | 8, 9, 9, 8 | |
| | | | OVM = 0 | 20-22 | | 8, 7, 6, 14 | |
| | | | | | | 3, 6, 9, 11 | |

PROJECT: LACV 30 — HOLE NO.: MW 1402

# DRILLING LOG

HOLE NO. 1403

| | |
|---|---|
| 1. COMPANY NAME: JAMES M. MONTGOMERY | 2. DRILLING SUBCONTRACTOR: HARDIN - HUBER, INC. — SHEET 1 OF 1 SHEETS |
| 3. PROJECT: USACE - LACV 30 | 4. LOCATION: LACV 30 PN-49 |
| 5. NAME OF DRILLER: HENRY SEALS | 6. MANUFACTURER'S DESIGNATION OF DRILL: MOBIL DRILL B-57 |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Augers: 4¼" ID, 7" OD; 2" DIA. LITH SPOONS | 8. HOLE LOCATION: MW 1403 NE section of PN-49 |
| | 9. SURFACE ELEVATION: |
| | 10. DATE STARTED: 1/25/91 — 11. DATE COMPLETED: 1/26/91 |
| 12. OVERBURDEN THICKNESS: N/A | 15. DEPTH GROUNDWATER ENCOUNTERED: 14.0' |
| 13. DEPTH DRILLED INTO ROCK: 0' | 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 14.4' 24 Hrs. |
| 14. TOTAL DEPTH OF HOLE: 23.0 FEET | 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): |

| 18. GEOTECHNICAL SAMPLES | DISTURBED | UNDISTURBED | 19. TOTAL NUMBER OF CORE BOXES |
|---|---|---|---|
| 1 (18-20) | — | YES | NONE |

| 20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY) | 21. TOTAL CORE RECOVERY |
|---|---|---|---|---|---|---|
| NONE | No | No | | | | 100 % |

| 22. DISPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY) | 23. SIGNATURE OF INSPECTOR |
|---|---|---|---|---|
| | | YES | | |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANALYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0-5.0 Sand (SW) - 100%, quartz, subrounded, medium grained, hard, well sorted, clean, very pale brown to very pale yellow | OVM = 0 | | | 6,9,9, 10 | |
| | | 5.0-10.0 Sand (SW) - 100%, quartz, subrounded, medium to fine grained, well sorted, clean, very pale brown. | OVM = 0 | | | 3,4,4, 5 | |
| | | 10.0-15.0 Sand (SP) - 100%, quartz, subrounded, medium grained, hard, poorly sorted, very pale brown | OVM = 0 | | | 4,6,8, 6 | Trace peat/c @ 14' gl. |
| | | 15.0 - 23.0 Sand (SP) - 100%, quartz, subrounded, medium grained, poorly sorted, very pale yellow. | OVM = 0 | 18 - 20 | | 2,2,5, 8 | |

PROJECT: LACV 30 — HOLE NO.: MW 1403

# DRILLING LOG

HOLE NO. 1404 | SHEET 1 OF 1 SHEETS

| | |
|---|---|
| 1. COMPANY NAME: James N. Montgomery | 2. DRILLING SUBCONTRACTOR: Hardin - Huber |
| 3. PROJECT: USACE - LACV 30 | 4. LOCATION: LACV 30 PN - 43 |
| 5. NAME OF DRILLER: Henry Seals | 6. MANUFACTURER'S DESIGNATION OF DRILL: Mobil Drill B-57 |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Augers = 4¼ ID, 7" OD; 2" DIA Split Spoons | 8. HOLE LOCATION: MW 1404 |
| | 9. SURFACE ELEVATION: |
| | 10. DATE STARTED: 1/28/91 — 11. DATE COMPLETED: 1/29/91 |
| 12. OVERBURDEN THICKNESS: N/A | 15. DEPTH GROUNDWATER ENCOUNTERED: |
| 13. DEPTH DRILLED INTO ROCK: 0 | 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: |
| 14. TOTAL DEPTH OF HOLE: 12.0 FEET | 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): |

| 18. GEOTECHNICAL SAMPLES | DISTURBED | UNDISTURBED | 19. TOTAL NUMBER OF CORE BOXES |
|---|---|---|---|
| 1 | — | YES | 0 |

| 20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY) | 21. TOTAL CORE RECOVERY |
|---|---|---|---|---|---|---|
| NONE | — | — | | | | 80 % |

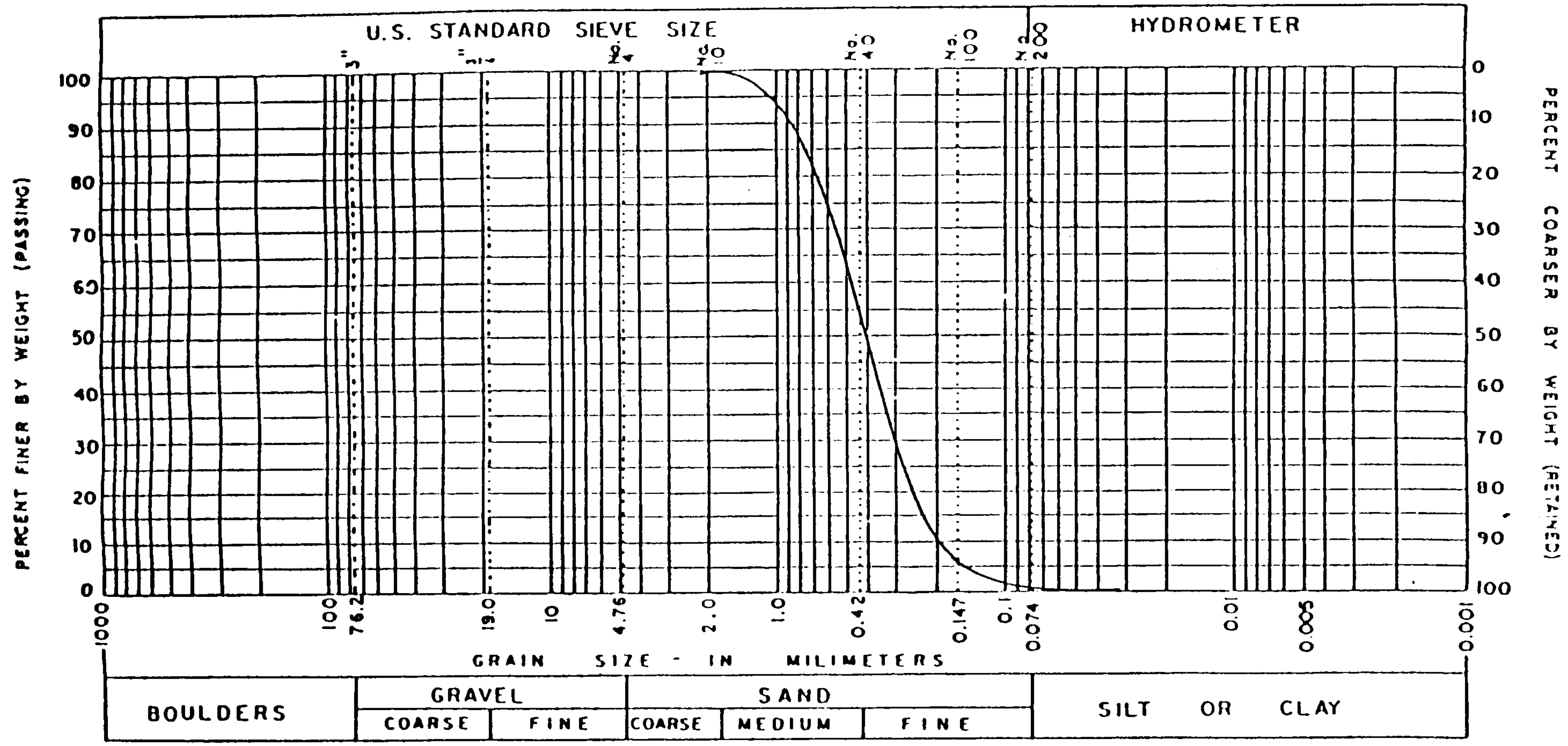
| 22. DISPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY) | 23. SIGNATURE OF INSPECTOR |
|---|---|---|---|---|
| | — | YES | | |

| ELEV. A | DEPTH B | DESCRIPTION OF MATERIALS C | FIELD SCREENING RESULTS D | GEOTECH SAMPLE OR CORE BOX NO. E | ANAYTICAL SAMPLE NO. F | BLOW COUNTS G | REMARKS H |
|---|---|---|---|---|---|---|---|
| | | 0-3.0 Sand (SP) - 100%, quartz, subrounded, medium to fine grained, hard, poorly sorted, very pale brown to yellowish brown. | OVM = 0; OVM = 0 | | | 2,2,3,4 | |
| | | 3.0 - 12.0 Sand (SW) - 100%, quartz, subrounded, hard, moderately well sorted, very pale brown. | OVM = 0; OVM = 0 | 8 - 10 | | 2,2,4,3 | |

PROJECT: LACV 30 — HOLE NO. MW 1404

# Geotechnical Grain Size Analyses

| PROJECT: Fort Story | LOCATION: - | | |
|---|---|---|---|
| BORING NO. SLCVMS | SAMPLE NO. 1401 | DEPTH: 2.5 | CONTRACT NO. 91-012 |




| SAMPLE NO. | DEPTH | LL | P.I. | M.C. | USDA Class. | Soil Description |
|---|---|---|---|---|---|---|
| 1401 | 2.5 | NP | NP | 16.7 | | Tan Fine Sand |
| | | | | | | |
| | | | | | | |
| | | | | | | |
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| | | | | | | |

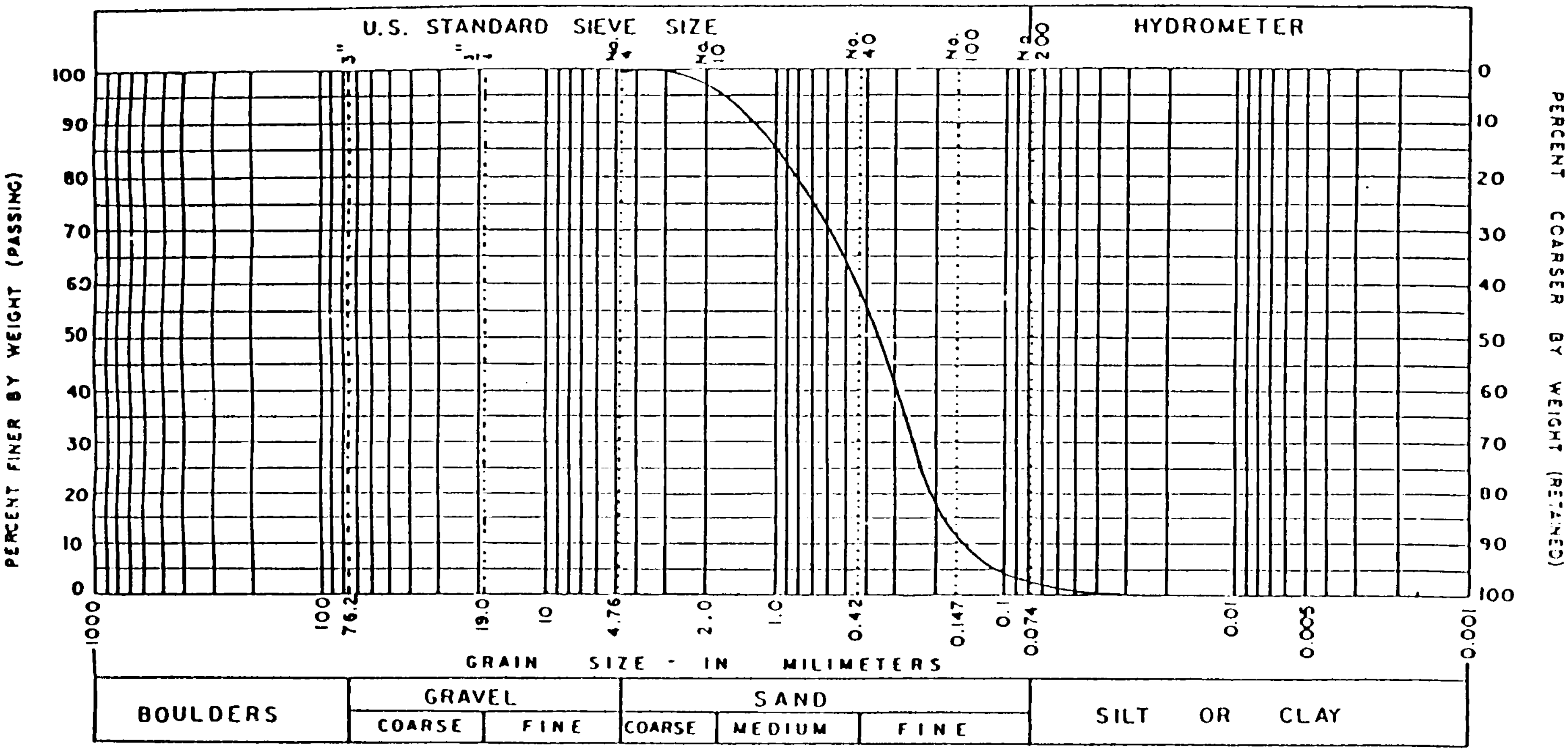
Earth Engineering & Sciences, Inc.

## GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 2/4/91 |
|---|---|
| CHECKED BY: JMK | SHEET No. 1 OF 1 |

| PROJECT: Fort Story | LOCATION: - |
|---|---|

| BORING NO. SLCVMS | SAMPLE NO. 1402 | DEPTH: 14.5 | CONTRACT NO. 91-012 |
|---|---|---|---|



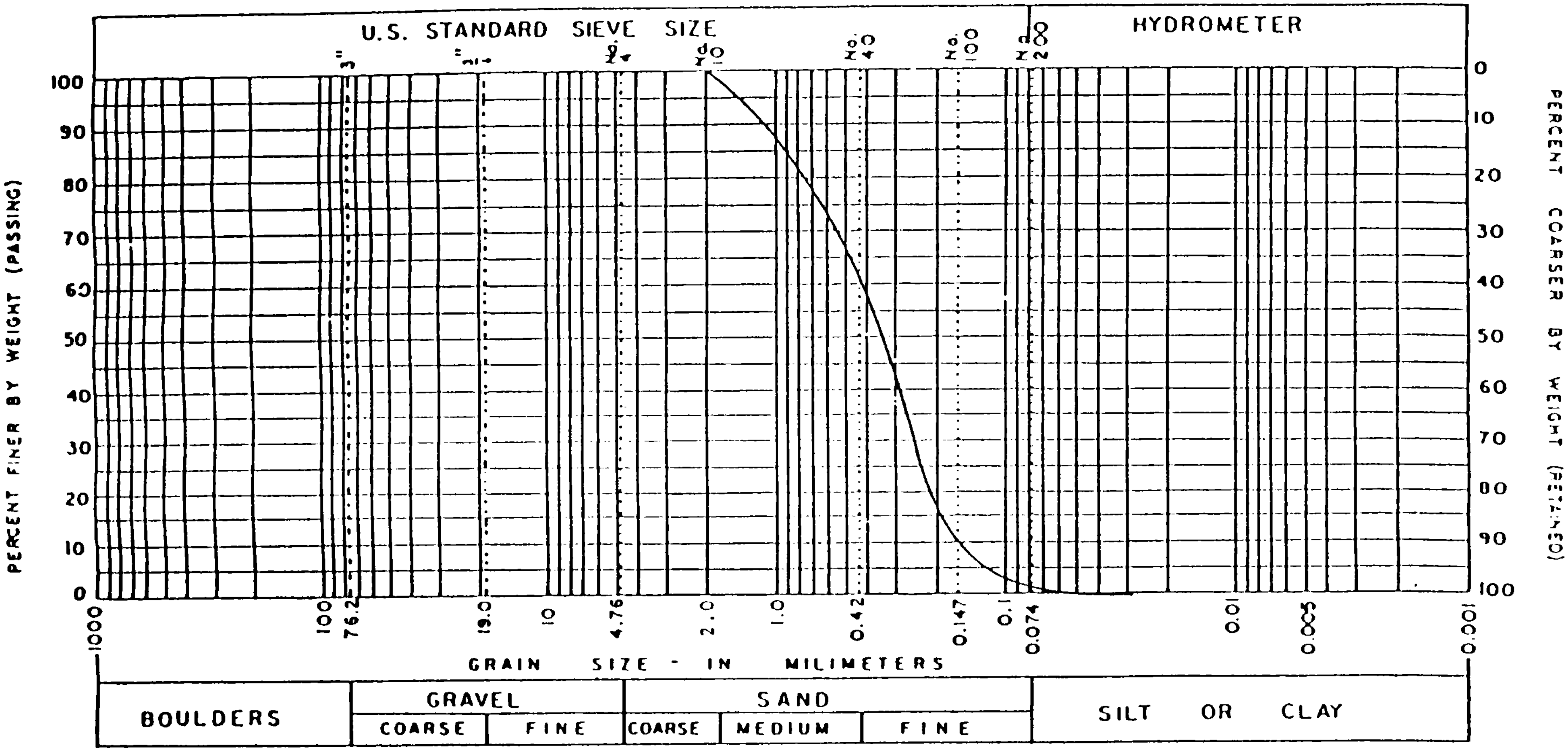

| SAMPLE NO. | DEPTH | LL. | P.I. | M.C. | USDA Class. | Soil Description |
|---|---|---|---|---|---|---|
| 1402 | 14.5 | NP | NP | 19.1 | | Tan Fine Sand |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Earth Engineering & Sciences, Inc.

## GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 2/4/91 |
|---|---|
| CHECKED BY: JMK | SHEET No. 2 OF 4 |

| PROJECT: Fort Story | | LOCATION: - | |
|---|---|---|---|
| BORING NO. SLCVMS | SAMPLE NO. 1403 | DEPTH: 12' | CONTRACT NO. 91-012 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | USDA Class. | Soil Description |
|---|---|---|---|---|---|---|
| 1403 | 12 | NP | NP | 20.6 | | Tan Fine Sand |
| | | | | | | |
| | | | | | | |
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| | | | | | | |

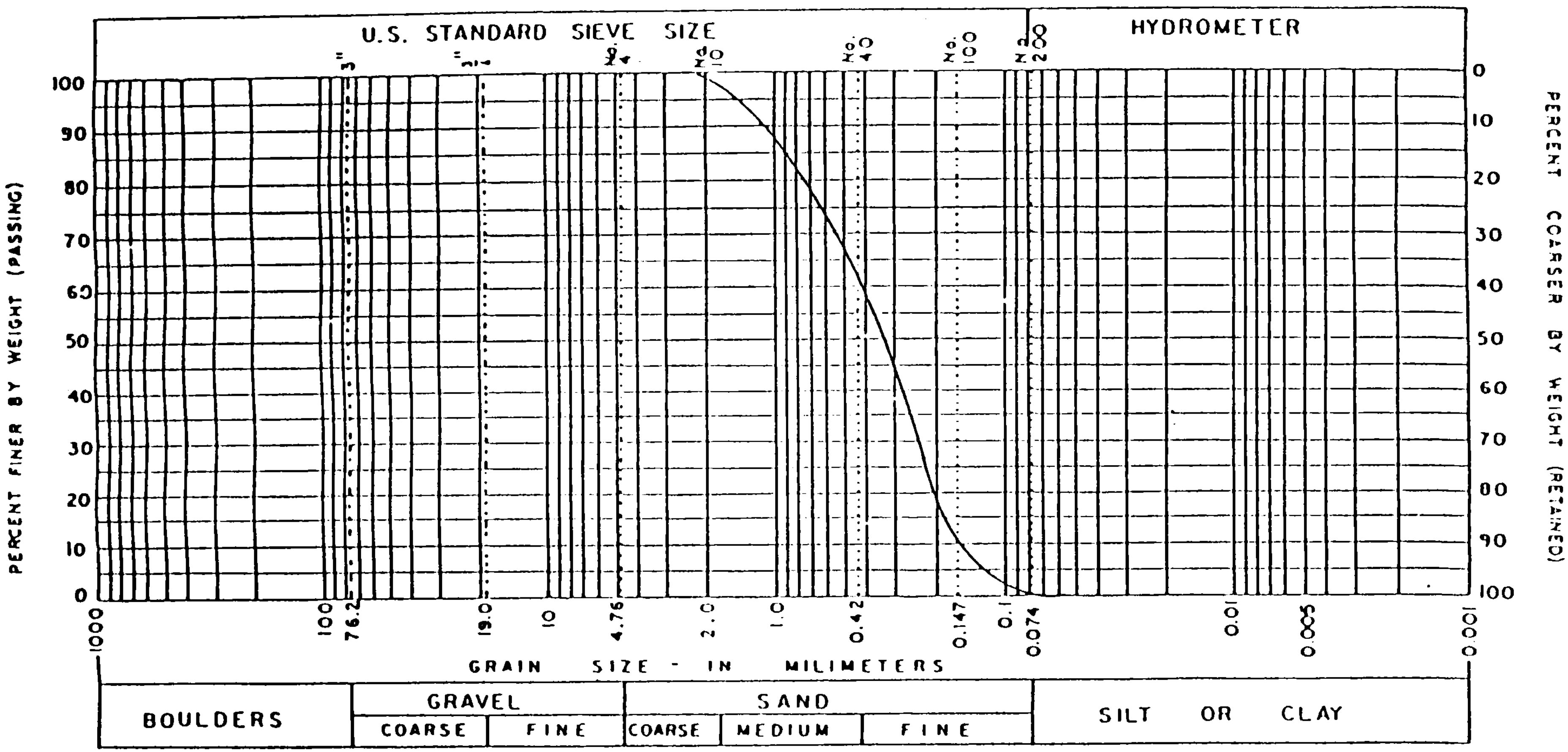
Earth Engineering & Sciences, Inc.

## GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 2/4/91 |
|---|---|
| CHECKED BY: JMK | SHEET No. 3 OF 4 |

| | |
|---|---|
| PROJECT: Fort Story | LOCATION: - |

| | | | |
|---|---|---|---|
| BORING NO. SLCVMS | SAMPLE NO. 1404 | DEPTH: 1' | CONTRACT NO. 91-012 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | USDA Class. | Soil Description |
|---|---|---|---|---|---|---|
| 1404 | 1' | NP | NP | 21.7 | - | Tan Sand |
| | | | | | | |
| | | | | | | |
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Earth Engineering & Sciences, Inc.

## GRAIN-SIZE DISTRIBUTION

| | |
|---|---|
| TESTED BY: RMP | DATE: 2/4/91 |
| CHECKED BY: JMK | SHEET No. 1 OF 1 |

# Monitoring Well Construction Diagrams

| ELEVATION GROUNDWATER | | | PROJECT LACV 30 |
| --- | --- | --- | --- |
| DATE INSTALLED 1/27/91 | STARTED 1/26/91 | COMPLETED 1/27/91 | LOCATION (Coordinates or Station) SLCV MW 1401 |
| ELEVATION TOP OF HOLE | | | SIGNATURE OF INSPECTOR [illegible] |
| TOTAL DEPTH OF HOLE 18.5 FEET | | | HOLE NO. (As shown on drawing title and file number) MW 1401 |

# ABOVE GROUND MONITORING WELL CONSTRUCTION DIAGRAM

PROTECTIVE CASING

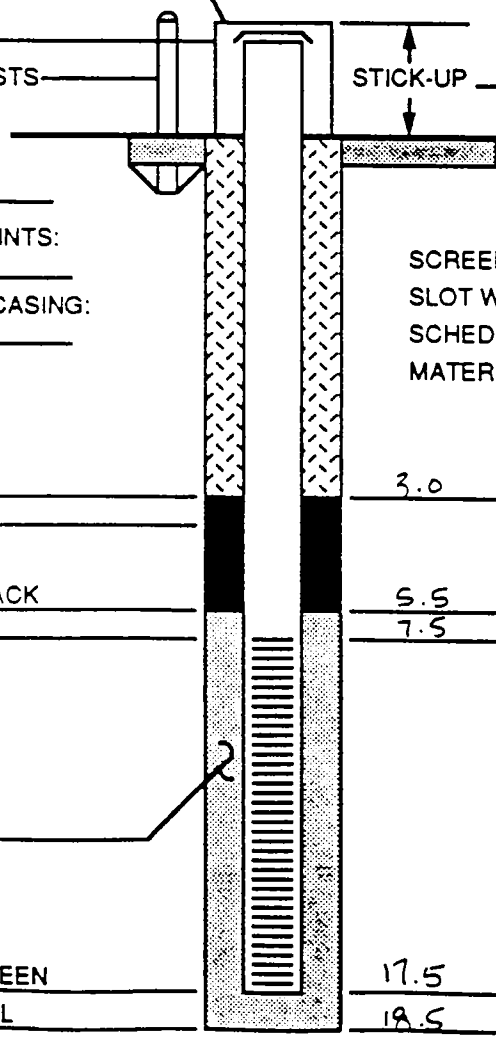
TYPE OF PROTECTIVE CASING: Steel

TOP OF WELL

PROTECTIVE POSTS

STICK-UP 3.0'

GROUND SURFACE



CASING DIAMETER 2"

TYPE OF PIPE JOINTS: threaded

TYPE OF BLANK CASING: PVC

LENGTH OF SOLID PIPE 10.5 FT.

**SCREEN INFORMATION**

SCREEN DIA.: 2"

SLOT WIDTH: 0.010

SCHEDULE: Sch 40

MATERIAL: ☑ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

TOP OF SEAL 3.0 FT.

TYPE OF SEAL:

TOP OF FILTERPACK 5.5 FT.

TOP OF SCREEN 7.5 FT.

WELL SCREEN LENGTH 10 FT.

FILTERPACK

**FILTERPACK MATERIAL**

TYPE:

BACKFILL METHOD:

BOTTOM OF SCREEN 17.5 FT.

BOTTOM OF WELL 18.5 FT.

**WELL DEVELOPMENT**

METHOD: SWAB / PUMPING

TIME SPENT DEVELOPMENT: 1 hr 40 min

VOLUME OF WATER REMOVED: 220 gal

VOLUME OF WATER ADDED: 38 gal

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER: turbid

**WATER LEVEL SUMMARY**

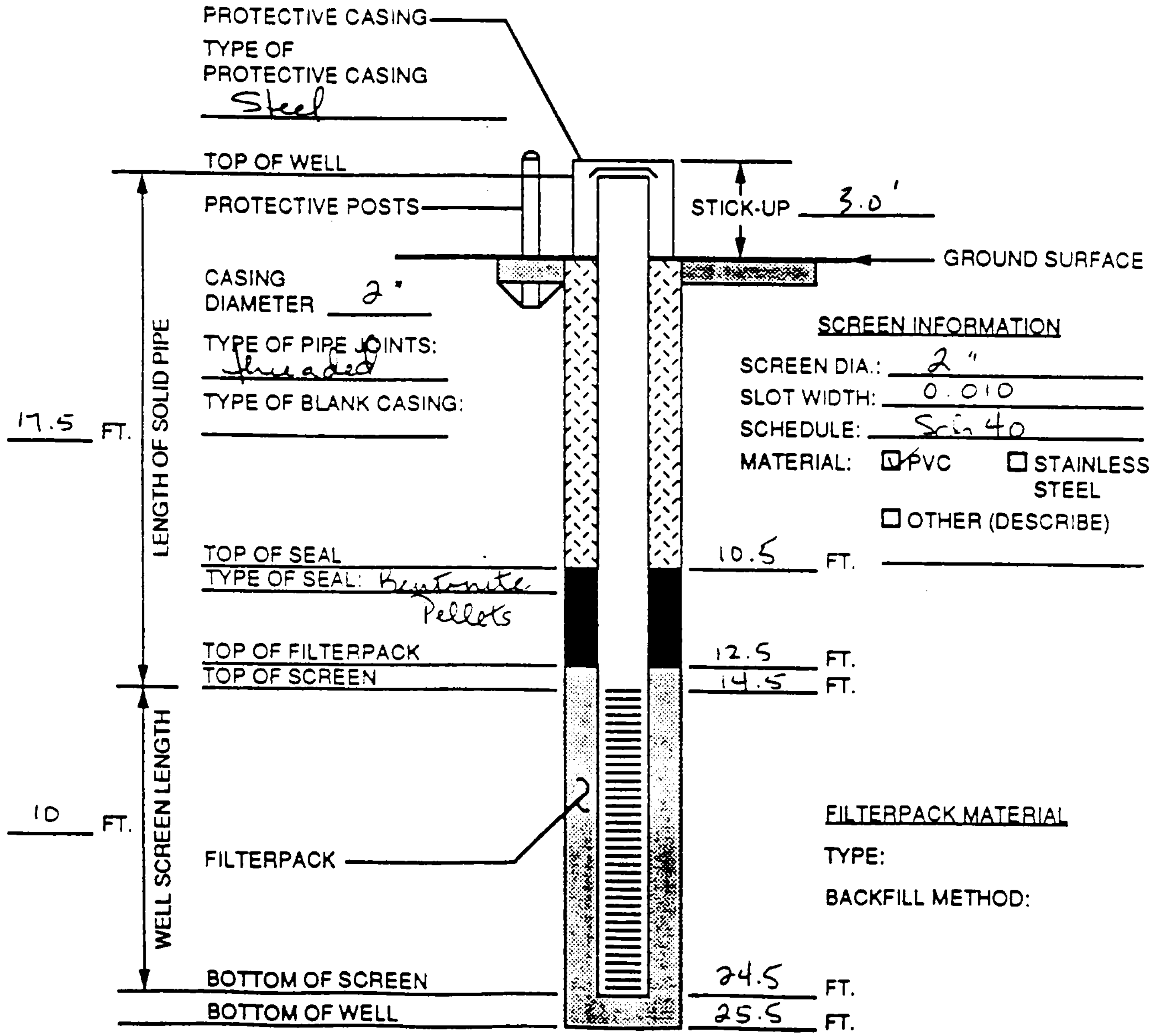
WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 1/28/91 / 1100 / 12.98

DEPTH FROM TOP CASING AFTER DEVELOPMENT: 12.98 FT (toc)

| | | | |
|---|---|---|---|
| ELEVATION GROUNDWATER | | | PROJECT: LACV 30 |
| DATE INSTALLED: 1/28/91 | STARTED: 1/27/91 | COMPLETED: 1/28/91 | LOCATION (Coordinates or Station): SLCV MW 1402 |
| ELEVATION TOP OF HOLE | | | SIGNATURE OF INSPECTOR |
| TOTAL DEPTH OF HOLE: 24.5 | | | HOLE NO. (As shown on drawing title and file number): MW 1402 |

# ABOVE GROUND MONITORING WELL CONSTRUCTION DIAGRAM




**WELL DEVELOPMENT**

METHOD: Swab/Bail

TIME SPENT DEVELOPMENT: 1 Hr

VOLUME OF WATER REMOVED: 165 gal

VOLUME OF WATER ADDED: 35 gal

DESCRIPTION OF PREDEVELOPMENT WATER: turbid

DESCRIPTION OF POST DEVELOPMENT WATER: Clear

**WATER LEVEL SUMMARY**

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL

DEPTH FROM TOP CASING AFTER DEVELOPMENT: 19.26' (toc)

| ELEVATION GROUNDWATER | | | PROJECT: LACV 30 |
|---|---|---|---|
| DATE INSTALLED: 1/26/91 | STARTED: 1/25/91 | COMPLETED: 1/26/91 | LOCATION (Coordinates or Station): SLCV MW 1403 |
| ELEVATION TOP OF HOLE | | | SIGNATURE OF INSPECTOR: M. [signature] |
| TOTAL DEPTH OF HOLE: 23 FEET | | | HOLE NO. (As shown on drawing title and file number): MW 1403 |

# ABOVE GROUND TEST PIEZOMETER CONSTRUCTION DIAGRAM

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel

TOP OF WELL

PROTECTIVE POSTS

STICK-UP 2.8'

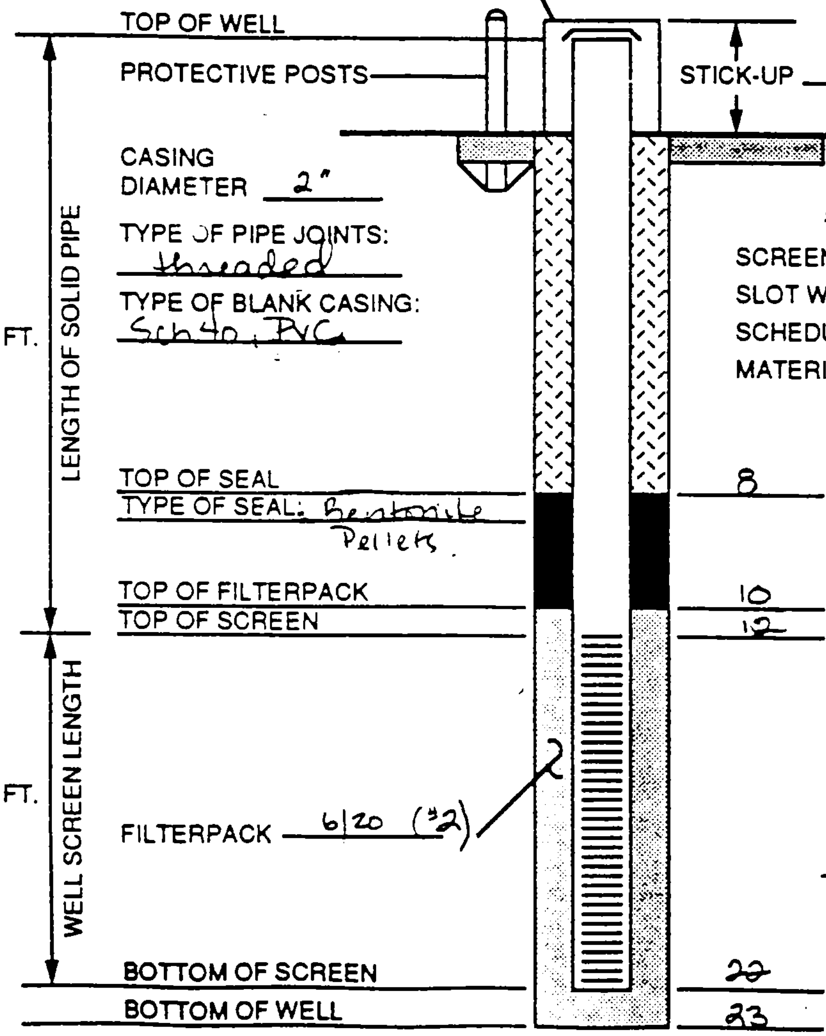
GROUND SURFACE

CASING DIAMETER 2"

TYPE OF PIPE JOINTS: threaded

TYPE OF BLANK CASING: Sch 40, PVC

LENGTH OF SOLID PIPE 14.8 FT.



**SCREEN INFORMATION**

SCREEN DIA.: 2"

SLOT WIDTH: 0.010"

SCHEDULE: 40

MATERIAL: ☑ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

TOP OF SEAL 8 FT.

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK 10 FT.

TOP OF SCREEN 12 FT.

WELL SCREEN LENGTH 10 FT.

FILTERPACK 6/20 (#2)

**FILTERPACK MATERIAL**

TYPE: 6/20 (#2 Moine)

~~BACKFILL~~ METHOD OF EMPLACEMENT: POUR FROM SURFACE, TAGGING CONTINUOUSLY

BOTTOM OF SCREEN 22 FT.

BOTTOM OF WELL 23 FT.

**WELL DEVELOPMENT**

METHOD: SWABBING / PUMPING

TIME SPENT DEVELOPMENT: 3 HRS.

VOLUME OF WATER REMOVED: 165

VOLUME OF WATER ADDED: 15 gal.

DESCRIPTION OF PREDEVELOPMENT WATER: Dirty, Cloudy

DESCRIPTION OF POST DEVELOPMENT WATER: Clear w/ Some tannin

**WATER LEVEL SUMMARY**

WATER LEVEL MEASUREMENTS

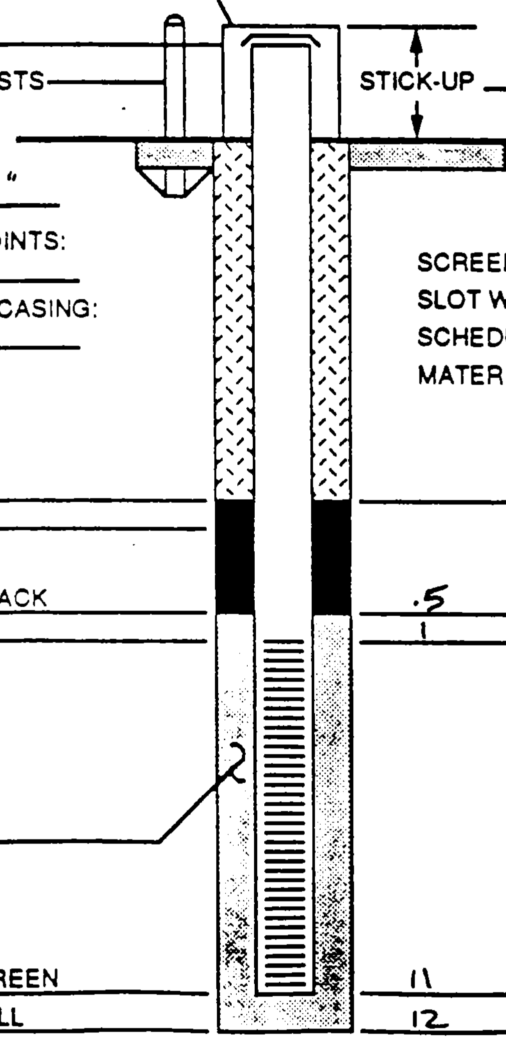
DATE/TIME/LEVEL:

| Date | Time | Level |
|---|---|---|
| 1/27/91 | 1100 | 17.38' (TOC) |
| 1/29/91 | 0700 | 17.43' (TOC) |

DEPTH FROM TOP CASING AFTER DEVELOPMENT: 17.35' (toc)

| ELEVATION GROUNDWATER | | | PROJECT: LACV 30 |
|---|---|---|---|
| DATE INSTALLED: 1/28/91 | STARTED: 1/28/91 | COMPLETED: 1/29/91 | LOCATION (Coordinates or Station): MW 1404 SW section of PN-43 |
| ELEVATION TOP OF HOLE | | | SIGNATURE OF INSPECTOR |
| TOTAL DEPTH OF HOLE: 12 FEET | | | HOLE NO. (As shown on drawing title and file number): MW 1404 |

# ABOVE GROUND MONITORING WELL CONSTRUCTION DIAGRAM



PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: ____

TOP OF WELL

PROTECTIVE POSTS

STICK-UP: 3.0'

GROUND SURFACE

CASING DIAMETER: 2"

TYPE OF PIPE JOINTS: threaded

TYPE OF BLANK CASING: PVC

LENGTH OF SOLID PIPE: 4 FT.

TOP OF SEAL: ____ FT.

TYPE OF SEAL: ____

TOP OF FILTERPACK: .5 FT.

TOP OF SCREEN: 1 FT.

WELL SCREEN LENGTH: 10 FT.

FILTERPACK

BOTTOM OF SCREEN: 11 FT.

BOTTOM OF WELL: 12 FT.

SCREEN INFORMATION

SCREEN DIA.: 2"

SLOT WIDTH: 0.010

SCHEDULE: 40

MATERIAL: ☑ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE) ____

FILTERPACK MATERIAL

TYPE: Silica Sand

BACKFILL METHOD: Pour from surface

WELL DEVELOPMENT

METHOD: SWAB / PUMP

TIME SPENT DEVELOPMENT: ____

VOLUME OF WATER REMOVED: ____

VOLUME OF WATER ADDED: ____

DESCRIPTION OF PREDEVELOPMENT WATER: ____

DESCRIPTION OF POST DEVELOPMENT WATER: ____

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL ____

DEPTH FROM TOP CASING AFTER DEVELOPMENT: ____

# Monitoring Well Development Sheets

JAMES M. MONTGOMERY, CONSULTING ENGINEERS, INC.
MONITORING WELL DEVELOPMENT DATA

WELL: MW 1401
DATE: 1/27/91
STATIC WATER LEVEL (ft) 9.5'
WELL DESIGN DEPTH (ft): 17.5'
WELL VOLUME (gal): 8 x .13 1.1 gal

TIME BEGAN: 0835
TIME ENDED: 1015
NUMBER OF DRUMS: 4
DRUM DESIGNATIONS: MW 1401
4 Water Drums

SITE NAME: LACV 30
PROJECT: LACV 30
PROJECT NUMBER: 1868.0531
FIELD PERSONNEL: [illegible] NAM
SHEET NO. 1 OF 1

| TIME | ACTIVITY (swab/surge, bailing, pumping) | EST'D SEDIMENT THICKNESS (feet) | CUMMULATIVE WATER VOLUME REMOVED (gallons) | TEMPERATURE (deg. C) | pH | CONDUCTIVITY (microsiemans) | TURBIDITY (NTU) | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 0840 | Pump | 0 | 10 gal | 12.0 | 6.1 | 1165 | OFF SCALE | Water would clear |
| 0847 | " | 0 | 25 gal | 16.6 | 6.0 | 175 | 106 | up faster if pump |
| 0855 | " | 0 | 55 gal | 17.0 | 6.0 | 185 | 98 | rate was lower. |
| 0900 | " | 0 | 60 gal | 16.0 | 6.0 | 175 | 92. | |
| 0904 | " | 0 | 80 gal | 19.0 | 6.1 | 190 | 82 | |
| 0909 | " | 0 | 90 gal | 19.0 | 6.1 | 190 | 78 | Lowered rate. |
| 0915 | " | 0 | 100 gal | 19.0 | 6.0 | 190 | 71 | |
| 0926 | " | 0 | 115 gal | 19.0 | 5.9 | 195 | 62 | |
| 0934 | " | 0 | 130 gal | 19.0 | 5.9 | 190 | 49 | |
| 0945 | " | 0 | 140 gal | 19.0 | 6.0 | 190 | 42 | |
| 1000 | " | 0 | 170 gal | 19.0 | 6.0 | 190 | 30 | |
| 1010 | " | 0 | 180 gal | 19.0 | 5.9 | 185 | 20 | |
| 1015 | " | 0 | 220 gal | 19.0 | 5.9 | 185 | 16 | |

JAMES M. MONTGOMERY, CONSULTING ENGINEERS, INC.

MONITORING WELL DEVELOPMENT DATA

WELL: MW 1402
DATE: 1/28/91
STATIC WATER LEVEL (ft): 16.5'
WELL DESIGN DEPTH (ft): 29.5'
WELL VOLUME (gal): 8 x .13 = 1.1 gal

TIME BEGAN: 0810
TIME ENDED: 1110
NUMBER OF DRUMS: 3
DRUM DESIGNATIONS: MW 1402

SITE NAME: LACU 30 MW 1402
PROJECT: LACU / AIC 15
PROJECT NUMBER: 1868.0521
FIELD PERSONNEL: (MP)
SHEET NO. 1 OF 1

| TIME | ACTIVITY (swab/surge, bailing, pumping) | EST'D SEDIMENT THICKNESS (feet) | CUMMULATIVE WATER VOLUME (gallons) | TEMPERATURE (deg. C) | pH | CONDUCTIVITY (microsiemans) | TURBIDITY (NTU) | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 0810 | SWAB | 0 | 2 | 18 | 6.1 | 215 | 133 | |
| 0820 | PUMP | 0 | 30 | 20 | 6.0 | 220 | 20 | |
| 0830-1030 | Stop for pump maintenance | | | | | | | |
| 1030 | PUMP | 0 | 50 | 20 | 6.6 | 220 | 43 | Raining |
| 1045 | " | " | 70 | 19.5 | 6.1 | 220 | 11 | |
| 1055 | " | " | 120 | 20.5 | 6.1 | 220 | 5 | |
| 1110 | " | " | 165 | 19.5 | 6.1 | 220 | | |

JAMES M. MONTGOMERY, CONSULTING ENGINEERS, INC.
MONITORING WELL DEVELOPMENT DATA

WELL: MW 1403
DATE: 1/26/91
STATIC WATER LEVEL (ft): 14.0'
WELL DESIGN DEPTH (ft): 22.0'
WELL VOLUME (gal):

TIME BEGAN: 1020 hrs
TIME ENDED: 1420 hrs
NUMBER OF DRUMS: 3
DRUM DESIGNATIONS: MW 1403 1

SITE NAME: LACV 30 Pad 9
PROJECT: LACV 30
PROJECT NUMBER: 1868.0531
FIELD PERSONNEL: [illegible]
SHEET NO. 1 OF 1

| TIME | ACTIVITY (swab/surge, bailing, pumping) | EST'D SEDIMENT THICKNESS (feet) | CUMMULATIVE WATER VOLUME (gallons) | TEMPERATURE (deg. C) °F | pH | CONDUCTIVITY (microsiemans) | TURBIDITY (NTU) | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 1020 - 1035 | SWAB | | | | | | | |
| 1055 | 1st/ pump | NONE | > 2 gal. | 41 | 9.1 | 160 | OFF SCALE | DIRTY |
| 1110 | pump | — | 4 gal. | 62 | 7.0 | 280 | " " | Cleaning up |
| 1115 | " | — | 15 gal | 63 | 7.1 | 260 | 164 | |
| 1125 | " | — | 30 gal | 63 | 7.1 | 215 | 133 | |
| 1200-1300 | Stop | work | | | | | | |
| 1310 Changed pump | | CHECKED | | | | | | |
| to | Honda | 0 | 40 gal | 63 | 6.8 | 300 | 76 | Recalibrate pH meter |
| w/ C. Valve/Gate Valve | | 0 | 55 gal | 63 | 6.4 | 320 | 62 | Checked |
| 1325 | pump | 0 | 65 gal | 63 | 6.0 | 330 | 40 | |
| 1340 | " | 0 | 115 gal | 64 | 6.0 | 330 | 18 | |
| 1350 | " | 0 | 125 gal | 63 | 6.1 | 350 | 23 | pH paper Check = 6.0 |
| 1405 | " | 0 | 165 gal | 63 | 6.1 | 330 | 24 | |
| | | | | | | | | Rechecked pH meter O.K. |

JAMES M. MONTGOMERY, CONSULTING ENGINEERS, INC.
MONITORING WELL DEVELOPMENT DATA

WELL: MW 1404
DATE: 1/28/91
STATIC WATER LEVEL (ft): 2.0'
WELL DESIGN DEPTH (ft): 11.0'
WELL VOLUME (gal): 9 x .13 = 1.2 gal

TIME BEGAN: 0410 hrs
TIME ENDED: 0730 hrs
NUMBER OF DRUMS: 5
DRUM DESIGNATIONS: MW 1404

SITE NAME: LACV 30
PROJECT: LACV / ATGAS
PROJECT NUMBER: 1868.0531
FIELD PERSONNEL: TLP
SHEET NO. 1 OF 1

| TIME | ACTIVITY (swab/surge, bailing, pumping) | EST'D SEDIMENT THICKNESS (feet) | CUMMULATIVE WATER VOLUME REMOVED (gallons) | TEMPERATURE (deg. C) | pH | CONDUCTIVITY (microsiemans) | TURBIDITY (NTU) | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 1610 | SWAB/PUMP | 0 | 20 | 18.5 | 5.6 | 85 | OFF SCALE | |
| 1625 | PUMP | 0 | 100 | 18.5 | 5.4 | 80 | " | |
| 1635 | " | 0 | 80 | 20.0 | 5.6 | 80 | 170 | |
| 1650 | " | 0 | 90 | 20.0 | 5.6 | 80 | 158 | |
| 1705 | " | 0 | 100 | 20.0 | 5.5 | 80 | 124 | |
| 1810 | " | 0 | 220 | 19.0 | 5.6 | 70 | 41 | |
| 1930 | " | 0 | 330 | 17.0 | 5.6 | 70 | 11 | |

# Groundwater Sampling Logs

1000-0031 [illegible]
Phase I

# GROUNDWATER SAMPLING LOG

PAGE 1 OF 1

CLIENT USACE
SITE LACV
WELL NUMBER MW 140[illegible]
JOB NUMBER 1868, 0531

TOTAL WELL DEPTH 21.7
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) ~~.05~~ 2 (Pest Pump)
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 13.0
STANDING WATER COLUMN (FT) 7.7

AMT ONE WELL VOL (GAL) 15.4
TOTAL GAL TO BE PURGED 46.2

PURGING SYSTEM Honda Pump
SAMPLING SYSTEM Teflon Bailer

| DATE | TIME | AMOUNT PURGED (GAL) | FIELD PARAMETERS MEASURED EC(µmhos) | pH | TEMP(C°) | TURBIDITY(NTU) | PID(ppm) | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|
| 1/29/91 | 1353 | 0 | 105 | 6.0 | 13.5 | 12.8 | | | Clear - No Sediment | MDS/NAM |
| | 1400 | 10 | 180 | 5.8 | 13.5 | 6.6 | | | Clear - Brownish | MDS/~~EJD~~ |
| | 1402 | 20 | 190 | 5.9 | 16.0 | 4.3 | | | Clear - 0% Sed | MDS/~~EJD~~ |
| | 1409 | 30 | 185 | 6.0 | 15.5 | 3.8 | | | Clear - 0% Sed | MDS/~~EJD~~ |
| | 1416 | 40 | 185 | 6.0 | 17.5 | 3.8 | | | Clear - 0% Sed | MDS/~~EJD~~ |
| | 1423 | 50 | 190 | 5.9 | 17.5 | 3.5 | | | Clear - 0% Sed | MDS/~~EJD~~ |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| 1/29/91 | 1423 | 50 | 190 | 5.9 | 17.5 | 3.5 | 0.0 | | Clear - 0% Sed | MDS/NAM |

NOTES:

TURBIDITY:

# GROUNDWATER SAMPLING LOG



CLIENT: USACE
SITE: LACV
WELL NUMBER: MW 1402
JOB NUMBER: 1868. 0531

TOTAL WELL DEPTH: 24.9
WELL DIAMETER: 2"
BOREHOLE DIAMETER: 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED: 3
VOL PER VERTICAL FT CASING (GAL): ~~.35~~ .13
VOL PER FT BOREHOLE (LESS CASING)(GAL):

STATIC WATER LEVEL (FT): 17.5
STANDING WATER COLUMN (FT): 7.5

AMT ONE WELL VOL (GAL): .98
TOTAL GAL TO BE PURGED: 2.9

PURGING SYSTEM: Bailer
SAMPLING SYSTEM: Bailer

| DATE | TIME | AMOUNT PURGED (GAL) | FIELD PARAMETERS MEASURED | | | | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | EC(µmhos) | pH | TEMP(C°) | TURBIDITY(NTU) | PID(ppm) | | | |
| 1/30/91 | 0628 | 0 | 200 | 5.9 | 16.0 | 35 | | | Clear 0% Sed | MDS/NAM |
| | 0631 | 4 | 300 | 6.0 | 16.0 | 248 | | | Cloudy Brown | MDS/[redacted] |
| | 0635 | 8 | 340 | 6.0 | 17.5 | 191 | | | Cloudy Brown | MDS/[redacted] |
| | 0640 | 12 | 335 | 6.0 | 17.0 | 153 | | | Cloudy Brown | MDS/[redacted] |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| 1/30/91 | 0640 | 2g | 335 | 6.0 | 17.0 | 153 | 0 | | Cloudy 0% Sediment | MDS/NAM |

NOTES:

TURBIDITY:

# GROUNDWATER SAMPLING LOG



CLIENT: USACE
SITE: LACV
WELL NUMBER: MW 1403
JOB NUMBER: 1868.0531

TOTAL WELL DEPTH: 27.4
WELL DIAMETER: 2"
BOREHOLE DIAMETER: 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED: 3
VOL PER VERTICAL FT CASING (GAL): ~~.16~~ .13
VOL PER FT BOREHOLE (LESS CASING)(GAL): ______

STATIC WATER LEVEL (FT): 19.3
STANDING WATER COLUMN (FT): 8.1

AMT ONE WELL VOL (GAL): 1.05
TOTAL GAL TO BE PURGED: 3.15

PURGING SYSTEM: Bailer
SAMPLING SYSTEM: Bailer

| DATE | TIME | AMOUNT PURGED (GAL) | FIELD PARAMETERS MEASURED: EC(µmhos) | pH | TEMP(C°) | TURBIDITY(NTU) | PID(ppm) | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|
| 1/30/91 | 0728 | 0 | 240 | 6.0 | 17 | 46 | | | | MDS/NAM |
| | 0735 | 3 | 230 | 6.2 | 18.5 | 284 | | | | MDS/~~EJD~~ |
| | 0743 | 6 | 240 | 5.9 | 19 | 290 | | | | MDS/~~EJD~~ |
| | 0753 | 9 | 220 | 6.2 | 18 | 285 | | | | MDS/~~EJD~~ |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| 1/30/91 | 0753 | 2 gal | 230 | 6.2 | 18.0 | 285 | 0 | | | |

NOTES:

TURBIDITY: 142.5
50%

# GROUNDWATER _ .MPLING LOG



CLIENT USACE
SITE LACV 1404
WELL NUMBER MW 1404
JOB NUMBER 1868.0531

TOTAL WELL DEPTH 13.4
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .13
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 4.3
STANDING WATER COLUMN (FT) 9.1

AMT ONE WELL VOL (GAL) 1.2
TOTAL GAL TO BE PURGED 3.6

PURGING SYSTEM Bailer
SAMPLING SYSTEM Bailer

| DATE | TIME | AMOUNT PURGED (GAL) | FIELD PARAMETERS MEASURED EC(μmhos) | pH | TEMP(C°) | TURBIDITY(NTU) | PID(ppm) | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|
| 1/30/91 | 0824 | 0 | 100 | 5.5 | 14.5 | 53 | | | Cloudy, Brown | MDS/NAM |
| " | 0828 | 3 | 110 | 5.4 | 15.5 | 196 | | | Cloudy, 0% Sed | MDS/[redacted] |
| " | 0832 | 5 | 85 | 5.6 | 15.5 | 163 | | | Cloudy, 0% Sed | MDS/[redacted] |
| " | 0836 | 7 | 80 | 5.4 | 15.0 | 165 | | | Cloudy, 0% Sed | MDS/[redacted] |
| " | 0840 | 10 | 85 | 5.5 | 15.0 | 163 | | | Cloudy, 0% Sed | MDS/[redacted] |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| | | | | | | | | | | MDS/EJD |
| 1/30/91 | 0845 | 2 gal | 80 | | | | 0.0 | | Cloudy, 0% Sed | MDS/NAM |

NOTES:

TURBIDITY:

# In Situ Permeability Data

TABLE C-3

SLUG TEST RESULTS SUMMARY
LACV-30 SITE, FORT STORY, VA

| Well Number | Hydraulic Conductivity (ft/min) | (ft/day) | (m/day) |
|---|---|---|---|
| MW-1401 | 0.0778 | 112.10 | 34.17 |
| MW-1402 | 0.0817 | 117.65 | 35.86 |
| MW-1403 | 0.152 | 218.88 | 66.71 |
| MW-1404 | 0.0848 | 122.16 | 37.23 |

SLUG TEST FIELD DATA: WELL # MW-1401

SE1000B
Environmental Logger
02/02 12:34

Unit# 00825 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.05
Offset - 0.04

Step# 0 01/29 10:57

| Elapsed Time | Value |
|---|---|
| 0.0000 | 0.27 |
| 0.0033 | 0.25 |
| 0.0066 | 0.26 |
| 0.0099 | 0.86 |
| 0.0133 | 1.04 |
| 0.0166 | 0.88 |
| 0.0200 | 0.67 |
| 0.0233 | 0.62 |
| 0.0266 | 0.52 |
| 0.0300 | 0.33 |
| 0.0333 | 0.27 |
| 0.0500 | 0.67 |
| 0.0666 | 0.42 |
| 0.0833 | 0.34 |
| 0.1000 | 0.32 |
| 0.1166 | 0.30 |
| 0.1333 | 0.30 |
| 0.1500 | 0.29 |
| 0.1666 | 0.29 |
| 0.1833 | 0.29 |
| 0.2000 | 0.29 |
| 0.2166 | 0.28 |
| 0.2333 | 0.28 |
| 0.2500 | 0.28 |
| 0.2666 | 0.28 |
| 0.2833 | 0.28 |
| 0.3000 | 0.28 |
| 0.3166 | 0.28 |
| 0.3333 | 0.28 |
| 0.4167 | 0.28 |
| 0.5000 | 0.28 |
| 0.5833 | 0.28 |
| 0.6667 | 0.28 |
| 0.7500 | 0.28 |
| 0.8333 | 0.28 |
| 0.9167 | 0.28 |
| 1.0000 | 0.28 |
| 1.0833 | 0.28 |
| 1.1667 | 0.28 |
| 1.2500 | 0.28 |

SLUG TEST FIELD DATA: WELL # MW-1401 CONT'D

| | |
|---|---|
| 1.3333 | 0.28 |
| 1.4166 | 0.28 |
| 1.5000 | 0.28 |
| 1.5833 | 0.28 |
| 1.6667 | 0.28 |
| 1.7500 | 0.28 |
| 1.8333 | 0.28 |
| 1.9167 | 0.28 |
| 2.0000 | 0.28 |
| 2.5000 | 0.28 |
| 3.0000 | 0.29 |
| 3.5000 | 0.28 |
| 4.0000 | 0.28 |
| 4.5000 | 0.28 |
| 5.0000 | 0.29 |
| 5.5000 | 0.28 |
| 6.0000 | 0.28 |
| 6.5000 | 0.28 |
| 7.0000 | 0.28 |
| 7.5000 | 0.28 |
| 8.0000 | 0.28 |
| 8.5000 | 0.29 |
| 9.0000 | 0.29 |
| 9.5000 | 0.29 |
| 10.0000 | 0.29 |
| 12.0000 | 0.25 |
| 14.0000 | 0.25 |

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# A Q T E S O L V   R E S U L T S

Version 1.10

09/17/91 11:15:33

## TEST DESCRIPTION

Data set........... mw1401.tst
Data set title..... LACV: WELL # MW1401

Knowns and Constants:

- No. of data points.................. 17
- Radius of well casing............... 0.154
- Radius of well...................... 0.25
- Aquifer saturated thickness......... 120
- Well screen length.................. 7.31
- Static height of water in well...... 7.31
- Log(Re/Rw).......................... 2.044
- A, B, C............................. 2.421, 0.393, 0.000

## ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

## RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

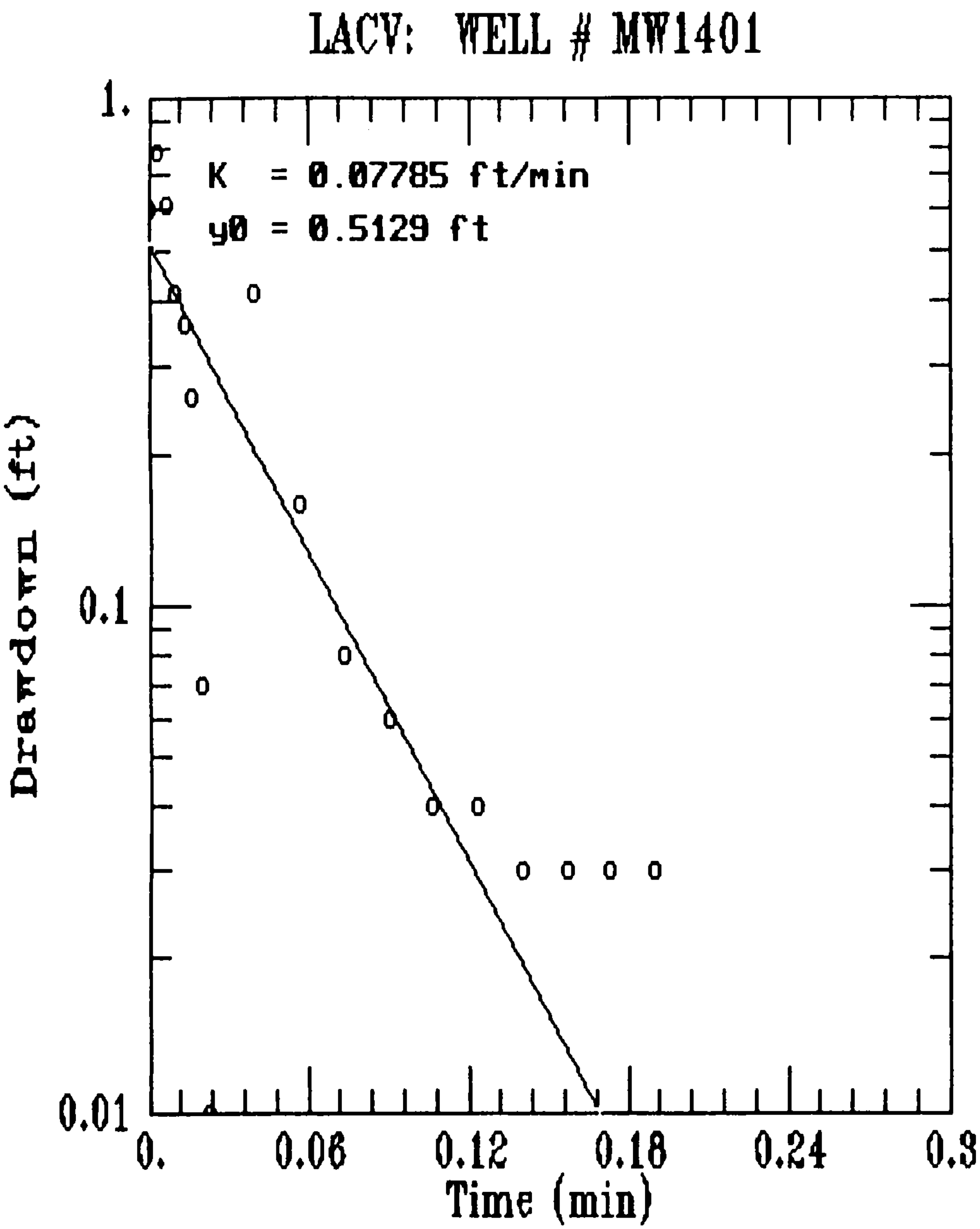
| | Estimate |
|---|---|
| K = | 7.7849E-002 |
| y0 = | 1.0546E+000 |

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

TYPE CURVE DATA

K = 7.78492E-002
y0 = 5.12861E-001

| Time | Drawdown | Time | Drawdown | Time | Drawdown |
|---|---|---|---|---|---|
| 0.000E+000 | 5.129E-001 | 3.000E-001 | 4.470E-004 | | |


LACV: WELL # MW1401
K = 0.07785 ft/min
y0 = 0.5129 ft
Drawdown (ft)
1.
0.1
0.01
0.
0.06
0.12
0.18
0.24
0.3
Time (min)

SLUG TEST FIELD DATA: WELL # MW-1402

SE1000B
Environmental Logger
02/02 12:37

Unit# 00825 Test# 2

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.05
Offset - 0.04

Step# 0 01/29 11:48

| Elapsed Time | Value |
|---|---|
| 0.0000 | 0.28 |
| 0.0033 | 0.27 |
| 0.0066 | 0.27 |
| 0.0099 | 0.27 |
| 0.0133 | 0.27 |
| 0.0166 | 0.27 |
| 0.0200 | 0.26 |
| 0.0233 | 0.26 |
| 0.0266 | 0.27 |
| 0.0300 | 0.68 |
| 0.0333 | 0.71 |
| 0.0500 | 0.49 |
| 0.0666 | 0.37 |
| 0.0833 | 0.55 |
| 0.1000 | 0.34 |
| 0.1166 | 0.31 |
| 0.1333 | 0.30 |
| 0.1500 | 0.29 |
| 0.1666 | 0.29 |
| 0.1833 | 0.29 |
| 0.2000 | 0.29 |
| 0.2166 | 0.29 |
| 0.2333 | 0.29 |
| 0.2500 | 0.29 |
| 0.2666 | 0.29 |
| 0.2833 | 0.29 |
| 0.3000 | 0.29 |
| 0.3166 | 0.29 |
| 0.3333 | 0.29 |
| 0.4167 | 0.29 |
| 0.5000 | 0.29 |
| 0.5833 | 0.29 |
| 0.6667 | 0.29 |
| 0.7500 | 0.29 |
| 0.8333 | 0.29 |
| 0.9167 | 0.29 |
| 1.0000 | 0.29 |
| 1.0833 | 0.29 |
| 1.1667 | 0.29 |
| 1.2500 | 0.29 |

SLUG TEST FIELD DATA: WELL # MW1402 CONT'D

| | |
|---|---|
| 1.3333 | 0.29 |
| 1.4166 | 0.29 |
| 1.5000 | 0.29 |
| 1.5833 | 0.29 |
| 1.6667 | 0.29 |
| 1.7500 | 0.29 |
| 1.8333 | 0.29 |
| 1.9167 | 0.29 |
| 2.0000 | 0.29 |
| 2.5000 | 0.29 |
| 3.0000 | 0.29 |
| 3.5000 | 0.29 |
| 4.0000 | 0.29 |
| 4.5000 | 0.29 |
| 5.0000 | 0.29 |
| 5.5000 | 0.29 |
| 6.0000 | 0.29 |
| 6.5000 | 0.29 |
| 7.0000 | 0.29 |
| 7.5000 | 0.29 |
| 8.0000 | 0.29 |
| 8.5000 | 0.29 |
| 9.0000 | 0.29 |
| 9.5000 | 0.29 |
| 10.0000 | 0.29 |
| 12.0000 | 0.25 |
| 14.0000 | 0.25 |
| 16.0000 | 0.25 |
| 18.0000 | 0.25 |
| 20.0000 | 0.25 |
| 22.0000 | 0.25 |
| 24.0000 | 0.26 |
| 26.0000 | 0.26 |

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# A Q T E S O L V   R E S U L T S
Version 1.10

09/17/91 12:06:44

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## TEST DESCRIPTION

Data set........... MW1402A.TST
Data set title..... LACV: WELL # MW1402

Knowns and Constants:
- No. of data points.................. 14
- Radius of well casing............... 0.154
- Radius of well...................... 0.25
- Aquifer saturated thickness......... 120
- Well screen length.................. 7.7
- Static height of water in well...... 7.7
- Log(Re/Rw).......................... 2.086
- A, B, C............................. 2.469, 0.402, 0.000

---

## ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

---

## RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

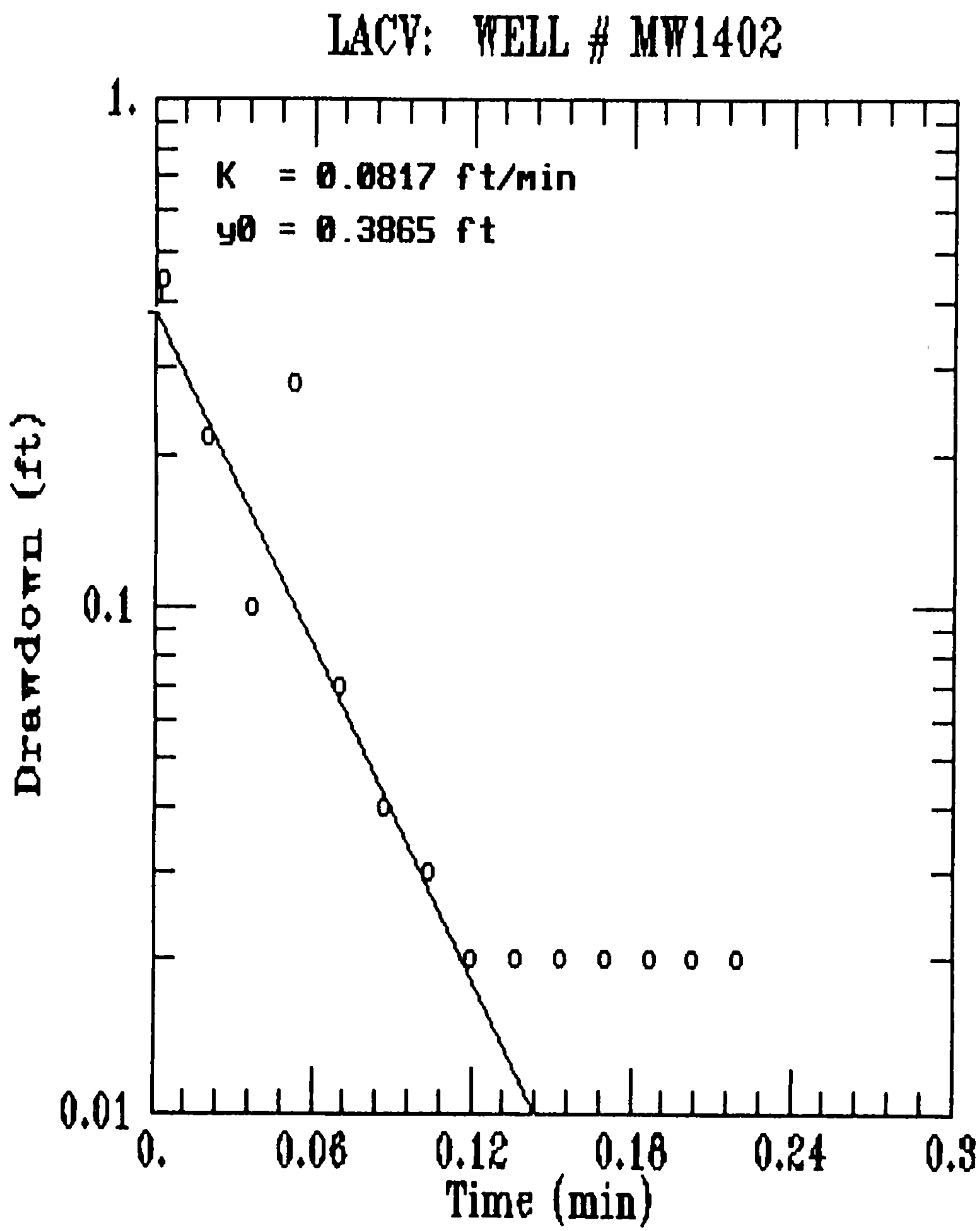
| | Estimate |
|---|---|
| K = | 4.5866E-002 |
| y0 = | 2.0847E+305 |

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

TYPE CURVE DATA

K = 8.17019E-002
y0 = 3.86499E-001

| Time | Drawdown | Time | Drawdown | Time | Drawdown |
|---|---|---|---|---|---|
| 0.000E+000 | 3.865E-001 | 3.000E-001 | 1.879E-004 | | |



LACV: WELL # MW1402
K = 0.0817 ft/min
y0 = 0.3865 ft
Drawdown (ft)
Time (min)
1.
0.1
0.01
0.
0.06
0.12
0.18
0.24
0.3

SLUG TEST FIELD DATA:  WELL # MW-1403

SE1000B
Environmental Logger
02/02  12:32

Unit# 00825  Test# 0

INPUT 1:  Level (F) TOC

Reference 0.00
Scale factor 10.05
Offset - 0.04

Step# 0  01/29  09:54

| Elapsed Time | Value |
|---|---|
| 0.0000 | 0.28 |
| 0.0033 | 0.28 |
| 0.0066 | 0.62 |
| 0.0099 | 0.73 |
| 0.0133 | 0.67 |
| 0.0166 | 0.57 |
| 0.0200 | 0.26 |
| 0.0233 | 0.43 |
| 0.0266 | 0.72 |
| 0.0300 | 0.78 |
| 0.0333 | 0.65 |
| 0.0500 | 0.37 |
| 0.0666 | 0.31 |
| 0.0833 | 0.29 |
| 0.1000 | 0.28 |
| 0.1166 | 0.28 |
| 0.1333 | 0.28 |
| 0.1500 | 0.28 |
| 0.1666 | 0.27 |
| 0.1833 | 0.27 |
| 0.2000 | 0.27 |
| 0.2166 | 0.27 |
| 0.2333 | 0.27 |
| 0.2500 | 0.27 |
| 0.2666 | 0.27 |
| 0.2833 | 0.27 |
| 0.3000 | 0.27 |
| 0.3166 | 0.27 |
| 0.3333 | 0.27 |
| 0.4167 | 0.27 |
| 0.5000 | 0.27 |
| 0.5833 | 0.27 |
| 0.6667 | 0.27 |
| 0.7500 | 0.27 |
| 0.8333 | 0.27 |
| 0.9167 | 0.27 |
| 1.0000 | 0.27 |
| 1.0833 | 0.27 |
| 1.1667 | 0.27 |
| 1.2500 | 0.27 |

SLUG TEST FIELD DATA:  WELL # MW-1403 CONT'D

| | |
|---|---|
| 1.3333 | 0.27 |
| 1.4166 | 0.27 |
| 1.5000 | 0.27 |
| 1.5833 | 0.27 |
| 1.6667 | 0.27 |
| 1.7500 | 0.27 |
| 1.8333 | 0.27 |
| 1.9167 | 0.27 |
| 2.0000 | 0.27 |
| 2.5000 | 0.28 |
| 3.0000 | 0.28 |
| 3.5000 | 0.28 |
| 4.0000 | 0.28 |
| 4.5000 | 0.28 |
| 5.0000 | 0.28 |
| 5.5000 | 0.28 |
| 6.0000 | 0.28 |
| 6.5000 | 0.28 |
| 7.0000 | 0.28 |
| 7.5000 | 0.28 |
| 8.0000 | 0.28 |
| 8.5000 | 0.28 |
| 9.0000 | 0.28 |
| 9.5000 | 0.28 |
| 10.0000 | 0.28 |
| 12.0000 | 0.25 |
| 14.0000 | 0.25 |

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# A Q T E S O L V   R E S U L T S
Version 1.10

09/17/91 13:04:54

================================================================================

## TEST DESCRIPTION

Data set........... MW1403A.TST
Data set title..... LACV: WELL # MW1403

Knowns and Constants:
No. of data points.................. 13
Radius of well casing.............. 0.154
Radius of well..................... 0.25
Aquifer saturated thickness......... 120
Well screen length.................. 7.1
Static height of water in well...... 7.1
Log(Re/Rw)......................... 2.02
A, B, C............................ 2.395, 0.389, 0.000

================================================================================

## ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

================================================================================

## RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

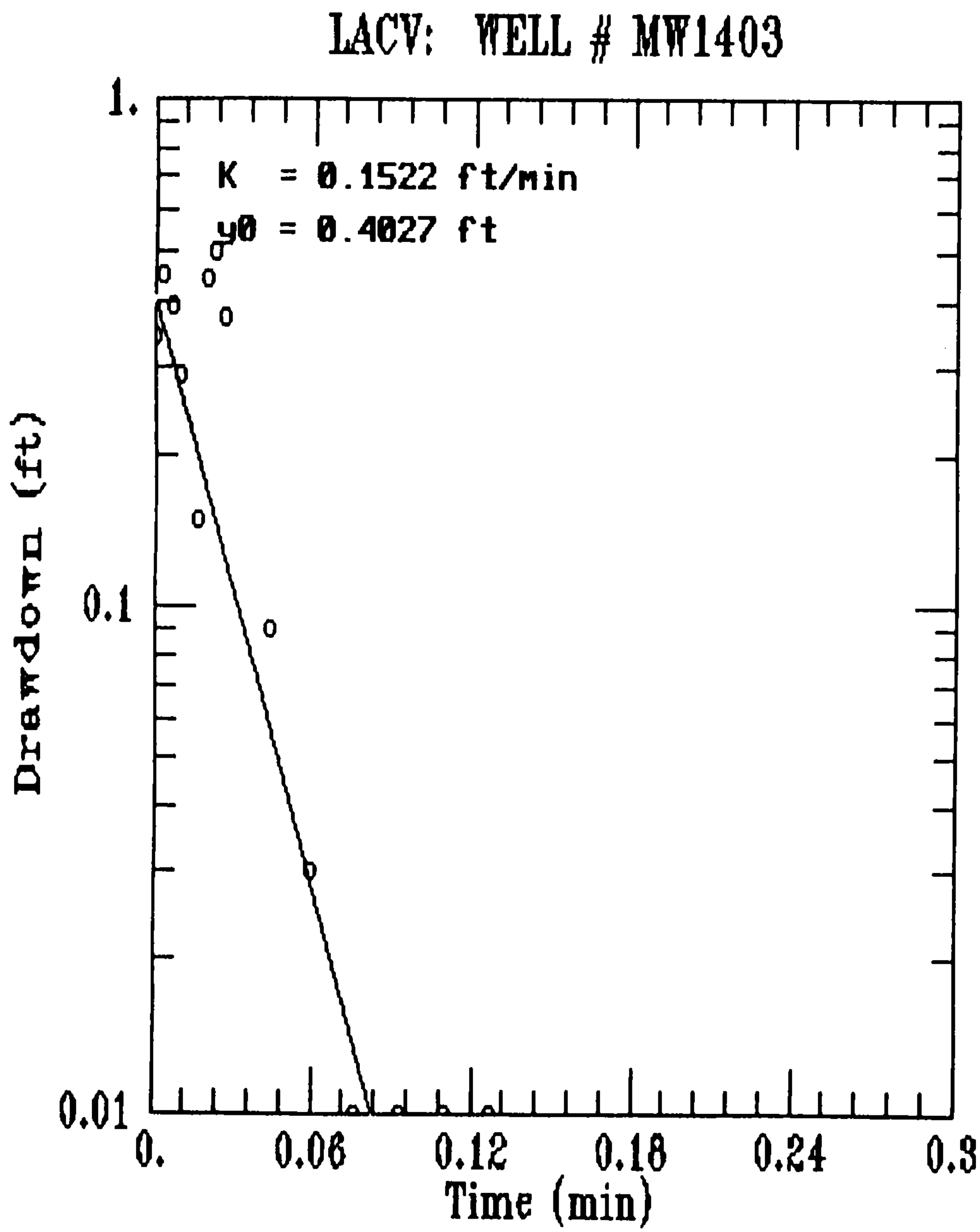
| | Estimate |
|---|---|
| K = | 1.5215E-001 |
| y0 = | 1.3036E-076 |

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

TYPE CURVE DATA

K = 1.52153E-001
y0 = 4.02717E-001

| Time | Drawdown | Time | Drawdown | Time | Drawdown |
|---|---|---|---|---|---|
| 0.000E+000 | 4.027E-001 | 3.000E-001 | 5.347E-007 | | |


LACV: WELL # MW1403
K = 0.1522 ft/min
y0 = 0.4027 ft
Drawdown (ft)
1.
0.1
0.01
0.
0.06
0.12
0.18
0.24
0.3
Time (min)

SLUG TEST FIELD DATA: WELL # MW-1404

SE1000B
Environmental Logger
02/02 12:39

Unit# 00825 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.05
Offset - 0.04

Step# 0 01/29 13:34

| Elapsed Time | Value |
|---|---|
| 0.0000 | 0.30 |
| 0.0033 | 0.29 |
| 0.0066 | 0.69 |
| 0.0099 | 0.66 |
| 0.0133 | 0.56 |
| 0.0166 | 0.54 |
| 0.0200 | 0.46 |
| 0.0233 | 0.56 |
| 0.0266 | 0.58 |
| 0.0300 | 0.43 |
| 0.0333 | 0.13 |
| 0.0500 | 0.61 |
| 0.0666 | 0.33 |
| 0.0833 | 0.32 |
| 0.1000 | 0.31 |
| 0.1166 | 0.31 |
| 0.1333 | 0.30 |
| 0.1500 | 0.30 |
| 0.1666 | 0.30 |
| 0.1833 | 0.30 |
| 0.2000 | 0.30 |
| 0.2166 | 0.30 |
| 0.2333 | 0.30 |
| 0.2500 | 0.30 |
| 0.2666 | 0.30 |
| 0.2833 | 0.30 |
| 0.3000 | 0.30 |
| 0.3166 | 0.30 |
| 0.3333 | 0.30 |
| 0.4167 | 0.30 |
| 0.5000 | 0.30 |
| 0.5833 | 0.30 |
| 0.6667 | 0.30 |
| 0.7500 | 0.30 |
| 0.8333 | 0.30 |
| 0.9167 | 0.30 |
| 1.0000 | 0.30 |
| 1.0833 | 0.30 |
| 1.1667 | 0.30 |
| 1.2500 | 0.30 |

SLUG TEST FIELD DATA: WELL # MW1404 CONT'D

| | |
|---|---|
| 1.3333 | 0.30 |
| 1.4166 | 0.30 |
| 1.5000 | 0.30 |
| 1.5833 | 0.30 |
| 1.6667 | 0.30 |
| 1.7500 | 0.30 |
| 1.8333 | 0.30 |
| 1.9167 | 0.30 |
| 2.0000 | 0.30 |
| 2.5000 | 0.30 |
| 3.0000 | 0.31 |
| 3.5000 | 0.30 |
| 4.0000 | 0.30 |
| 4.5000 | 0.31 |
| 5.0000 | 0.31 |
| 5.5000 | 0.31 |
| 6.0000 | 0.31 |
| 6.5000 | 0.31 |
| 7.0000 | 0.31 |
| 7.5000 | 0.30 |
| 8.0000 | 0.30 |
| 8.5000 | 0.30 |
| 9.0000 | 0.30 |
| 9.5000 | 0.30 |
| 10.0000 | 0.30 |
| 12.0000 | 0.27 |
| 14.0000 | 0.27 |

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# A Q T E S O L V   R E S U L T S

Version 1.10

09/17/91 13:22:00

================================================================================

## TEST DESCRIPTION

Data set........... MW1404A.TST
Data set title..... LACV: WELL # MW1404

Knowns and Constants:
No. of data points.................. 14
Radius of well casing............... 0.154
Radius of well...................... 0.25
Aquifer saturated thickness......... 120
Well screen length.................. 9.1
Static height of water in well...... 9.1
Log(Re/Rw).......................... 2.224
A, B, C............................. 2.645, 0.430, 0.000

================================================================================

## ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

================================================================================

## RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

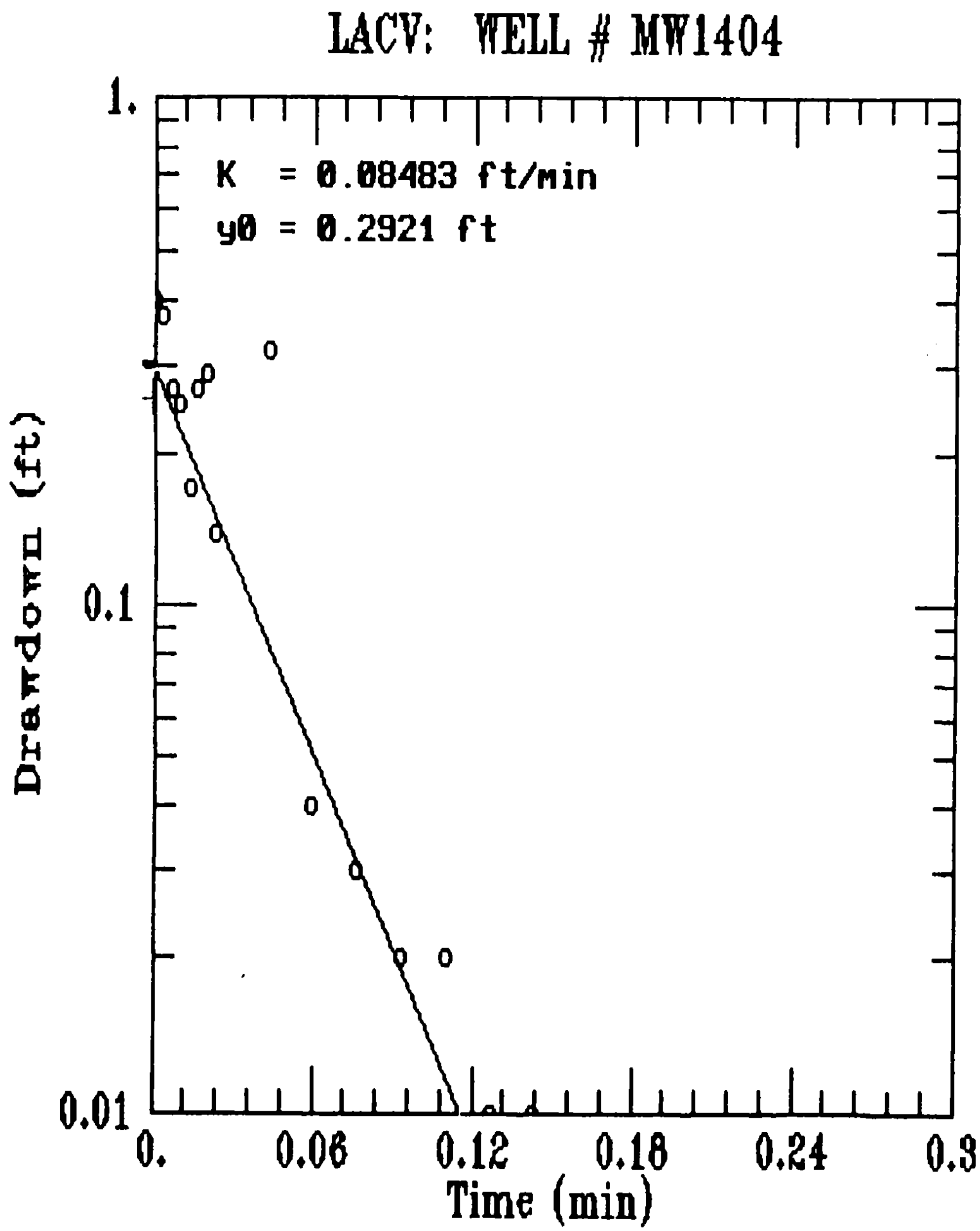
| | Estimate |
|---|---|
| K = | 7.9089E-002 |
| y0 = | 1.3036E-076 |

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

TYPE CURVE DATA

K = 8.48286E-002
y0 = 2.92136E-001

| Time | Drawdown | Time | Drawdown | Time | Drawdown |
|---|---|---|---|---|---|
| 0.000E+000 | 2.921E-001 | 3.000E-001 | 4.487E-005 | | |



LACV: WELL # MW1404
K = 0.08483 ft/min
y0 = 0.2921 ft
Drawdown (ft)
1.
0.1
0.01
0.
0.06
0.12
0.18
0.24
0.3
Time (min)

Trans Cal

1/29/91
0900 hrs.

MW 1403

| | | |
|---|---|---|
| TOTAL WELL DEPTH | 24.5' | (TOC) |
| Trans @ | 24.0 | |
| WL | 17.4 | |
| | 6.6' water | |

Trans. 6.18 Reads

Raise trans. 1 foot reads 5.19 Trans O.K

Background after slug was inserted 6.19 ft
6.18 ft

MW 1401

| | | |
|---|---|---|
| TOTAL WELL DEPTH | 20.5' | (TOC) |
| Trans @ | 20.5 | |
| WL | ~~12.97~~ → 13.0 | |
| | 7.5' water | |

Trans. reads 6.39

Raise trans 1 foot reads 5.45

MW 1402

TOTAL Well Depth 24.5'
+ 3
27.5 (TOC)

Trans @ 27.0
WL 19.3
7.7'

Trans reads 6.92

MW 1404

Total Well Depth 11.0
+ 3
14.0 (toc

Trans @ 13.5
WL 5.0
8.5'

Trans reads 7.74'

4-11

## APPENDIX D

## SUMMARY OF LACV-30 ANALYTICAL RESULTS

Analytical results for the LACV-30 field samples are presented in Appendix D, Tables D-1 through D-15. Analytical results for QC samples (i.e., duplicate, rinsate blank and trip blank samples) were documented in JMM's *ARR* (JMM, 1991b). Compounds detected at concentrations greater than the MRL are designated in a boldface font. Tables D-1 and D-2 present VOC results for soil and groundwater samples, respectively. Tables D-3 through D-5 present BNA results for soil, sediment and groundwater samples, respectively. Tables D-6 and D-7 present pesticide/PCB results for soil and sediment samples, respectively. Tables D-8 through D-11 present metals results for soil, sediment, groundwater and surface water samples, respectively. Tables D-12 through D-15 present TFH-H results for soil, sediment, groundwater and surface water samples.

TABLE D-1

SUMMARY OF VOC ANALYTICAL RESULTS FOR SOIL SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSB1401(0) | SLCVSB1402(10) | SLCVSB1403(0) | SLCVSB1404(5) |
| VOLATILE PRIORITY POLLUTANTS | | | | | |
| Acrolein | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Acrylonitrile | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Benzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Bromoform | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Carbon Tetrachloride | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Chlorobenzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Dibromochloromethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Chloroethane | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| 2-Chloroethylvinylether | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Chloroform | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Dichlorobromomethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,1-Dichloroethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,2-Dichloroethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,1-Dichloroethene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,2-Dichloropropane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Ethylbenzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Methyl Bromide | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Methyl Chloride | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Methylene Chloride | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| 1,1,2,2-Tetrachloroethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Tetrachloroethene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Toluene | 0.01 | ***0.03*** | < 0.01 | < 0.01 | < 0.01 |
| 1,1,1-Trichloroethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,1,2-Trichloroethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Trichloroethene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Vinyl Chloride | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| trans-1,3-Dichloropropene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| cis-1,3-Dichloropropene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| trans-1,2-Dichloroethene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| cis-1,2-Dichloroethene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Trichlorofluoromethane | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| m,p-Xylenes | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,2-Dichlorobenzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,3-Dichlorobenzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,4-Dichlorobenzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| HAZARDOUS SUBSTANCES COMPOUNDS | | | | | |
| Acetone | 0.25 | < 0.25 | < 0.25 | < 0.25 | < 0.25 |
| 2-Butanone | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Carbon disulfide | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 2-Hexanone | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| 4-Methyl-2-Pentanone | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Styrene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Tetrahydrofuran | 0.25 | < 0.25 | < 0.25 | < 0.25 | < 0.25 |
| Vinyl Acetate | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| o-Xylene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |

TABLE D-1
(Continued)

SUMMARY OF VOC ANALYTICAL RESULTS FOR SOIL SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSB1405(0) | SLCVSB1406(0) | SLCVSB1407(5) | SLCVSB1408(5) |
| VOLATILE PRIORITY POLLUTANTS | | | | | |
| Acrolein | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Acrylonitrile | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Benzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Bromoform | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Carbon Tetrachloride | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Chlorobenzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Dibromochloromethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Chloroethane | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| 2-Chloroethylvinylether | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Chloroform | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Dichlorobromomethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,1-Dichloroethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,2-Dichloroethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,1-Dichloroethene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,2-Dichloropropane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Ethylbenzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Methyl Bromide | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Methyl Chloride | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Methylene Chloride | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| 1,1,2,2-Tetrachloroethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Tetrachloroethene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Toluene | 0.01 | < 0.01 | *0.2* | < 0.01 | < 0.01 |
| 1,1,1-Trichloroethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,1,2-Trichloroethane | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Trichloroethene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Vinyl Chloride | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| trans-1,3-Dichloropropene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| cis-1,3-Dichloropropene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| trans-1,2-Dichloroethene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| cis-1,2-Dichloroethene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Trichlorofluoromethane | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| m,p-Xylenes | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,2-Dichlorobenzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,3-Dichlorobenzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 1,4-Dichlorobenzene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| HAZARDOUS SUBSTANCES COMPOUNDS | | | | | |
| Acetone | 0.25 | < 0.25 | < 0.25 | < 0.25 | < 0.25 |
| 2-Butanone | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Carbon disulfide | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| 2-Hexanone | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| 4-Methyl-2-Pentanone | 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Styrene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Tetrahydrofuran | 0.25 | < 0.25 | < 0.25 | < 0.25 | < 0.25 |
| Vinyl Acetate | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| o-Xylene | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |

TABLE D-2

SUMMARY OF VOC ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

| Compound | Detection Limit (µg/l) | Sample ID and Analytical Results (µg/l) | | |
|---|---|---|---|---|
| | | SLCVMW1401 | SLCVMW1401 D | SLCVMW1402 |
| VOLATILE PRIORITY POLLUTANTS | | | | |
| Acrolein | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Acrylonitrile | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Bromoform | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Carbon Tetrachloride | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Chlorobenzene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Dibromochloromethane | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Chloroethane | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Chloroethylvinylether | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Chloroform | 0.5 | ***2.6*** | ***2.4*** | < 0.5 |
| Dichlorobromomethane | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| 1,1-Dichloroethane | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| 1,2-Dichloroethane | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| 1,1-Dichloroethene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| 1,2-Dichloropropane | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Ethylbenzene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Methyl Bromide | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Methyl Chloride | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Methylene Chloride | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 1,1,2,2-Tetrachloroethane | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Tetrachloroethene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Toluene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| 1,1,1-Trichloroethane | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| 1,1,2-Trichloroethane | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Trichloroethene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Vinyl Chloride | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| trans-1,3-Dichloropropene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| cis-1,3-Dichloropropene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| trans-1,2-Dichloroethene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| cis-1,2-Dichloroethene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Trichlorofluoromethane | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| m,p-Xylenes | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| 1,2-Dichlorobenzene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| 1,3-Dichlorobenzene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| 1,4-Dichlorobenzene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| HAZARDOUS SUBSTANCES COMPOUNDS | | | | |
| Acetone | 10 | < 10 | < 10 | < 10 |
| 2-Butanone | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Carbon disulfide | 0.5 | ***0.6*** | < 0.5 | < 0.5 |
| 2-Hexanone | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Methyl-2-Pentanone | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Styrene | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Tetrahydrofuran | 10 | < 10 | < 10 | < 10 |
| Vinyl Acetate | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| o-Xylene | 0.5 | < 0.5 | < 0.5 | < 0.5 |

TABLE D-2
(Continued)

SUMMARY OF VOC ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

| Compound | Detection Limit (µg/l) | Sample ID and Analytical Results (µg/l) | |
|---|---|---|---|
| | | SLCVMW1403 | SLCVMW1404 |
| VOLATILE PRIORITY POLLUTANTS | | | |
| Acrolein | 1.0 | < 1.0 | < 1.0 |
| Acrylonitrile | 1.0 | < 1.0 | < 1.0 |
| Benzene | 0.5 | ***1.0*** | < 0.5 |
| Bromoform | 0.5 | < 0.5 | < 0.5 |
| Carbon Tetrachloride | 0.5 | < 0.5 | < 0.5 |
| Chlorobenzene | 0.5 | < 0.5 | < 0.5 |
| Dibromochloromethane | 0.5 | < 0.5 | < 0.5 |
| Chloroethane | 1.0 | < 1.0 | < 1.0 |
| 2-Chloroethylvinylether | 1.0 | < 1.0 | < 1.0 |
| Chloroform | 0.5 | < 0.5 | < 0.5 |
| Dichlorobromomethane | 0.5 | < 0.5 | < 0.5 |
| 1,1-Dichloroethane | 0.5 | ***2.4*** | < 0.5 |
| 1,2-Dichloroethane | 0.5 | < 0.5 | < 0.5 |
| 1,1-Dichloroethene | 0.5 | ***1.4*** | < 0.5 |
| 1,2-Dichloropropane | 0.5 | < 0.5 | < 0.5 |
| Ethylbenzene | 0.5 | < 0.5 | < 0.5 |
| Methyl Bromide | 1.0 | < 1.0 | < 1.0 |
| Methyl Chloride | 1.0 | < 1.0 | < 1.0 |
| Methylene Chloride | 5.0 | < 5.0 | < 5.0 |
| 1,1,2,2-Tetrachloroethane | 0.5 | < 0.5 | < 0.5 |
| Tetrachloroethene | 0.5 | < 0.5 | < 0.5 |
| Toluene | 0.5 | < 0.5 | < 0.5 |
| 1,1,1-Trichloroethane | 0.5 | < 0.5 | < 0.5 |
| 1,1,2-Trichloroethane | 0.5 | < 0.5 | < 0.5 |
| Trichloroethene | 0.5 | < 0.5 | < 0.5 |
| Vinyl Chloride | 1.0 | < 1.0 | < 1.0 |
| trans-1,3-Dichloropropene | 0.5 | < 0.5 | < 0.5 |
| cis-1,3-Dichloropropene | 0.5 | < 0.5 | < 0.5 |
| trans-1,2-Dichloroethene | 0.5 | < 0.5 | < 0.5 |
| cis-1,2-Dichloroethene | 0.5 | < 0.5 | < 0.5 |
| Trichlorofluoromethane | 1.0 | < 1.0 | < 1.0 |
| m,p-Xylenes | 0.5 | ***0.50*** | < 0.5 |
| 1,2-Dichlorobenzene | 0.5 | < 0.5 | < 0.5 |
| 1,3-Dichlorobenzene | 0.5 | < 0.5 | < 0.5 |
| 1,4-Dichlorobenzene | 0.5 | < 0.5 | < 0.5 |
| HAZARDOUS SUBSTANCES COMPOUNDS | | | |
| Acetone | 10 | < 10 | < 10 |
| 2-Butanone | 1.0 | < 1.0 | < 1.0 |
| Carbon disulfide | 0.5 | < 0.5 | < 0.5 |
| 2-Hexanone | 1.0 | < 1.0 | < 1.0 |
| 4-Methyl-2-Pentanone | 1.0 | < 1.0 | < 1.0 |
| Styrene | 0.5 | < 0.5 | < 0.5 |
| Tetrahydrofuran | 10 | < 10 | < 10 |
| Vinyl Acetate | 5.0 | < 5.0 | < 5.0 |
| o-Xylene | 0.5 | ***0.80*** | < 0.5 |

TABLE D-3

SUMMARY OF BNA ANALYTICAL RESULTS FOR SOIL SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSB1401(C3) | SLCVSB1402(C3) | SLCVSB1403(C3) | SLCVSB1404(C3) |
| BASE/NEUTRAL EXTRACTABLE-PRIORITY POLLUTANTS | | | | | |
| Acenaphthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Acenaphthylene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzidine | 10 | < 10 | < 10 | < 10 | < 10 |
| Benzo(a)anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(a)pyrene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(g,h,i)perylene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(b)fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(k)fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| bis(2-Chloroethoxy)methane | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Chloroethyl)ether | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Chloroisopropyl)ether | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Ethylhexyl)phthalate | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 4-Bromophenylphenylether | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Butylbenzylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Chloronaphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Chlorophenylphenylether | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Chrysene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dibenzo(a,h)anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,2-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,3-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,4-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 3,3'-Dichlorobenzidine | 10 | < 10 | < 10 | < 10 | < 10 |
| Diethylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dimethylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Di-n-butylphthalate | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 2,4-Dinitrotoluene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,6-Dinitrotoluene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Di-n-octylphthalate | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 1,2-Diphenylhydrazine | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Fluorene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Hexachlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Hexachlorobutadiene | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Hexachlorocyclopentadiene | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Hexachloroethane | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Indeno(1,2,3-c,d)pyrene | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Isophorone | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Naphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Nitrobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodimethylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodi-N-propylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodiphenylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Phenanthrene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Pyrene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,2,4-Trichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

TABLE D-3
(Continued)

SUMMARY OF BNA ANALYTICAL RESULTS FOR SOIL SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSB1401(C3) | SLCVSB1402(C3) | SLCVSB1403(C3) | SLCVSB1404(C3) |
| ACID EXTRACTABLE PRIORITY POLLUTANTS | | | | | |
| 2-Chlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4-Dichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4-Dimethylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4,6-Dinitro-o-cresol | 10 | < 10 | < 10 | < 10 | < 10 |
| 2,4-Dinitrophenol | 10 | < 10 | < 10 | < 10 | < 10 |
| 2-Nitrophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Nitrophenol | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| p-Chloro-m-cresol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Pentachlorophenol | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Phenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4,6-Trichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| HAZARDOUS SUBSTANCES COMPOUNDS | | | | | |
| Aniline | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzyl Alcohol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Methylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Methylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzoic Acid | 10 | < 10 | < 10 | < 10 | < 10 |
| 4-Chloroaniline | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Methylnaphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dibenzofuran | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Nitroaniline | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 3-Nitroaniline | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 4-Nitroaniline | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 2,4,5-Trichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

TABLE D-3
(Continued)

SUMMARY OF BNA ANALYTICAL RESULTS FOR SOIL SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSB1405(C3) | SLCVSB1406(C3) | SLCVSB1407(C3) | SLCVSB1408(C3) |
| BASE/NEUTRAL EXTRACTABLE-PRIORITY POLLUTANTS | | | | | |
| Acenaphthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Acenaphthylene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzidine | 10 | < 10 | < 10 | < 10 | < 10 |
| Benzo(a)anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(a)pyrene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(g,h,i)perylene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(b)fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(k)fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| bis(2-Chloroethoxy)methane | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Chloroethyl)ether | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Chloroisopropyl)ether | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Ethylhexyl)phthalate | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 4-Bromophenylphenylether | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Butylbenzylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Chloronaphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Chlorophenylphenylether | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Chrysene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dibenzo(a,h)anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,2-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,3-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,4-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 3,3'-Dichlorobenzidine | 10 | < 10 | < 10 | < 10 | < 10 |
| Diethylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dimethylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Di-n-butylphthalate | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 2,4-Dinitrotoluene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,6-Dinitrotoluene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Di-n-octylphthalate | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 1,2-Diphenylhydrazine | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Fluorene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Hexachlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Hexachlorobutadiene | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Hexachlorocyclopentadiene | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Hexachloroethane | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Indeno(1,2,3-c,d)pyrene | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Isophorone | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Naphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Nitrobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodimethylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodi-N-propylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodiphenylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Phenanthrene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Pyrene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,2,4-Trichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

TABLE D-3
(Continued)

SUMMARY OF BNA ANALYTICAL RESULTS FOR SOIL SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSB1405(C3) | SLCVSB1406(C3) | SLCVSB1407(C3) | SLCVSB1408(C3) |
| ACID EXTRACTABLE PRIORITY POLLUTANTS | | | | | |
| 2-Chlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4-Dichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4-Dimethylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4,6-Dinitro-o-cresol | 10 | < 10 | < 10 | < 10 | < 10 |
| 2,4-Dinitrophenol | 10 | < 10 | < 10 | < 10 | < 10 |
| 2-Nitrophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Nitrophenol | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| p-Chloro-m-cresol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Pentachlorophenol | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Phenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4,6-Trichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| HAZARDOUS SUBSTANCES COMPOUNDS | | | | | |
| Aniline | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzyl Alcohol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Methylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Methylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzoic Acid | 10 | < 10 | < 10 | < 10 | < 10 |
| 4-Chloroaniline | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Methylnaphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dibenzofuran | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Nitroaniline | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 3-Nitroaniline | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 4-Nitroaniline | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 2,4,5-Trichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

TABLE D-4

SUMMARY OF BNA ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSD1431(C3) | SLCVSD1432(C3) | SLVSD1433(C3) | SLCVSD1434(C3) |
| BASE/NEUTRAL EXTRACTABLE-PRIORITY POLLUTANTS | | | | | |
| Acenaphthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Acenaphthylene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzidine | 10 | < 10 | < 10 | < 10 | < 10 |
| Benzo(a)anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(a)pyrene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(g,h,i)perylene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(b)fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(k)fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| bis(2-Chloroethoxy)methane | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Chloroethyl)ether | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Chloroisopropyl)ether | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Ethylhexyl)phthalate | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 4-Bromophenylphenylether | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Butylbenzylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Chloronaphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Chlorophenylphenylether | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Chrysene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dibenzo(a,h)anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,2-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,3-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,4-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 3,3'-Dichlorobenzidine | 10 | < 10 | < 10 | < 10 | < 10 |
| Diethylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dimethylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Di-n-butylphthalate | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 2,4-Dinitrotoluene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,6-Dinitrotoluene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Di-n-octylphthalate | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 1,2-Diphenylhydrazine | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Fluorene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Hexachlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Hexachlorobutadiene | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Hexachlorocyclopentadiene | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Hexachloroethane | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Indeno(1,2,3-c,d)pyrene | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Isophorone | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Naphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Nitrobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodimethylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodi-N-propylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodiphenylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Phenanthrene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Pyrene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,2,4-Trichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

TABLE D-4
(Continued)

SUMMARY OF BNA ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSD1431(C3) | SLCVSD1432(C3) | SLVSD1433(C3) | SLCVSD1434(C3) |
| ACID EXTRACTABLE PRIORITY POLLUTANTS | | | | | |
| 2-Chlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4-Dichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4-Dimethylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4,6-Dinitro-o-cresol | 10 | < 10 | < 10 | < 10 | < 10 |
| 2,4-Dinitrophenol | 10 | < 10 | < 10 | < 10 | < 10 |
| 2-Nitrophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Nitrophenol | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| p-Chloro-m-cresol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Pentachlorophenol | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Phenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4,6-Trichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| HAZARDOUS SUBSTANCES COMPOUNDS | | | | | |
| Aniline | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzyl Alcohol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Methylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Methylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzoic Acid | 10 | < 10 | < 10 | < 10 | < 10 |
| 4-Chloroaniline | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Methylnaphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dibenzofuran | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Nitroaniline | 2.0 | < 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 3-Nitroaniline | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 4-Nitroaniline | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 2,4,5-Trichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

TABLE D-4
(Continued)

SUMMARY OF BNA ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | |
|---|---|---|---|---|
| | | SLCVSD1435(C3) | SLCVSD1436(C3) | SLCVSD1436(C3) D |
| BASE/NEUTRAL EXTRACTABLE-PRIORITY POLLUTANTS | | | | |
| Acenaphthene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Acenaphthylene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzidine | 10 | < 10 | < 10 | < 10 |
| Benzo(a)anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(a)pyrene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(g,h,i)perylene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(b)fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzo(k)fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| bis(2-Chloroethoxy)methane | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Chloroethyl)ether | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Chloroisopropyl)ether | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| bis(2-Ethylhexyl)phthalate | 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 4-Bromophenylphenylether | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Butylbenzylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Chloronaphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Chlorophenylphenylether | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Chrysene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dibenzo(a,h)anthracene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,2-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,3-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,4-Dichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 3,3'-Dichlorobenzidine | 10 | < 10 | < 10 | < 10 |
| Diethylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dimethylphthalate | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Di-n-butylphthalate | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 2,4-Dinitrotoluene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,6-Dinitrotoluene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Di-n-octylphthalate | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 1,2-Diphenylhydrazine | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Fluoranthene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Fluorene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Hexachlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Hexachlorobutadiene | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Hexachlorocyclopentadiene | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Hexachloroethane | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Indeno(1,2,3-c,d)pyrene | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Isophorone | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Naphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Nitrobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodimethylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodi-N-propylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| N-Nitrosodiphenylamine | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Phenanthrene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Pyrene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 1,2,4-Trichlorobenzene | 1.0 | < 1.0 | < 1.0 | < 1.0 |

TABLE D-4
(Continued)

SUMMARY OF BNA ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | |
|---|---|---|---|---|
| | | SLCVSD1435(C3) | SLCVSD1436(C3) | SLCVSD1436(C3) D |
| ACID EXTRACTABLE PRIORITY POLLUTANTS | | | | |
| 2-Chlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4-Dichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4-Dimethylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4,6-Dinitro-o-cresol | 10 | < 10 | < 10 | < 10 |
| 2,4-Dinitrophenol | 10 | < 10 | < 10 | < 10 |
| 2-Nitrophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Nitrophenol | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| p-Chloro-m-cresol | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Pentachlorophenol | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| Phenol | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2,4,6-Trichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| HAZARDOUS SUBSTANCES COMPOUNDS | | | | |
| Aniline | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzyl Alcohol | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Methylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 4-Methylphenol | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Benzoic Acid | 10 | < 10 | < 10 | < 10 |
| 4-Chloroaniline | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Methylnaphthalene | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Dibenzofuran | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| 2-Nitroaniline | 2.0 | < 2.0 | < 2.0 | < 2.0 |
| 3-Nitroaniline | 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 4-Nitroaniline | 4.0 | < 4.0 | < 4.0 | < 4.0 |
| 2,4,5-Trichlorophenol | 1.0 | < 1.0 | < 1.0 | < 1.0 |

TABLE D-5

SUMMARY OF BNA ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

| Compound | Detection Limit (µg/l) | Sample ID and Analytical Results (µg/l) | |
|---|---|---|---|
| | | SLCVMW1401 | SLCVMW1401 D |
| BASE/NEUTRAL EXTRACTABLE-PRIORITY POLLUTANTS | | | |
| Acenaphthene | 5.0 | < 5.0 | < 5.0 |
| Acenaphthylene | 5.0 | < 5.0 | < 5.0 |
| Anthracene | 5.0 | < 5.0 | < 5.0 |
| Benzidine | 50 | < 50 | < 50 |
| Benzo(a)anthracene | 5.0 | < 5.0 | < 5.0 |
| Benzo(a)pyrene | 5.0 | < 5.0 | < 5.0 |
| Benzo(g,h,i)perylene | 10 | < 10 | < 10 |
| Benzo(b)fluoranthene | 5.0 | < 5.0 | < 5.0 |
| Benzo(k)fluoranthene | 5.0 | < 5.0 | < 5.0 |
| bis(2-Chloroethoxy)methane | 10 | < 10 | < 10 |
| bis(2-Chloroethyl)ether | 10 | < 10 | < 10 |
| bis(2-Chloroisopropyl)ether | 10 | < 10 | < 10 |
| bis(2-Ethylhexyl)phthalate | 20 | < 20 | < 20 |
| 4-Bromophenylphenylether | 5.0 | < 5.0 | < 5.0 |
| Butylbenzylphthalate | 5.0 | < 5.0 | < 5.0 |
| 2-Chloronaphthalene | 5.0 | < 5.0 | < 5.0 |
| 4-Chlorophenylphenylether | 5.0 | < 5.0 | < 5.0 |
| Chrysene | 5.0 | < 5.0 | < 5.0 |
| Dibenzo(a,h)anthracene | 10 | < 10 | < 10 |
| 1,2-Dichlorobenzene | 5.0 | < 5.0 | < 5.0 |
| 1,3-Dichlorobenzene | 5.0 | < 5.0 | < 5.0 |
| 1,4-Dichlorobenzene | 5.0 | < 5.0 | < 5.0 |
| 3,3'-Dichlorobenzidine | 50 | < 50 | < 50 |
| Diethylphthalate | 5.0 | < 5.0 | < 5.0 |
| Dimethylphthalate | 5.0 | < 5.0 | < 5.0 |
| Di-n-butylphthalate | 10 | < 10 | < 10 |
| 2,4-Dinitrotoluene | 5.0 | < 5.0 | < 5.0 |
| 2,6-Dinitrotoluene | 5.0 | < 5.0 | < 5.0 |
| Di-n-octylphthalate | 10 | < 10 | < 10 |
| 1,2-Diphenylhydrazine | 10 | < 10 | < 10 |
| Fluoranthene | 5.0 | < 5.0 | < 5.0 |
| Fluorene | 5.0 | < 5.0 | < 5.0 |
| Hexachlorobenzene | 5.0 | < 5.0 | < 5.0 |
| Hexachlorobutadiene | 10 | < 10 | < 10 |
| Hexachlorocyclopentadiene | 10 | < 10 | < 10 |
| Hexachloroethane | 5.0 | < 5.0 | < 5.0 |
| Indeno(1,2,3-c,d)pyrene | 10 | < 10 | < 10 |
| Isophorone | 5.0 | < 5.0 | < 5.0 |
| Naphthalene | 5.0 | < 5.0 | < 5.0 |
| Nitrobenzene | 5.0 | < 5.0 | < 5.0 |
| N-Nitrosodimethylamine | 5.0 | < 5.0 | < 5.0 |
| N-Nitrosodi-N-propylamine | 5.0 | < 5.0 | < 5.0 |
| N-Nitrosodiphenylamine | 5.0 | < 5.0 | < 5.0 |
| Phenanthrene | 5.0 | < 5.0 | < 5.0 |
| Pyrene | 5.0 | < 5.0 | < 5.0 |
| 1,2,4-Trichlorobenzene | 5.0 | < 5.0 | < 5.0 |

TABLE D-5
(Continued)

SUMMARY OF BNA ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

| Compound | Detection Limit (µg/l) | Sample ID and Analytical Results (µg/l) | |
|---|---|---|---|
| | | SLCVMW1401 | SLCVMW1401 D |
| ACID EXTRACTABLE PRIORITY POLLUTANTS | | | |
| 2-Chlorophenol | 5.0 | < 5.0 | < 5.0 |
| 2,4-Dichlorophenol | 5.0 | < 5.0 | < 5.0 |
| 2,4-Dimethylphenol | 5.0 | < 5.0 | < 5.0 |
| 4,6-Dinitro-o-cresol | 50 | < 50 | < 50 |
| 2,4-Dinitrophenol | 50 | < 50 | < 50 |
| 2-Nitrophenol | 5.0 | < 5.0 | < 5.0 |
| 4-Nitrophenol | 10 | < 10 | < 10 |
| p-Chloro-m-cresol | 5.0 | < 5.0 | < 5.0 |
| Pentachlorophenol | 10 | < 10 | < 10 |
| Phenol | 5.0 | < 5.0 | < 5.0 |
| 2,4,6-Trichlorophenol | 5.0 | < 5.0 | < 5.0 |
| HAZARDOUS SUBSTANCES COMPOUNDS | | | |
| Aniline | 5.0 | < 5.0 | < 5.0 |
| Benzyl Alcohol | 5.0 | < 5.0 | < 5.0 |
| 2-Methylphenol | 5.0 | < 5.0 | < 5.0 |
| 4-Methylphenol | 5.0 | < 5.0 | < 5.0 |
| Benzoic Acid | 50 | < 50 | < 50 |
| 4-Chloroaniline | 5.0 | < 5.0 | < 5.0 |
| 2-Methylnaphthalene | 5.0 | < 5.0 | < 5.0 |
| Dibenzofuran | 5.0 | < 5.0 | < 5.0 |
| 2-Nitroaniline | 10 | < 10 | < 10 |
| 3-Nitroaniline | 20 | < 20 | < 20 |
| 4-Nitroaniline | 20 | < 20 | < 20 |
| 2,4,5-Trichlorophenol | 5.0 | < 5.0 | < 5.0 |

TABLE D-5
(Continued)

SUMMARY OF BNA ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

| Compound | Detection Limit (µg/l) | Sample ID and Analytical Results (µg/l) | | |
|---|---|---|---|---|
| | | SLCVMW1402 | SLCVMW1403 | SLCVMW1404 |
| BASE/NEUTRAL EXTRACTABLE-PRIORITY POLLUTANTS | | | | |
| Acenaphthene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Acenaphthylene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Anthracene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Benzidine | 50 | < 50 | < 50 | < 50 |
| Benzo(a)anthracene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Benzo(a)pyrene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Benzo(g,h,i)perylene | 10 | < 10 | < 10 | < 10 |
| Benzo(b)fluoranthene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Benzo(k)fluoranthene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| bis(2-Chloroethoxy)methane | 10 | < 10 | < 10 | < 10 |
| bis(2-Chloroethyl)ether | 10 | < 10 | < 10 | < 10 |
| bis(2-Chloroisopropyl)ether | 10 | < 10 | < 10 | < 10 |
| bis(2-Ethylhexyl)phthalate | 20 | < 20 | < 20 | < 20 |
| 4-Bromophenylphenylether | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Butylbenzylphthalate | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 2-Chloronaphthalene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 4-Chlorophenylphenylether | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Chrysene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Dibenzo(a,h)anthracene | 10 | < 10 | < 10 | < 10 |
| 1,2-Dichlorobenzene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 1,3-Dichlorobenzene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 1,4-Dichlorobenzene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 3,3'-Dichlorobenzidine | 50 | < 50 | < 50 | < 50 |
| Diethylphthalate | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Dimethylphthalate | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Di-n-butylphthalate | 10 | < 10 | < 10 | < 10 |
| 2,4-Dinitrotoluene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 2,6-Dinitrotoluene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Di-n-octylphthalate | 10 | < 10 | < 10 | < 10 |
| 1,2-Diphenylhydrazine | 10 | < 10 | < 10 | < 10 |
| Fluoranthene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Fluorene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Hexachlorobenzene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Hexachlorobutadiene | 10 | < 10 | < 10 | < 10 |
| Hexachlorocyclopentadiene | 10 | < 10 | < 10 | < 10 |
| Hexachloroethane | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Indeno(1,2,3-c,d)pyrene | 10 | < 10 | < 10 | < 10 |
| Isophorone | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Naphthalene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Nitrobenzene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| N-Nitrosodimethylamine | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| N-Nitrosodi-N-propylamine | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| N-Nitrosodiphenylamine | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Phenanthrene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Pyrene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 1,2,4-Trichlorobenzene | 5.0 | < 5.0 | < 5.0 | < 5.0 |

TABLE D-5
(Continued)

SUMMARY OF BNA ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

| Compound | Detection Limit (μg/l) | Sample ID and Analytical Results (μg/l) | | |
|---|---|---|---|---|
| | | SLCVMW1402 | SLCVMW1403 | SLCVMW1404 |
| ACID EXTRACTABLE PRIORITY POLLUTANTS | | | | |
| 2-Chlorophenol | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 2,4-Dichlorophenol | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 2,4-Dimethylphenol | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 4,6-Dinitro-o-cresol | 50 | < 50 | < 50 | < 50 |
| 2,4-Dinitrophenol | 50 | < 50 | < 50 | < 50 |
| 2-Nitrophenol | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 4-Nitrophenol | 10 | < 10 | < 10 | < 10 |
| p-Chloro-m-cresol | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Pentachlorophenol | 10 | < 10 | < 10 | < 10 |
| Phenol | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 2,4,6-Trichlorophenol | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| HAZARDOUS SUBSTANCES COMPOUNDS | | | | |
| Aniline | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Benzyl Alcohol | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 2-Methylphenol | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 4-Methylphenol | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Benzoic Acid | 50 | < 50 | < 50 | < 50 |
| 4-Chloroaniline | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 2-Methylnaphthalene | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Dibenzofuran | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| 2-Nitroaniline | 10 | < 10 | < 10 | < 10 |
| 3-Nitroaniline | 20 | < 20 | < 20 | < 20 |
| 4-Nitroaniline | 20 | < 20 | < 20 | < 20 |
| 2,4,5-Trichlorophenol | 5.0 | < 5.0 | < 5.0 | < 5.0 |

TABLE D-6

SUMMARY OF PESTICIDE/PCB ANALYTICAL RESULTS FOR SOIL SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSB1401(C3) | SLCVSB1402(C3) | SLCVSB1403(C3) | SLCVSB1404(C3) |
| PRIORITY POLLUTANT PESTICIDES | | | | | |
| Aldrin | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Alpha-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Beta-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Delta-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Gamma-BHC (Lindane) | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Chlordane | 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 |
| p,p' DDD | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| p,p' DDE | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| p,p' DDT | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Dieldrin | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan I (alpha) | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan II (beta) | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan sulfate | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endrin | 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Heptachlor | 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Heptachlor Epoxide | 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Endrin Aldehyde | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Toxaphene | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| POLYCHLORINATED BIPHENYLS | | | | | |
| Arochlor 1016 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1221 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1232 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1242 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1248 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1254 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1260 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |

TABLE D-6
(Continued)

SUMMARY OF PESTICIDE/PCB ANALYTICAL RESULTS FOR SOIL SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSB1405(C3) | SLCVSB1406(C3) | SLCVSB1407(C3) | SLCVSB1408(C3) |
| PRIORITY POLLUTANT PESTICIDES | | | | | |
| Aldrin | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Alpha-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Beta-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Delta-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Gamma-BHC (Lindane) | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Chlordane | 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 |
| p,p' DDD | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| p,p' DDE | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| p,p' DDT | 0.004 | < 0.004 | < 0.004 | < 0.004 | ***0.005*** |
| Dieldrin | 0.004 | < 0.004 | < 0.004 | ***0.011*** | ***0.007*** |
| Endosulfan I (alpha) | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan II (beta) | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan sulfate | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endrin | 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Heptachlor | 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Heptachlor Epoxide | 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Endrin Aldehyde | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Toxaphene | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| POLYCHLORINATED BIPHENYLS | | | | | |
| Arochlor 1016 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1221 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1232 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1242 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1248 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1254 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1260 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |

TABLE D-7

SUMMARY OF PESTICIDE/PCB ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLVSD1431(C3) | SLVSD1432(C3) | SLVSD1433(C3) | SLCVSD1434(C3) |
| PRIORITY POLLUTANT PESTICIDES | | | | | |
| Aldrin | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Alpha-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Beta-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Delta-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Gamma-BHC (Lindane) | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Chlordane | 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 |
| p,p' DDD | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| p,p' DDE | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| p,p' DDT | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Dieldrin | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan I (alpha) | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan II (beta) | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan sulfate | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endrin | 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Heptachlor | 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Heptachlor Epoxide | 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Endrin Aldehyde | 0.004 | < 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Toxaphene | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| POLYCHLORINATED BIPHENYLS | | | | | |
| Arochlor 1016 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1221 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1232 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1242 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1248 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1254 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1260 | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |

TABLE D-7
(Continued)

SUMMARY OF PESTICIDE/PCB ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | |
|---|---|---|---|---|
| | | SLCVSD1435(C3) | SLCVSD1436(C3) | SLCVSD1436(C3) D |
| PRIORITY POLLUTANT PESTICIDES | | | | |
| Aldrin | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Alpha-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Beta-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Delta-BHC | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Gamma-BHC (Lindane) | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Chlordane | 0.04 | < 0.04 | < 0.04 | < 0.04 |
| p,p' DDD | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| p,p' DDE | 0.004 | ***0.004*** | < 0.004 | < 0.004 |
| p,p' DDT | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Dieldrin | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan I (alpha) | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan II (beta) | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endosulfan sulfate | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Endrin | 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Heptachlor | 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Heptachlor Epoxide | 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Endrin Aldehyde | 0.004 | < 0.004 | < 0.004 | < 0.004 |
| Toxaphene | 0.10 | < 0.10 | < 0.10 | < 0.10 |
| POLYCHLORINATED BIPHENYLS | | | | |
| Arochlor 1016 | 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1221 | 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1232 | 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1242 | 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1248 | 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1254 | 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Arochlor 1260 | 0.10 | < 0.10 | < 0.10 | < 0.10 |

TABLE D-8

SUMMARY OF METAL ANALYTICAL RESULTS FOR SOIL SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSB1401(C3) | SLCVSB1402(C3) | SLCVSB1403(C3) | SLCVSB1404(C3) |
| Silver | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Arsenic | 10 | < 10 | < 10 | < 10 | < 10 |
| Beryllium | 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Cadmium | 0.50 | < 0.50 | < 0.50 | < 0.50 | < 0.50 |
| Chromium | 1.0 | < 1.0 | ***1.4*** | < 1.0 | ***1.6*** |
| Copper | 1.0 | < 1.0 | < 1.0 | < 1.0 | ***26*** |
| Mercury | 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Nickel | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| Lead | 10 | < 10 | < 10 | < 10 | < 10 |
| Antimony | 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Selenium | 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Thallium | 10 | < 10 | < 10 | < 10 | < 10 |
| Zinc | 2.0 | ***3.9*** | ***4.5*** | ***4.1*** | ***4.3*** |
| Barium | 10 | < 10 | < 10 | < 10 | < 10 |

TABLE D-9

SUMMARY OF METAL ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLVSD1431(C3) | SLVSD1432(C3) | SLVSD1433(C3) | SLCVSD1434(C3) |
| Silver | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Arsenic | 10 | < 10 | < 10 | < 10 | < 10 |
| Beryllium | 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Cadmium | 0.50 | < 0.50 | 2.5 | 0.7 | < 0.50 |
| Chromium | 1.0 | < 1.0 | 9.2 | 1.4 | 1.2 |
| Copper | 1.0 | 3.5 | 3.1 | 1.9 | 12 |
| Mercury | 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Nickel | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| Lead | 10 | < 10 | < 10 | < 10 | < 10 |
| Antimony | 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Selenium | 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Thallium | 10 | < 10 | < 10 | < 10 | < 10 |
| Zinc | 2.0 | 83 | 27 | 5.4 | 2.7 |
| Barium | 10 | < 10 | < 10 | < 10 | < 10 |

TABLE D-8
(Continued)

SUMMARY OF METAL ANALYTICAL RESULTS FOR SOIL SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | | |
|---|---|---|---|---|---|
| | | SLCVSB1405(C3) | SLCVSB1406(C3) | SLCVSB1407(C3) | SLCVSB1408(C3) |
| Silver | 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Arsenic | 10 | < 10 | < 10 | < 10 | < 10 |
| Beryllium | 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Cadmium | 0.50 | ***0.7*** | < 0.50 | < 0.50 | < 0.50 |
| Chromium | 1.0 | ***2.4*** | ***1.4*** | ***2*** | ***1.8*** |
| Copper | 1.0 | ***2.8*** | ***1.4*** | ***19*** | < 1.0 |
| Mercury | 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Nickel | 4.0 | < 4.0 | < 4.0 | < 4.0 | < 4.0 |
| Lead | 10 | < 10 | < 10 | < 10 | < 10 |
| Antimony | 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Selenium | 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Thallium | 10 | < 10 | < 10 | < 10 | < 10 |
| Zinc | 2.0 | ***15*** | ***13*** | ***4.8*** | ***3.5*** |
| Barium | 10 | < 10 | < 10 | < 10 | < 10 |

TABLE D-9
(Continued)

SUMMARY OF METAL ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

| Compound | Detection Limit (mg/kg) | Sample ID and Analytical Results (mg/kg) | | |
|---|---|---|---|---|
| | | SLCVSD1435(C3) | SLCVSD1436(C3) | SLCVSD1436(C3) D |
| Silver | 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Arsenic | 10 | < 10 | < 10 | < 10 |
| Beryllium | 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Cadmium | 0.50 | < 0.50 | < 0.50 | < 0.50 |
| Chromium | 1.0 | ***5.3*** | ***1.4*** | < 1.0 |
| Copper | 1.0 | ***16*** | < 1.0 | < 1.0 |
| Mercury | 0.02 | ***0.04*** | < 0.02 | < 0.02 |
| Nickel | 4.0 | < 4.0 | < 4.0 | < 4.0 |
| Lead | 10 | < 10 | < 10 | < 10 |
| Antimony | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Selenium | 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Thallium | 10 | < 10 | < 10 | < 10 |
| Zinc | 2.0 | ***8.3*** | ***8*** | ***6.1*** |
| Barium | 10 | 15 | < 10 | < 10 |

TABLE D-10

SUMMARY OF METAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

| Compound | Detection Limit (mg/l) | Sample ID and Analytical Results (mg/l) | | | |
|---|---|---|---|---|---|
| | | SLCV MW1401 TOT | SLCV MW1401 DIS | SLCV MW1401 TOT D | SLCV MW1401 DIS D |
| Silver | 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| Arsenic | 0.025 | < 0.025 | ***0.006*** | < 0.025 | ***0.009*** |
| Beryllium | 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Cadmium | 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Chromium | 0.010 | ***0.021*** | < 0.010 | ***0.014*** | < 0.010 |
| Copper | 0.010 | ***0.019*** | < 0.010 | < 0.010 | < 0.010 |
| Mercury | 0.0002 | < 0.0002 | < 0.0002 | < 0.0002 | < 0.0002 |
| Nickel | 0.040 | < 0.040 | < 0.040 | < 0.040 | < 0.040 |
| Lead | 0.010 | ***0.025*** | < 0.002 | ***0.015*** | ***0.009*** |
| Antimony | 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 |
| Selenium | 0.025 | < 0.025 | < 0.005 | < 0.025 | < 0.005 |
| Thallium | 0.050 | < 0.050 | < 0.010 | < 0.050 | < 0.010 |
| Zinc | 0.020 | ***0.19*** | ***0.07*** | ***0.13*** | ***0.14*** |
| Barium | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |

TABLE D-10
(Continued)

SUMMARY OF METAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

| Compound | Detection Limit (mg/l) | Sample ID and Analytical Results (mg/l) | | | |
|---|---|---|---|---|---|
| | | SLCV MW1402 TOT | SLCV MW1402 DIS | SLCV MW1403 TOT | SLCV MW1403 DIS |
| Silver | 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| Arsenic | 0.025 | < 0.025 | ***0.005*** | < 0.025 | < 0.005 |
| Beryllium | 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Cadmium | 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Chromium | 0.010 | ***0.024*** | < 0.010 | ***0.019*** | < 0.010 |
| Copper | 0.010 | ***0.016*** | < 0.010 | < 0.010 | < 0.010 |
| Mercury | 0.0002 | < 0.0002 | < 0.0002 | < 0.0002 | < 0.0002 |
| Nickel | 0.040 | < 0.040 | < 0.040 | < 0.040 | < 0.040 |
| Lead | 0.010 | ***0.02*** | < 0.002 | ***0.02*** | < 0.002 |
| Antimony | 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 |
| Selenium | 0.025 | < 0.025 | < 0.005 | < 0.025 | < 0.005 |
| Thallium | 0.050 | < 0.050 | < 0.010 | < 0.050 | < 0.010 |
| Zinc | 0.020 | ***0.16*** | ***0.026*** | ***0.14*** | ***0.044*** |
| Barium | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |

TABLE D-10
(Continued)

SUMMARY OF METAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

| Compound | Detection Limit (mg/l) | Sample ID and Analytical Results (mg/l) | |
|---|---|---|---|
| | | SLCV MW1404 TOT | SLCV MW1404 DIS |
| Silver | 0.010 | < 0.010 | < 0.010 |
| Arsenic | 0.025 | < 0.025 | *0.005* |
| Beryllium | 0.005 | < 0.005 | < 0.005 |
| Cadmium | 0.005 | < 0.005 | < 0.005 |
| Chromium | 0.010 | *0.013* | < 0.010 |
| Copper | 0.010 | < 0.010 | < 0.010 |
| Mercury | 0.0002 | < 0.0002 | < 0.0002 |
| Nickel | 0.040 | < 0.040 | < 0.040 |
| Lead | 0.010 | *0.035* | < 0.002 |
| Antimony | 0.050 | < 0.050 | < 0.050 |
| Selenium | 0.025 | < 0.025 | < 0.005 |
| Thallium | 0.050 | < 0.050 | < 0.010 |
| Zinc | 0.020 | *0.24* | *0.035* |
| Barium | 0.10 | < 0.10 | < 0.10 |

TABLE D-11

SUMMARY OF METAL ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES

| Compound | Detection Limit (mg/l) | Sample ID and Analytical Results (mg/l) | | | |
|---|---|---|---|---|---|
| | | SLCV SW1451 TOT | SLCV SW1451 DIS | SLCV SW1452 TOT | SLCV SW1452 DIS |
| Silver | 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| Arsenic | 0.025 | < 0.025 | < 0.005 | < 0.025 | < 0.005 |
| Beryllium | 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Cadmium | 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Chromium | 0.010 | < 0.010 | < 0.010 | ***0.005*** | < 0.010 |
| Copper | 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| Mercury | 0.0002 | < 0.0002 | < 0.0002 | < 0.0002 | < 0.0002 |
| Nickel | 0.040 | < 0.040 | < 0.040 | < 0.040 | < 0.040 |
| Lead | 0.010 | < 0.010 | < 0.002 | ***0.010*** | < 0.002 |
| Antimony | 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 |
| Selenium | 0.025 | < 0.025 | < 0.005 | < 0.025 | < 0.005 |
| Thallium | 0.050 | < 0.050 | < 0.010 | < 0.050 | < 0.010 |
| Zinc | 0.020 | ***0.075*** | ***0.069*** | ***0.068*** | ***0.042*** |
| Barium | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |

TABLE D-11
(Continued)

SUMMARY OF METAL ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES

| Compound | Detection Limit (mg/l) | Sample ID and Analytical Results (mg/l) | | | |
|---|---|---|---|---|---|
| | | SLCV SW1455 TOT | SLCV SW1455 DIS | SLCV SW1454 TOT | SLCV SW1454 DIS |
| Silver | 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| Arsenic | 0.025 | < 0.025 | < 0.005 | < 0.025 | < 0.005 |
| Beryllium | 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Cadmium | 0.005 | ***0.011*** | < 0.005 | < 0.005 | < 0.005 |
| Chromium | 0.010 | ***0.023*** | < 0.010 | < 0.010 | < 0.010 |
| Copper | 0.010 | ***0.046*** | < 0.010 | < 0.010 | < 0.010 |
| Mercury | 0.0002 | < 0.0002 | < 0.0002 | < 0.0002 | < 0.0002 |
| Nickel | 0.040 | < 0.040 | < 0.040 | < 0.040 | < 0.040 |
| Lead | 0.010 | ***0.05*** | < 0.002 | < 0.010 | < 0.002 |
| Antimony | 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 |
| Selenium | 0.025 | < 0.025 | < 0.005 | < 0.025 | < 0.005 |
| Thallium | 0.050 | < 0.050 | < 0.010 | < 0.050 | < 0.010 |
| Zinc | 0.020 | ***0.19*** | < 0.020 | ***0.062*** | ***0.046*** |
| Barium | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |

TABLE D-11
(Continued)

SUMMARY OF METAL ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES

| Compound | Detection Limit (mg/l) | Sample ID and Analytical Results (mg/l) | | | |
|---|---|---|---|---|---|
| | | SLCV SW1453 TOT | SLCV SW1453 DIS | SLCV SW1453 TOT D | SLCV SW1453 DIS D |
| Silver | 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| Arsenic | 0.025 | < 0.025 | < 0.005 | < 0.025 | < 0.005 |
| Beryllium | 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Cadmium | 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Chromium | 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| Copper | 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| Mercury | 0.0002 | < 0.0002 | < 0.0002 | < 0.0002 | < 0.0002 |
| Nickel | 0.040 | < 0.040 | < 0.040 | < 0.040 | < 0.040 |
| Lead | 0.010 | ***0.015*** | ***0.006*** | ***0.015*** | ***0.007*** |
| Antimony | 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 |
| Selenium | 0.025 | < 0.025 | < 0.005 | < 0.025 | < 0.005 |
| Thallium | 0.050 | < 0.050 | < 0.010 | < 0.050 | < 0.010 |
| Zinc | 0.020 | ***0.10*** | ***0.10*** | ***0.088*** | ***0.10*** |
| Barium | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |

TABLE D-12

SUMMARY OF TFH-H ANALYTICAL RESULTS FOR SOIL SAMPLES

| Sample ID | Concentration (mg/kg) |
| --- | --- |
| SLCVSB1401 (C3) | <10 |
| SLCVSB1402 (C3) | <10 |
| SLCVSB1403 (C3) | <10 |
| SLCVSB1404 (C3) | <10 |
| SLCVSB1405 (C3) | <10 |
| SLCVSB1406 (C3) | <10 |
| SLCVSB1407 (C3) | <10 |
| SLCVSB1408 (C3) | <10 |
| SLCVSD1436 (C3) | <10 |
| SLCVSD1436 (C3) D | <10 |

TABLE D-13

SUMMARY OF TFH-H ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

| Sample ID | Concentration (mg/kg) |
|---|---|
| SLCVSD1431 (C3) | <10 |
| SLCVSD1432 (C3) | 35 |
| SLCVSD1433 (C3) | <10 |
| SLCVSD1434 (C3) | <10 |
| SLCVSD1435 (C3) | <10 |

TABLE D-14

SUMMARY OF TFH-H ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

| Sample ID | Concentration (mg/l) |
|---|---|
| SLCVMW1401 (C3) | <0.05 |
| SLCVMW1401 (C3) D | <0.05 |
| SLCVMW1402 (C3) | <0.05 |
| SLCVMW1403 (C3) | <0.05 |
| SLCVMW1404 (C3) | <0.05 |

TABLE D-15

SUMMARY OF TFH-H ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES

| Sample ID | Concentration (mg/l) |
|---|---|
| SLCVSW1451 (C3) | <0.05 |
| SLCVSW1452 (C3) | *0.8* |
| SLCVSW1453 (C3) | <0.05 |
| SLCVSW1453 (C3) D | <0.05 |
| SLCVSW1454 (C3) | *56* |
| SLCVSW1455 (C3) | <0.05 |

## TABLE E-1

## FORT STORY BACKGROUND SOIL BORING ANALYTICAL RESULTS[a]

| Parameters | SB-134 | | SB-135 | | | SB-136 | |
|---|---|---|---|---|---|---|---|
| | 0 | 13 | 0 | 0-D | 40 | 0 | 20 |
| Pesticides/PCBs (mg/kg) | | | | | | | |
| p,p' DDT | ND[b] | ND | 0.005 | 0.005 | ND | ND | ND |
| VOCs (mg/kg) | ND | ND | ND | ND | ND | ND | ND |
| BNAs (mg/kg) | ND | ND | ND | ND | ND | ND | ND |
| Metals (mg/kg) | | | | | | | |
| Arsenic | ND | ND | ND | 2.5 | ND | ND | ND |
| Chromium | 1.3 | 2.9 | 2.4 | 2.9 | 2.3 | 1.2 | 2.1 |
| Copper | 1.5 | ND | ND | ND | ND | 1.2 | 1.8 |
| Lead | 2.5 | 2.0 | 2.3 | 6.5 | 11 | ND | 1.0 |
| Zinc | ND | ND | 3.0 | 2.7 | 8.9 | ND | 3.7 |
| EP Tox Metals (mg/l) | ND | ND | ND | ND | ND | ND | ND |
| Total Solids (%) | 96 | 83 | 94 | 94 | 99 | 81 | 94 |

(a) JMM, 1991c.
(b) ND - not detected.

## APPENDIX F

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## PERSONAL COMMUNICATION

Telephone conversation between Dr. Jacqueline Clarkson (JMM) and Dr. Roderick Young, Professor, Virginia Polytechnic Institute and State University. July 12, 1991.

Telephone conversation between Colin Campbell (JMM) and Bill Chase, Analytical Chemist, Commonwealth of Virginia, Consolidated Laboratory Services, Pesticide Laboratory. July 12, 1991.

Telephone conversation between Reid Dennis (JMM) and Janet Grubbs, Chief of Site Assessments, EPA. May 1991.

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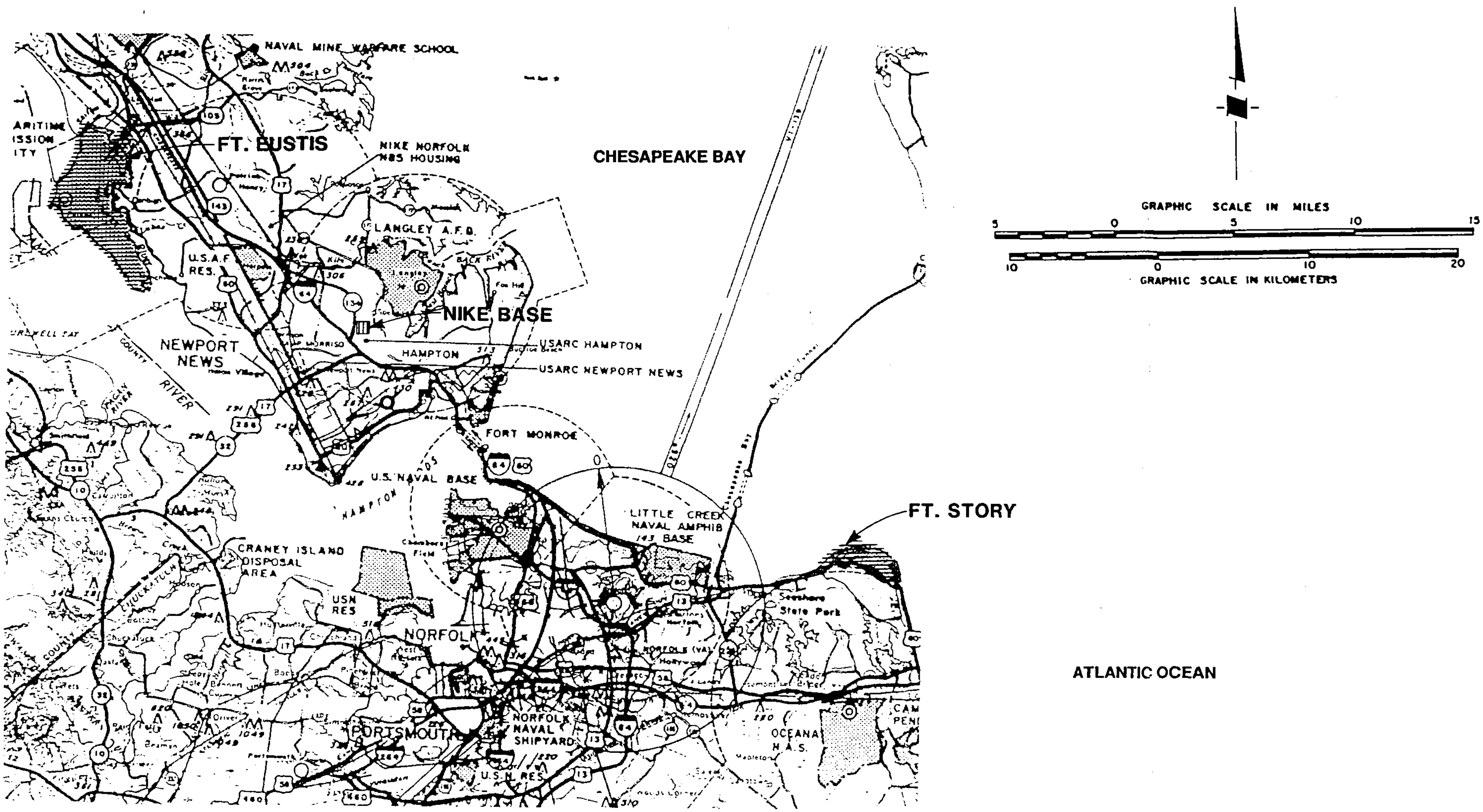
Telephone conversation between Nancy McNelly (JMM) and Dr. Roderick Young, Professor, Virginia Polytechnic Institute and State University. August 29, 1991.

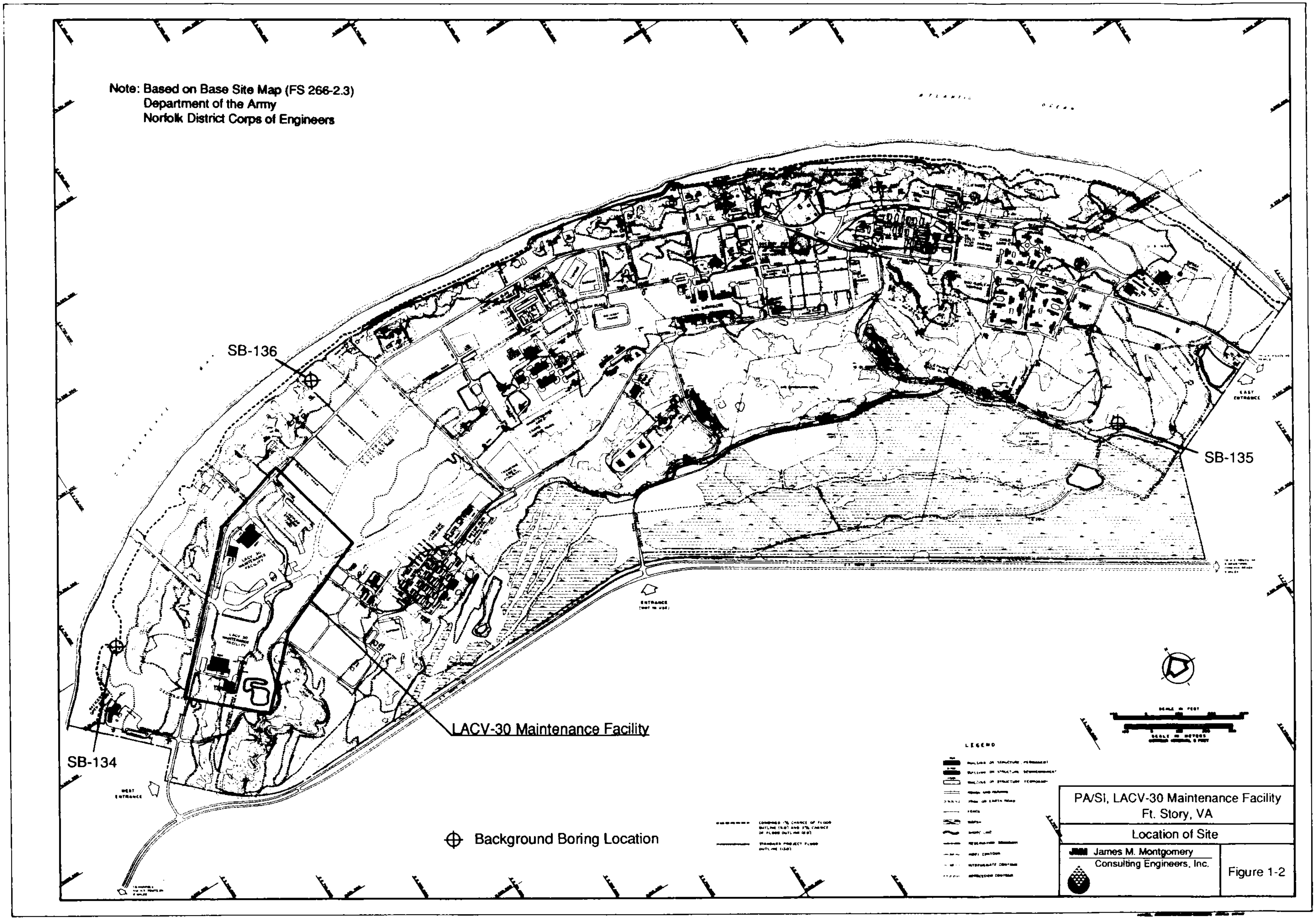
Telephone conversation between Nancy McNelly (JMM) and Bill Chase, Analytical Chemist, Commonwealth of Virginia, Consolidated Laboratory Services, Pesticide Laboratory. August 29, 1991.

Fredericks, 1992. Personal Communication to Michael Kelly of James M. Montgomery, Consulting Engineers Inc., Sergent Fredricks, Fort Story, Virginia, December 1992.

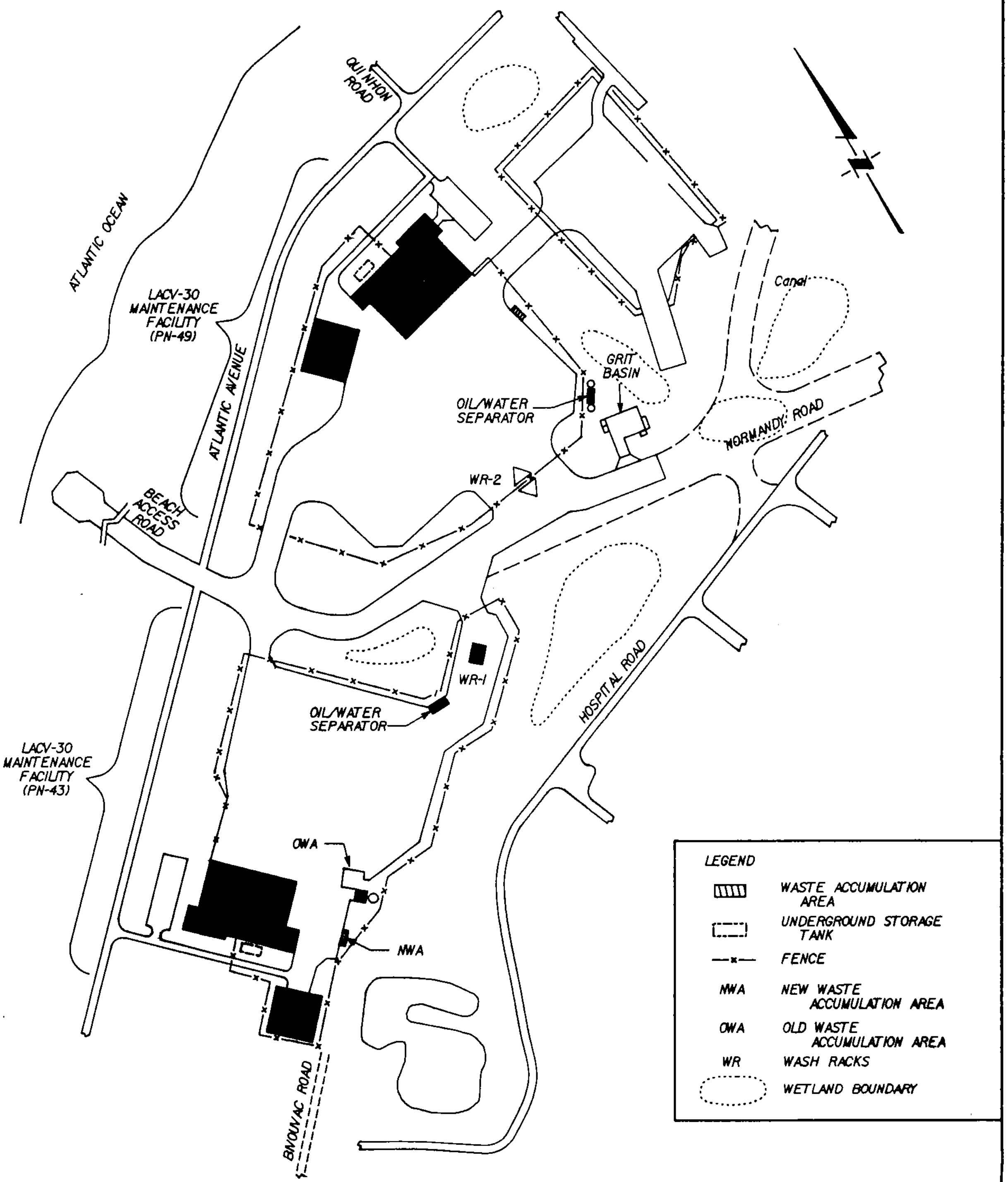



Vicinity Map
Location of USACE Project Installations
Ft. Eustis/Ft. Story

Figure 1-1



Note: Based on Base Site Map (FS 266-2.3)
Department of the Army
Norfolk District Corps of Engineers
SB-136
SB-135
SB-134
LACV-30 Maintenance Facility
Background Boring Location
PA/SI, LACV-30 Maintenance Facility
Ft. Story, VA
Location of Site
James M. Montgomery
Consulting Engineers, Inc.
Figure 1-2



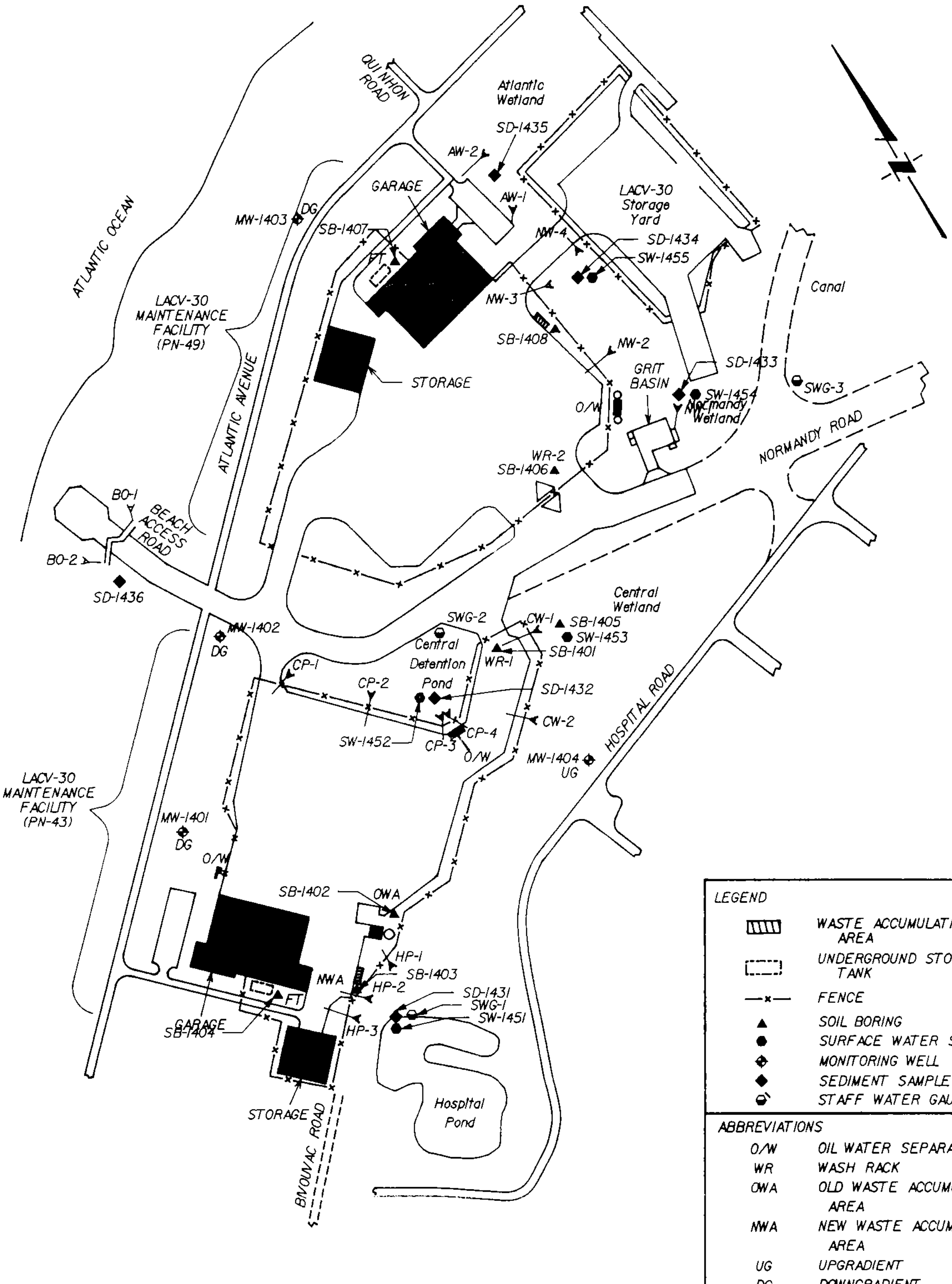

PA/SI, FT. STORY, VA

SITE MAP
LACV-30 MAINTENANCE FACILITY

JMM James M. Montgomery

FIGURE 1-3

NOTE: THIS FIGURE NOT TO SCALE




NOTE: THIS FIGURE NOT TO SCALE

**LEGEND**

| Symbol | Meaning |
|---|---|
| (hatched box) | WASTE ACCUMULATION AREA |
| (dashed box) | UNDERGROUND STORAGE TANK |
| —x— | FENCE |
| ▲ | SOIL BORING |
| ● | SURFACE WATER SAMPLE |
| (well symbol) | MONITORING WELL |
| ◆ | SEDIMENT SAMPLE |
| (gauge symbol) | STAFF WATER GAUGE |

**ABBREVIATIONS**

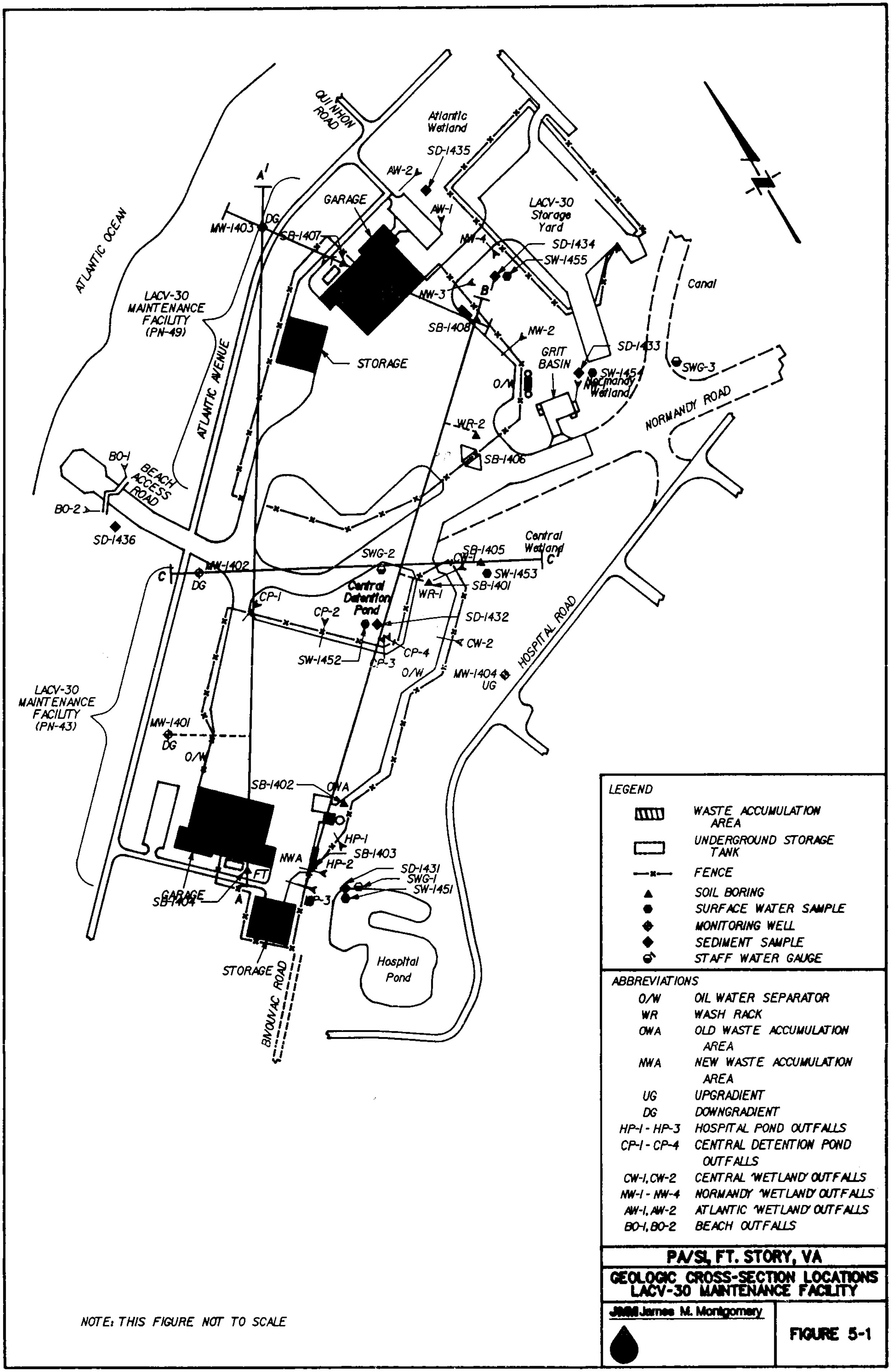
| | |
|---|---|
| O/W | OIL WATER SEPARATOR |
| WR | WASH RACK |
| OWA | OLD WASTE ACCUMULATION AREA |
| NWA | NEW WASTE ACCUMULATION AREA |
| UG | UPGRADIENT |
| DG | DOWNGRADIENT |
| HP-1 - HP-3 | HOSPITAL POND OUTFALLS |
| CP-1 - CP-4 | CENTRAL DETENTION POND OUTFALLS |
| CW-1, CW-2 | CENTRAL 'WETLAND' OUTFALLS |
| NW-1 - NW-4 | NORMANDY 'WETLAND' OUTFALLS |
| AW-1, AW-2 | ATLANTIC 'WETLAND' OUTFALLS |
| BO-1, BO-2 | BEACH OUTFALLS |

**PA/SI, FT. STORY, VA**

**SAMPLING LOCATIONS**
**LACV-30 MAINTENANCE FACILITY**

JMM James M. Montgomery

**FIGURE 1-4**

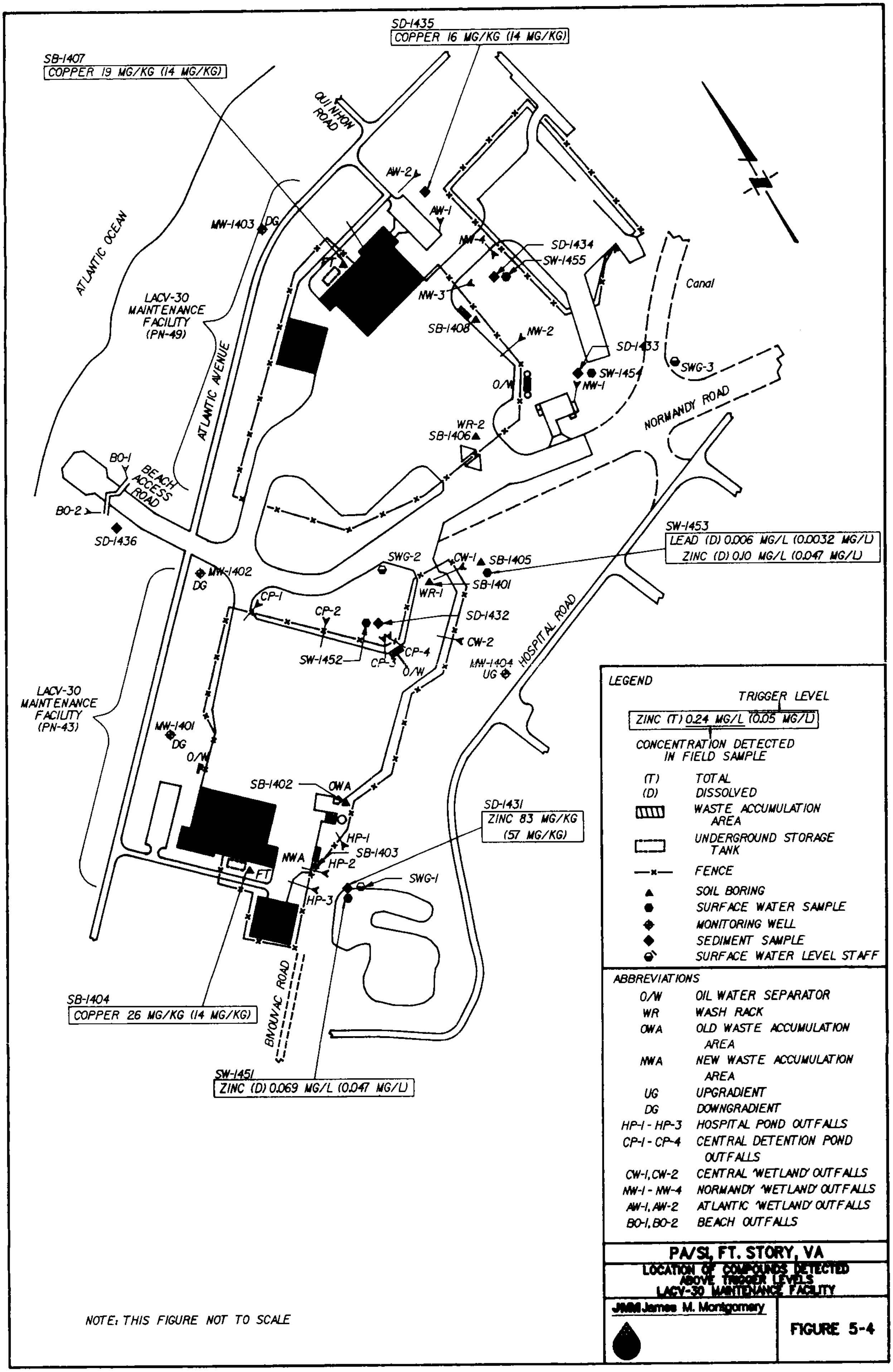



**PA/SI, FT. STORY, VA**

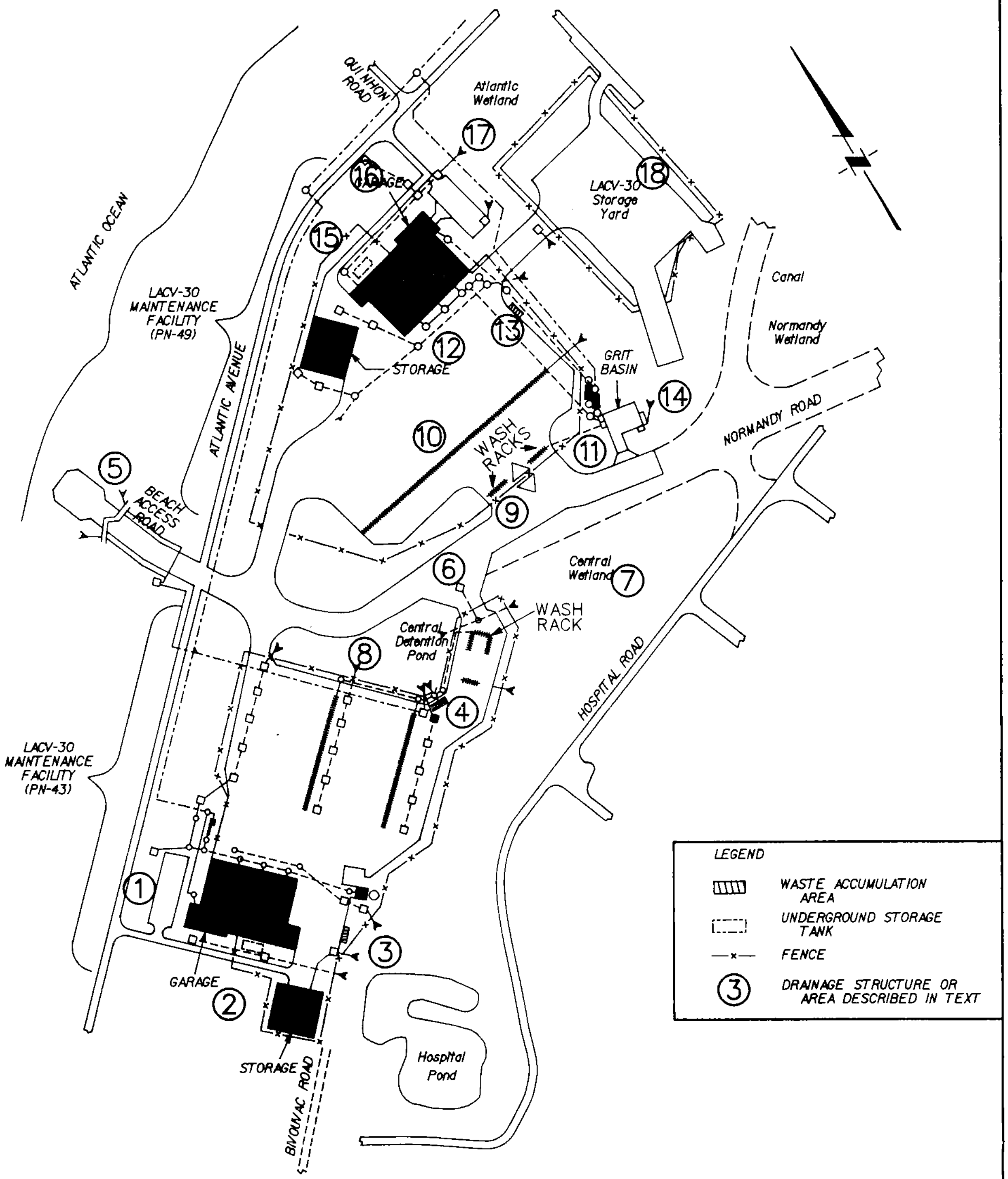
**GEOLOGIC CROSS-SECTION LOCATIONS LACV-30 MAINTENANCE FACILITY**

JMM James M. Montgomery

**FIGURE 5-1**



SD-1435
COPPER 16 MG/KG (14 MG/KG)
SB-1407
COPPER 19 MG/KG (14 MG/KG)
QUI NHON ROAD
AW-2
AW-1
MW-1403 DG
ATLANTIC OCEAN
NW-4
SD-1434
SW-1455
Canal
LACV-30 MAINTENANCE FACILITY (PN-49)
NW-3
SB-1408
NW-2
SD-1433
SWG-3
SW-1454
NW-1
O/W
ATLANTIC AVENUE
NORMANDY ROAD
WR-2
SB-1406
BO-1
BEACH ACCESS ROAD
BO-2
SD-1436
SW-1453
LEAD (D) 0.006 MG/L (0.0032 MG/L)
ZINC (D) 0.10 MG/L (0.047 MG/L)
SWG-2
CW-1
SB-1405
MW-1402 DG
WR-1
SB-1401
CP-1
CP-2
SD-1432
CW-2
SW-1452
CP-3
CP-4
O/W
MW-1404 UG
HOSPITAL ROAD
LACV-30 MAINTENANCE FACILITY (PN-43)
MW-1401 DG
O/W
SB-1402
OWA
SD-1431
ZINC 83 MG/KG (57 MG/KG)
HP-1
SB-1403
NWA
HP-2
FT
SWG-1
HP-3
BIVOUAC ROAD
SB-1404
COPPER 26 MG/KG (14 MG/KG)
SW-1451
ZINC (D) 0.069 MG/L (0.047 MG/L)
LEGEND
TRIGGER LEVEL
ZINC (T) 0.24 MG/L (0.05 MG/L)
CONCENTRATION DETECTED IN FIELD SAMPLE
(T) TOTAL
(D) DISSOLVED
WASTE ACCUMULATION AREA
UNDERGROUND STORAGE TANK
FENCE
SOIL BORING
SURFACE WATER SAMPLE
MONITORING WELL
SEDIMENT SAMPLE
SURFACE WATER LEVEL STAFF
ABBREVIATIONS
O/W OIL WATER SEPARATOR
WR WASH RACK
OWA OLD WASTE ACCUMULATION AREA
NWA NEW WASTE ACCUMULATION AREA
UG UPGRADIENT
DG DOWNGRADIENT
HP-1 - HP-3 HOSPITAL POND OUTFALLS
CP-1 - CP-4 CENTRAL DETENTION POND OUTFALLS
CW-1, CW-2 CENTRAL 'WETLAND' OUTFALLS
NW-1 - NW-4 NORMANDY 'WETLAND' OUTFALLS
AW-1, AW-2 ATLANTIC 'WETLAND' OUTFALLS
BO-1, BO-2 BEACH OUTFALLS
PA/SI, FT. STORY, VA
LOCATION OF COMPOUNDS DETECTED ABOVE TRIGGER LEVELS LACV-30 MAINTENANCE FACILITY
JMM James M. Montgomery
FIGURE 5-4
NOTE: THIS FIGURE NOT TO SCALE




NOTE: THIS FIGURE NOT TO SCALE

PA/SI, FT. STORY, VA

DRAINAGE AREAS
LACV-30 MAINTENANCE FACILITY

JMM James M. Montgomery

FIGURE 5-5