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FEASIBILITY STUDY LIGHTER AMPHIBIOUS RESUPPLY CARGO (LARC) 60
MAINTENANCE AREA FORT STORY VA
6/1/2002
MALCOLM PIRNIE

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DRAFT

WORK PLAN ADDENDUM

***GROUNDWATER INVESTIGATIONS
TREATABILITY/FEASIBILITY STUDY***

***LARC 60 MAINTENANCE AREA
FORT STORY, VIRGINIA***

**Installation Restoration Program
Fort Story, Virginia**

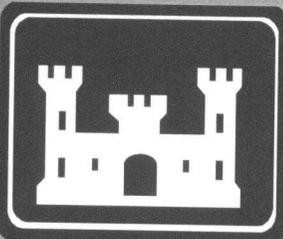
**U. S. Army Transportation Center
Fort Eustis, Virginia**

and

**U.S. Army Corps of Engineers
Baltimore District**

June 2002

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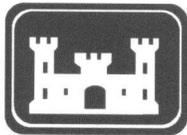
DRAFT

WORK PLAN ADDENDUM

**GROUNDWATER INVESTIGATIONS
TREATABILITY STUDY/FEASIBILITY STUDY**

**LARC 60 MAINTENANCE AREA
FORT STORY, VIRGINIA**

PREPARED FOR:



**U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT
BALTIMORE, MARYLAND**

AND

**U.S. ARMY TRANSPORTATION CENTER
FORT EUSTIS, VIRGINIA**



**CONTRACT DACA31-00-D-0043
DELIVERY ORDER No. 15**

JUNE 2002

**MALCOLM PIRNIE, INC.
11832 Rock Landing Drive, Suite 400
Newport News, Virginia 23606**

**WORK PLAN ADDENDUM
GROUNDWATER INVESTIGATIONS
FEASIBILITY STUDY, LARC 60 SITE
FORT STORY, VIRGINIA**

SCOPE

Malcolm Pirnie, Inc. is under contract to the U.S. Army Corps of Engineers (USACE) to conduct a treatability and feasibility study for the LARC 60 site at Fort Story, Virginia. This Work Plan Addendum has been developed to address field investigation requirements, quality assurance/quality control requirements for field and analytical data and site health and safety issues.

The Addendum shall be used in conjunction with the Field Investigation Plan and generic and site specific Chemical Data Acquisition and Site Safety and Health Plans.

ACKNOWLEDGEMENTS

1. **Work Plan Addendum - Reviewed by:**

Title	Signature	Date
Project Manager		
Project Leader		
Site H&S Officer		
Site QA/QC Officer		

2. **Employee Acknowledgment** (To be signed by all Malcolm Pirnie and subcontractor employees prior to initiating field investigations on-site):

I acknowledge that I have reviewed the information in the Final Work Plan and this Work Plan Addendum and understand the required activities and procedures necessary to ensure QA/QC and health and safety for sampling activities at the site.

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Draft Work Plan Addendum

1.1 INTRODUCTION

Malcolm Pirnie, Inc. was contracted by the U.S. Army Corps of Engineers (USACE), Baltimore District to conduct a Treatability Study (TS) and Feasibility Study (FS) at the LARC 60 Maintenance Area site at Fort Story, Virginia under Contract DACA31-00-D-0043.

Tetrachloroethene (PCE), trichloroethene (TCE), cis 1,2-dichloroethene (cis 1,2-DCE), naphthalene and 2-methylnaphthalene, toluene, and total and dissolved iron and manganese were detected in groundwater above EPA risk screening criteria (EPA RBCs and/or USEPA MCLs). To assist in the planned TS for the groundwater at the site and to further refine the plume configuration at the site, the installation and sampling of additional monitoring wells are required.

The U.S. Army Corps of Engineers (USACE), Baltimore District, has developed a Scope of Work, dated 17 September 2001, which is included in **Appendix A**, to address those data gaps.

The Work Plan Addendum is comprised of three components: a Field Investigation Plan (FIP), a Chemical Data Acquisition Plan (CDAP) and a Site Safety and Health Plan (SSHP) which provides information to supplement the data provided in the FIP and generic and site-specific CDAP and SSHP (all dated December 1994) for the three Fort Story sites previously referenced which have been previously submitted to and approved by the USACE and the Virginia Department of Environmental Quality (VDEQ). Any revisions or additions to the information or data presented in the generic or site-specific plans that relate to the site will be outlined and discussed in this Addendum.

1.2 RI SUMMARY

This section provides a summary of the remedial investigation (RI) results for the LARC 60 site.

Site Description

- The Lighter Amphibious Resupply Cargo (LARC) 60 Maintenance Area, which is the maintenance and wash rack area for LARC 60 vehicles, is located in a sand flat area in the north central portion of Fort Story.

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- Past use of the area includes use as the barge amphibious resupply cargo (BARC) motor pool and maintenance facility and the LARC 60 vehicle maintenance area.
- A former 10,000-gallon underground storage tank (UST) was located at the north gate of the LARC 60 vehicle motor pool.
- Previous investigations included a PA/SI by James M. Montgomery which indicated the presence of several contaminants including metals, petroleum hydrocarbons and chlorinated solvents. IT Corporation conducted a removal action which included excavation and biotreatment of petroleum-contaminated soils from within the sandbox area. Treated soils were placed back into the sandbox area.
- Three areas of concern (AOCs) were identified at this site requiring investigation including the Former UST Area, the Oil/Water Separator (OWS) Area, and the Sandbox Area.

Nature and Extent of Contamination

- Acetone, methylene chloride, MEK, PCE, TCE, styrene, and toluene were detected in several surface and subsurface soil samples collected at the site, however, at concentrations less than EPA screening criteria. Concentrations of the VOCs varied from surface to deeper depths with no apparent trends.
- TPH as Heavy Oils were detected in the majority of surface and subsurface soil samples collected at the site with concentrations greater than 100 mg/kg in approximately 50 percent of the samples.
- Numerous metals were detected in soils at this site with concentrations typically decreasing with depth. The lateral extent of metals was not defined. Although typically above background levels, except for arsenic at two soil sample locations (SB-1 and SB-20), metal concentrations were at least one order of magnitude lower than the EPA screening criteria.
- PCE, trichloroethene (TCE), Cis 1,2-dichloroethene, toluene, total lead, total and dissolved manganese, and total and dissolved arsenic were detected in groundwater above EPA risk screening criteria. No compounds were detected in soils or sediment above EPA risk screening criteria, however, TPH as Heavy Oils were

detected above the Virginia UST Program action level of 100 milligrams per kilogram.

Fate and Transport

- Because of the persistence of TPH as Heavy Oils, its concentrations will only slowly decrease over time in surface soils and groundwater although some migration in groundwater would be expected.
- The chlorinated hydrocarbons detected in groundwater are also associated with the release from the former UST. PCE was present in groundwater at roughly 0.25 percent of its aqueous solubility. Degradation products were also present which indicates that degradation of PCE is occurring. In comparison to concentrations established for these compounds in groundwater during the PA/SI, the concentrations of degradation products have increased. The increased concentrations of degradation products indicates that degradation of PCE is occurring as expected.

Baseline Risk Assessment

- Because arsenic was detected in site soils at concentrations consistent with the background soils, the risk associated with it is not related to site-specific activities such as spills, leaks, or industrial activities. Therefore, upon removal of arsenic as a COPC, the risk levels become less than the criterion of 1.0 and 10^{-6} , and no further action related to the soils at this site (based on human health risk) is warranted. Additional studies in the form of a feasibility study are warranted for the groundwater risk associated with the site.
- No exposure pathways or exposed populations were identified for contaminated media at the site. Therefore, no potential ecological risk was identified due to contaminants present at the LARC 60 site.

1.3 DATA QUALITY

The data generated from the chemical and physical analysis will be of sufficient quality to represent site conditions for determining the need for additional remedial response or support preparation of decision documents for no further actions. To achieve these objectives, this Work Plan Addendum incorporates procedures defined in the USEPA's document entitled "Data Quality Objectives Process for Superfund",

Interim Final Guidance, EPA540-R-93-071, September 1993. To assist in the interpretation of data, the Superfund program has developed the following two descriptive data categories:

- **Screening Data with Definitive Confirmation.** Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. At least 10 percent of the screening data are confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data QA/QC elements include the following:
 - Sample documentation
 - Chain of Custody
 - Sampling design approach
 - Initial and continuing calibration
 - Determination and documentation of detection limits
 - Analyte identification and quantification
 - Analytical error determination
 - Definitive confirmation

- **Definitive Data.** Definitive data are generated using rigorous analytical methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. For the data to be definitive, either analytical or total measurement error must be determined. Definitive data QA/QC elements include the following:
 - Sample documentation
 - Chain of Custody
 - Sampling design approach
 - Initial and continuing calibration
 - Determination and documentation of detection limits
 - Analyte identification and quantification
 - QC blanks (trip, method, rinse)
 - Matrix spike recoveries
 - Performance Evaluation (PE) samples (when specified)
 - Analytical error determination
 - Total measurement error determination

These data categories replace the references to analytical levels, quality assurance objectives and data use categories discussed in the generic CDAP.

The data category for samples collected at the LARC 60 site will include **Definitive Data** for off-site laboratory chemical analysis of groundwater samples collected. Compounds will be analyzed using the following SW-846 or EPA methods:

- TCL Volatile Organics (VOCs) – SW-846 Method 8260

A CLP-equivalent data package will be generated for the analytical data. A description of the standard SW-846 methodology items and the additional items to enhance the package to a CLP-equivalent are provided in **Table 1-1**. The CLP-equivalent data that will be generated will be sufficient for data validation in accordance with the IM1 (inorganic) and M2 (organic) procedures in *the Innovative Approaches to Data Validation*, 1995.

1.4 INVESTIGATION METHODOLOGIES

The investigation methodologies for decontamination, investigative derived waste management, and site restoration are described in the previously approved FIP, dated December 1994. Procedures for monitoring well sampling (all wells have QED well pumps) are described below.

1.4.1 Monitoring Well Sampling

Each well will be purged of three to five well volumes (or more if required for stabilization of field parameters) prior to collecting groundwater samples. Stabilization of field parameters is defined as less than 10 percent variation for turbidity and conductivity, less than one-half unit variation for pH and less than 1 unit variation for temperature over three well volumes. The volume of standing water in the borehole will be calculated using the pre-purge water level, total depth of the well and a known constant for the number of gallons of water per foot of well diameter. Water purged from the well before sampling will be disposed of in accordance with procedures outlined in Section 3.9 of the December 1994 FIP.

Sampling protocol will be in accordance with the following procedure as described by the *Installation, Operation & Maintenance User's Guide* for the WELL WIZARD Dedicated Monitoring Systems, by QED Environmental Systems, Inc.:

**TABLE 1-1
LABORATORY DATA PACKAGE**

ORGANICS PACKAGE	INORGANICS PACKAGE
SW-846 Data Package (CLP-Equivalent)	
<p>Standard Items:</p> <ul style="list-style-type: none"> Envision Forms Title Page Cross Reference Index Case Narratives Form 1 (Sample Results) Form 2 (Surrogate Recoveries) Form 3 (MS/MSD Recoveries) Form 4 (Method Blank Results) Form 5 (GC/MS Performance Check) Form 6 (Initial Calibration) Form 7 (Continuing Calibration) Form 8 (GC/MS IS Area) Form 8 (GC Analytical Sequence) Dry Weight Log Extraction Log Run Logs (GC/MS Only) Internal COC's Sample COC's Analytical Run Logs <p>Additional Items:</p> <ul style="list-style-type: none"> Raw Data Preparation Logs Data Summary Package TIC's Run Logs pH Logs "J" Values (GC/MS Only) Cross Reference Index 	<p>Standard Items:</p> <ul style="list-style-type: none"> Quattro Forms Case Narratives Sample Results QC Blank Results Spike/Duplicate Results ICV/CCV (Calibration Data) LCSS/LCSW Results ICP Interference Check Data ICP Linear Range Form 5A (Spike Recoveries) ICP Post Spike Dry Weight Logs Internal COC's Sample COC's <p>Additional Items:</p> <ul style="list-style-type: none"> Raw Data Preparation Logs Data Summary Package Run Logs pH Logs Cross Reference Index

- Sampling will begin by obtaining a static groundwater level measurement reading, which will be achieved using a portable water level indicator. The water level indicator will be inserted through the removable black ½-inch square head hole in the well cap. The purge volume required (3 times the volume of standing water in each well) will be determined from static water level measurements, based upon the known depth of each well.
- Well purging will be performed prior to obtaining groundwater samples at each well location. Purging of a well is accomplished using the following procedure:
 1. Start the compressor engine.
 2. Connect the short end of the red pump air-supply line to the pump connector on the well cap.
 3. Connect the long end of the red pump air-supply line to the PUMP SUPPLY connector on the Well Wizard controller.
 4. Point the pump discharge line away from the operator.
 5. Set both timers on the Model 3013 controller on setting "C".
 6. Connect the black driver/controller hose to the PUMP PRESSURE INLET connector on the Well Wizard controller. At this stage, there should be a loud hissing and honking noise associated with air releases through the side of the Well Wizard controller. If this sound does not sound as if it is alternating between pressurizing and venting, shorten cycle times by setting the REFILL and DISCHARGE timer knobs to setting "A" on the controller. After the venting noises stop, water flows from the pump discharge line as you begin to purge the well. The time required to actually begin discharge of water depends on the depth to water - it may take several seconds or several minutes.
 7. Check the air pressure on the PRESSURE gage on the controller. The pressure (which controls flow rate) should be between 60 and 120 psi. If necessary, adjust the pressure by using the FLOW THROTTLE control knob. Pull up on the yellow outer ring to unlock the throttle, adjust the setting, then push down to lock the throttle. Turning the FLOW THROTTLE knob clockwise increases

pressure; turning it counterclockwise decreases pressure. Flow rate may be maximized by following this procedure:

- a. Lift the yellow outer ring of the FLOW THROTTLE control, turn the knob fully clockwise, then push down to lock the control.
 - b. Turn the DISCHARGE and REFILL timer knobs to setting "D" on the controller.
 - c. Using a 1,000 mL graduated cylinder, measure the volume of water discharged in one cycle. This is the maximum pump volume should be noted. NOTE: for 1100 series pumps, discharge should be 250 - 350 mL; If the discharge volume is less than this, try increasing the refill cycle time. If this is not effective, try shortening the refill cycle time, especially in deeper wells.
 - d. To achieve as short a refill time as possible, slightly decrease the REFILL timer setting (turn the knob counterclockwise about a half of a setting). Then measure the volume of water discharged in the next three cycles. Repeat this step until there is a decrease in discharge water volume.
 - e. Increase the REFILL timer setting (turn the knob clockwise) enough to regain full discharge volume. Refill is now set for maximum flow.
 - f. To achieve as short a discharge time as possible without losing any discharge volume, slightly decrease the DISCHARGE timer setting (turn the knob counterclockwise). Then measure the volume of water discharged in the next three cycles. Repeat this step until you notice a decrease in discharge water volume.
 - g. Increase the DISCHARGE timer setting (turn the knob clockwise) enough to regain full discharge volume. Discharge is now set for maximum flow.
8. During humid conditions and very cold conditions, it is especially important to vent the moisture. Press down (and hold for 5 seconds) the silver MOISTURE VENT button on the controller about every 15

minutes. This expels accumulated moisture from the side of the controller.

- Samples will be collected once the well has been purged of the required volume. A slow flow rate will be used to fill sample bottles. The FLOW THROTTLE knob on the Model 3013 controller will be adjusted counterclockwise to slow the flow. As suggested by the manufacturer, pressure will not exceed 60 psi to avoid housing or membrane failure, and sample contamination.

After collection and transfer to the appropriate sample container, the samples will be secured in a cooler at 4°C and made ready for shipment to the laboratory.

1.5 SITE-SPECIFIC FIELD INVESTIGATIONS

The following sections outline the specific field activities to be performed at the LARC 60 site at Fort Story. To assist in the planned TS for the groundwater at the site and to further refine the plume configuration at the site, the installation and sampling of additional monitoring wells are required. Specific activities are based on the Scope of Work for the project dated 17 September 2001.

A summary of the field investigation and sampling and laboratory analysis program for the LARC 60 site is provided below:

Well Installation

To supplement the data gathered during previous investigations and to further refine the plume configuration for the TS and FS, six additional monitoring wells will be installed and developed at the site. The wells will be installed at the following locations:

- Cluster wells (one shallow and one deep) (6MW-5S and 6MW-5D) will be installed approximately 300 feet downgradient of the former UST location.
- One well (6MW-6) will be installed approximately 200 feet west of the cluster wells.
- One well (6MW-7) will be installed approximately 200 feet east of the cluster wells.

- One well (6MW-8) will be installed approximately 300 feet east of the cluster wells 6MW-3S and 6MW-3D.
- One well (6MW-9) will be installed approximately 300 feet downgradient (north) of the cluster wells 6MW-3S and 6MW-3D.

Each well will have a 10-foot screened interval with one foot of the screened interval set above the water table interface. The depth to water across the site is approximately 5 to 8 feet below land surface. The deep well (6MW-5D) will be screened at an approximate depth of 30 to 40 feet below land surface to assess any vertical migration of contaminants. This is the approximate depth that the other two existing deeper wells (6MW-2 and 6MW-3D) are screened.

QED Ferret Well Pump Installations

QED Ferret well pumps will be installed for the six new wells previously discussed. In addition, QED well pumps will be installed in two existing wells (6MW-1 and 6MW-3D) that currently do not contain dedicated well pumps.

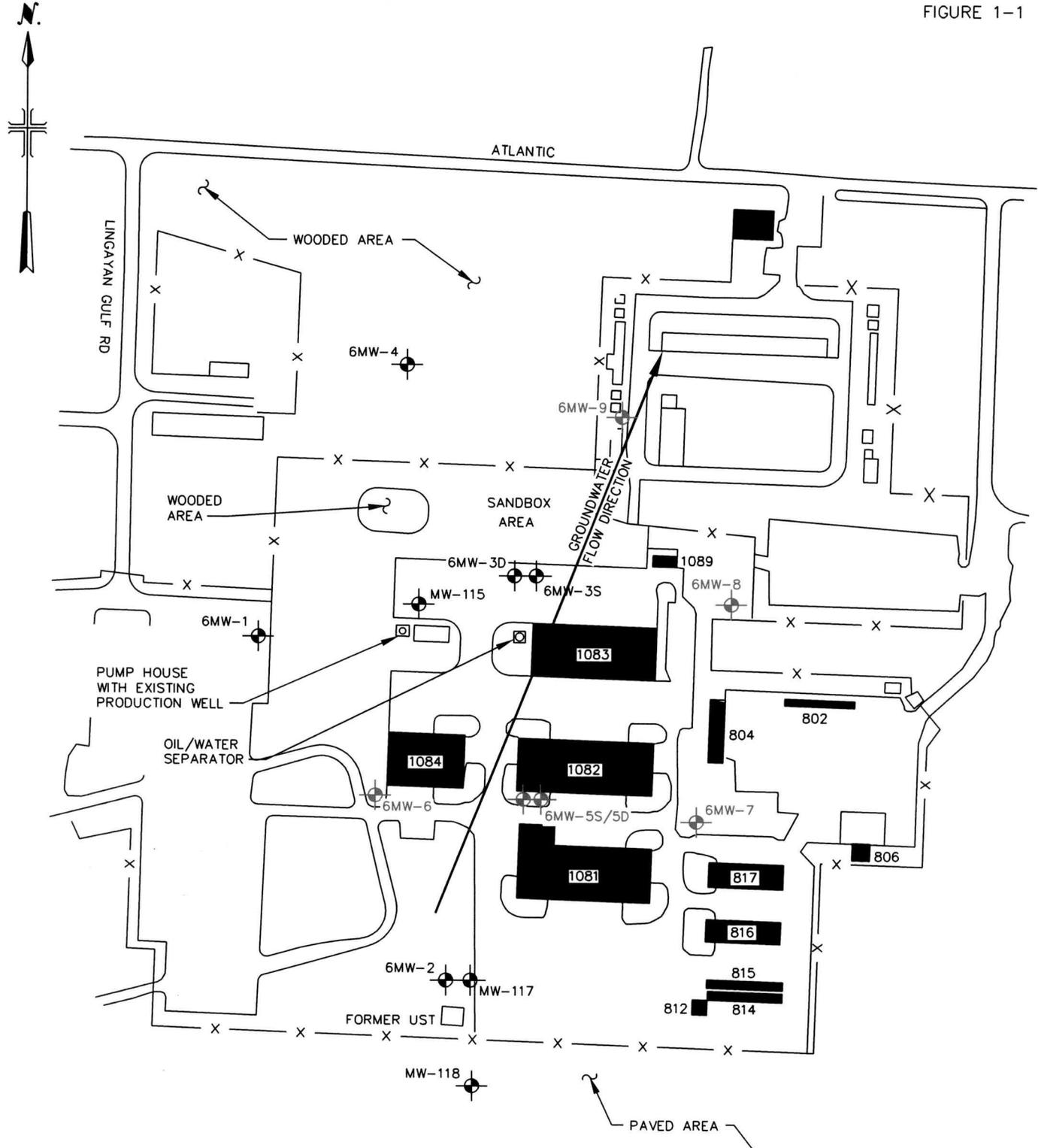
Groundwater Sampling and Analysis

Groundwater samples will be collected from eight existing and six newly installed wells at the LARC 60 site. Samples will be analyzed for TCL volatile organic compounds (Method 8260). Laboratory turnaround time (TAT) shall be 21 days. The locations of these monitoring wells are provided on **Figure 1-1**.

1.6 MISCELLANEOUS

Other information such as RI Reporting formats, data management, and the project organization are not changed as listed in Sections 5, 6, and 8 of the previously approved December 1994 FIP, respectively.

FIGURE 1-1



LEGEND:

- EXISTING MONITORING WELLS
- PROPOSED MONITORING WELLS



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FORT STORY, VIRGINIA
 WORK PLAN ADDENDUM
 LARC 60 MAINTENANCE AREA
 MONITORING WELL LOCATIONS

MALCOLM PIRNIE, INC.

JUNE 2002

2.1 INTRODUCTION

This section in conjunction with the generic Chemical Data Acquisition Plan (CDAP) and site-specific CDAP for the Fort Story sites, dated December 1994, and the Field Investigation Plan (FIP) (Section 1.0 of this Work Plan Addendum) establishes procedures for the collection, analysis and evaluation of data that will be legally and scientifically defensible for the site.

The site description and history as well as the Data Quality Objectives typically discussed in this section were previously described in Section 1 of this Addendum and in the approved December 1994 FIP and CDAP and will not be discussed further.

2.2 FIELD ACTIVITIES

A discussion of field equipment requirements, sample and analysis program, and sampling and preservation procedures will be provided in this section.

2.2.1 Field Equipment

Equipment required to implement the field activities include:

- Photoionization Detector (PID)
- Water Quality Meter (pH, temperature, turbidity, and conductivity)
- Portable gas generator/pump control box (provided by the facility)
- Teflon-lined tygon tubing
- Sample collection containers
- Personal protective equipment including latex gloves, nitrile gloves, steel toed boots, and work gloves.

Calibration and maintenance requirements for field instrumentation are provided in Section 6.3 of the December 1994 CDAP.

2.2.2 Sampling Program

Numerous groundwater samples will be collected during the field investigation. Details on the locations and numbers of samples are provided in Section 1.5.2 of this Addendum.

Draft Work Plan Addendum**2.2.3 Sampling and Preservation Procedures**

Procedures for the collection of groundwater samples are provided in Section 1.4 of this Addendum. Container type and volume, preservation, and holding time requirements for the TCL VOC samples are provided as follows:

Container Type: Three 40-ml vials with teflon septa

Preservation: HCl to pH < 2 and cool to 4°C

Holding time: 14 days

Sample containers will be preserved by Severn Trent Savannah Laboratories prior to shipment to Malcolm Pirnie.

2.2.4 Analytical Program

The total number of field samples and QA/QC samples are presented as follows:

Groundwater Samples:	14
Duplicates:	2
Trip Blanks:	3
MS/MSD:	1

2.2.5 Field Documentation

For all sampling events, entries shall be made in a field notebook and logbook as specified in Section 4.4 of the December 1994 CDAP.

Field custody procedures including sample identification and chain-of-custody are specified in Section 5.2 of the December 1994 CDAP.

Sample shipment requirements are provided in Section 5.3 of the December 1994 CDAP.

2.3 LABORATORY ANALYTICAL PROCEDURES

Severn Trent Savannah Laboratories will provide the necessary analysis of the groundwater samples with TCL VOC analysis (Method 8260) conducted.

Draft Work Plan Addendum**3.1 INTRODUCTION**

This section in conjunction with the generic and site specific Site Safety and Health Plan (SSHP) for the Fort Story sites, dated December 1994, establishes procedures to protect the health and welfare of both investigative personnel and the surrounding community during the performance of field investigations on and in the immediate vicinity of the LARC 60 site.

The December 1994 SSHP addresses the issues and concerns of the overall project site and the ubiquitous hazards that are found on the base. The site-specific SSHP supplements the information in the generic SSHP and addresses the chemicals and associated hazards that are unique to the site. The site description and history was previously described in Section 1 of this Addendum and in the previously submitted and approved December 1994 FIP and SSHP and will not be discussed further.

3.2 HAZARD ASSESSMENT**3.2.1 Description of Field Activities**

Samples will be collected to chemically characterize the groundwater at the site. A site map with proposed sampling locations is provided as **Figure 1-1** in this Addendum. A summary of the field sampling program is provided in Section 1.5 of this Addendum.

3.2.2 Summary of Project Risks

Malcolm Pirnie personnel must be cognizant of the health hazards, chemical, physical and biological, associated with the individual field activities to be conducted and the physical environment in which the work will take place. A hazards analysis of each work task is provided in **Table 3-1**. These hazards are discussed below.

Chemical Hazards

While conducting site investigations, a potential exists for exposure to chemical contaminants through ingestion, inhalation and skin contact. A toxicological summary of chemical contaminants previously detected at the site above EPA Region III RBC values, which are regulated by the Occupational Safety and Health Administration (OSHA), are listed in

**TABLE 3-1
HAZARDS ANALYSIS**

Work Task	Slip/ Trip/Fall	Noise Exposure	Fire/ Explosions	Dust Inhalation	Vapor/Gas Inhalation	Insects/ Bio Hazards	Exposure to Contaminated Media	Flying Particles
Monitoring Well Installation	X	X	X		X	X	X	X
Groundwater Sampling	X				X	X	X	

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Table 3-2. General chemical, physical, and toxicological data, protective exposure standards, and first aid procedures for each contaminant of concern are given in **Table 3-2**.

During monitoring well installations and sampling, potential inhalation hazards may be present. A Photoionization Detector (PID) will be used to monitor the breathing zones of personnel during the monitoring well sampling activities. Action levels for volatile compounds are provided in Table 10-1 of the December 1994 SSHP. More detailed air monitoring with a flame ionization detector (e.g., Photovac organic vapor analyzer) to ascertain specific compounds and concentrations may be necessary if initial breathing zone levels persist above action levels.

Dermal contact with these contaminants can be avoided through the use of proper personal protective equipment as described in Attachment II-4.0 of the December 1994 site-specific SSHP.

Physical Hazards

The primary physical hazard which may be encountered during field investigations is injury due to working around heavy equipment. To address this hazard, the following protective equipment shall be used at all times:

- Hard hats
- Steel-toed work boots
- Durable work gloves

This protective clothing shall be utilized in conjunction with the PPE requirements, if any, specified in Attachment II-4.0 in the December 1994 site specific SSHP for protection from chemical hazards. Other potential physical hazards include slip, trip and fall, noise, fire or explosions, dust inhalation, insects, and flying particles.

3.3 SITE CONTROL

The only site control required will be a zone of 30 feet around the monitoring wells during sampling. Only sampling personnel should be within this exclusion zone. Personal protective equipment, training, communications and decontamination requirements and procedures are specified in the December 1994 generic and site specific SSHPs.

**TABLE 3-2
TOXICOLOGICAL SUMMARY**

Compound	Vapor Pressure (mm Hg)	Ionization Potential (eV)	PEL	Target Organs	Route of Entry	Symptoms and Toxicological Effects	First Aid
Metals							
Iron	0	N/A	None	Eyes, skin, liver, respiratory system, and GI tract	Inhalation, Absorption, Ingestion, Skin/eye contact	Diarrhea, vomiting, and possible liver damage	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention
Manganese	0	N/A	0.2 mg/m ³	Resp system, CNS, blood, and kidneys	Inhalation, Ingestion	Insomnia, asthenia, dry throat, Parkinson's, chest tightness, kidney damage, and metal fume fever.	Breath: Respiratory support Swallow: Immediate medical attention
Volatile Organics							
cis 1,2-DCE	180 - 265	9.65	200 ppm	Eyes, CNS, respiratory system	Inhalation, Absorption, Ingestion, Skin/eye contact	Irritation of eyes, respiratory system, CNS depression	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention
MIBK	16	9.3	100 ppm	Eyes, skin, resp system, liver, CNS, and kidneys	Inhalation, Absorption, Ingestion, Skin/eye contact	Irritation of eyes, skin, mucous membranes, nausea, dizziness, and liver and kidney damage	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention
Tetrachloroethene	14	9.32	100 ppm	Eyes, skin, resp system, liver, CNS, and kidneys	Inhalation, Absorption, Ingestion, Skin/eye contact	Irritation of eyes, skin, mucous membranes and resp system, nausea, dizziness, and liver damage	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention

**TABLE 3-2
TOXICOLOGICAL SUMMARY**

Compound	Vapor Pressure (mm Hg)	Ionization Potential (eV)	PEL	Target Organs	Route of Entry	Symptoms and Toxicological Effects	First Aid
Toluene	21	8.82	200 ppm	Eyes, skin, resp system, liver, CNS, and kidneys	Inhalation, Absorption, Ingestion, Skin/eye contact	Irritation of eyes, skin, mucous membranes, fatigue, nausea, dizziness, and liver and kidney damage	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention
Trichloroethene	58	9.45	100 ppm	Eyes, skin, resp system, liver, CNS, and heart	Inhalation, Absorption, Ingestion, Skin/eye contact	Irritation of eyes, skin, vertigo, dizziness, nausea, and liver damage	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention

Notes: N/A - Data not available.
 PEL - OSHA Permissible Exposure Limit
 CNS - Central Nervous System

*Appendix A
Scope of Work*

*Work Plan Addendum
LARC 60 Maintenance Area Site
Fort Story, Virginia*



SCOPE OF ARCHITECT-ENGINEER SERVICES

Groundwater Bench and Pilot-Scale Treatability Study LARC 60 Maintenance Area Site, Fort Story, Virginia

1.0 GENERAL

Malcolm Pirnie, Inc. was contracted by the U.S. Army Corps of Engineers (USACE), Baltimore District to conduct a treatability study and install and sample additional groundwater monitoring wells at the LARC 60 Maintenance Area site at Fort Story, Virginia under contract DACA31-00-D-0043.

2.0 BACKGROUND

The Lighter Amphibious Resupply Cargo (LARC) 60 Maintenance Area, which is the maintenance and wash rack area for LARC 60 vehicles, is located in the sand flat area that lies between the coastal dune complex to the north and the central sand ridge to the south. The LARC 60 area includes Buildings 1081, 1082, 1083 and 1084.

During the 1950s, the wash rack area was first used as the barge amphibious resupply cargo (BARC) motor pool and maintenance facility. In 1964, the BARC vehicle was phased out and the LARC 60 vehicle was prototyped. Presently, Fort Story is the only base on the East Coast available to the Army Transportation Corps for amphibious training. In 1982, the LARC 60 facility was modified with the construction of a concrete wash rack pad. Approximately 39 catch basins are located through the LARC 60 site which are used for collection of storm and wash water. A former 10,000-gallon underground storage tank (UST) was located at the north gate of the LARC 60 vehicle motor pool approximately 600 feet south of the wash rack area. This UST was installed in 1983 and used for waste oil and degreaser storage.

Heavy equipment are currently stored awaiting maintenance and operated on the concrete wash rack and Sandbox Area.

Tetrachloroethene (PCE), trichloroethene (TCE), Cis 1,2-dichloroethene, toluene, total lead, total and dissolved manganese and total and dissolved arsenic were detected in groundwater above EPA risk screening criteria. Although no current exposure pathways or exposed populations were identified for contaminated groundwater, there would be a potential for human health risk due to contaminants present in the groundwater at the LARC 60 site if the shallow aquifer was utilized as a potable water source. Therefore, additional studies as part of the Feasibility Study (FS) are required to assess various alternatives.

3.0 OBJECTIVES AND PURPOSE

The primary goal of this project is to conduct a bench and pilot-scale treatability study for the contaminated groundwater at the site. This treatability study will be conducted to primarily achieve the following:

- Provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the detailed analysis and to support the remedial design of a selected alternative.
- Reduce cost and performance uncertainties for treatment alternatives to acceptable levels so that a remedy can be selected.

4.0 SCOPE OF WORK

Task 1 – Preparation of Work Plan Addendum

The A/E shall prepare a Sampling and Analysis Plan (SAP) in the form of an addendum to the existing Fort Story Field Investigation Plan (FIP) for the additional investigations discussed below and sampling program activities addressing: project objectives and sampling strategy; sampling and analyses approach and protocols, data quality objectives, management, and evaluation; health and safety, and quality assurance/quality control (QA/QC). The Plan shall be prepared in preliminary draft, draft, and final versions.

Task 2 – Field Investigation Program

The A/E shall conduct a field investigation program to gather data to supplement information collected during the RI. The primary objective of the investigation is collect additional groundwater analytical data to further define the extent of the groundwater plume that is currently on-site. The A/E shall conduct field investigations as follows:

Well Installation

To supplement the data gathered during previous investigations and to fill data gaps identified, six additional monitoring wells shall be installed and developed at the site. The wells shall be installed at the following locations:

- Cluster wells (one shallow and one deep) shall be installed approximately 200 feet downgradient of the former UST location to further define the lateral and vertical extent of contamination.
- One well shall be installed approximately 100 feet west of the cluster wells to further access the lateral extent of contamination.
- One well shall be installed approximately 100 feet east of the cluster wells to further access the lateral extent of contamination.

- One well shall be installed approximately 200 feet east of the cluster wells 6MW-3S and 6MW-3D to further access the lateral extent of contamination
- One well shall be installed approximately 200 feet downgradient (north) of the cluster wells 6MW-3S and 6MW-3D to further access the downgradient lateral extent of contamination

QED Ferret Well Pump Installations

The A/E shall purchase and install six QED Ferret well pumps for the newly installed wells previously discussed.

Groundwater Sampling and Analysis

Groundwater samples will be collected from eight existing and six newly installed wells at the LARC 60 site. Samples will be analyzed for TCL volatile organic compounds (Method 8260). Laboratory turnaround time (TAT) shall be 21 days.

Data Validation

The A/E shall complete the necessary data management and assessment of environmental data generated through sampling and analysis activities. A CLP-equivalent data package will be generated for the groundwater data. The CLP-equivalent data that will be generated will be sufficient for data validation in accordance with the IM1 (inorganic) and M2 (organic) procedures in the *Innovative Approaches to Data Validation*, 1995.

Task 3 – Treatability Testing

Treatability Test(s) Work Plan

The A/E shall prepare a Treatability Test Work Plan which will include the remedial technology descriptions, test objectives, any pilot plant installation and startup procedures, operation and maintenance issues, specialized equipment and materials required, any experimental procedures, the treatability test plan including any variables for the testing, analytical methods required, data management issues, health and safety, and residual management. The plan shall be prepared in preliminary draft, draft, and final versions.

Specifics of the Work Plan will not be known until initial screening of technologies and alternatives have been conducted as part of the FS. However, based on the contaminants at the site (primarily VOCs) some preliminary technologies to be considered for the testing include air sparging/soil vapor extraction (AS/SVE), bioremediation, in-situ chemical oxidation, and reactive iron wall.

Bench-Scale and/or Pilot-Scale Treatability Test

The A/E shall implement the requirements of the Treatability Test Work Plan. All analytical data for the chemicals of potential concern generated as part of the testing will be validated in accordance with the IM1 (inorganic) and M2 (organic) procedures in the *Innovative Approaches to Data Validation*, 1995.

Data Analysis and Interpretation

The A/E shall interpret the test data on the technology's effectiveness, implementability, and cost and compare anticipated results versus actual results.

Task 4 - Reporting

Groundwater Monitoring Report

The A/E shall prepare a report summarizing the monitoring well installations and results of the groundwater sampling as they relate to the nature and extent of contamination at the site. The report shall be prepared in preliminary draft, draft, and final versions.

Treatability Test Report

The A/E shall prepare a report summarizing the results of the treatability study which will include a summary of the testing conducted, the results of the tests, an interpretation of how the results would affect evaluation of the remedial alternatives being considered, a summary of the effectiveness of the treatment technology for the wastes, and an evaluation of how the test results will affect treatment costs developed during the detailed analysis of alternatives. The report shall be prepared in preliminary draft, draft, and final versions. It also shall be included as an appendix within the FS Report.

Task 5 - Meetings and Project Management

Meetings

The A/E's Project Manager shall attend the following required meetings:

- **Project Initiation Meeting.** Meeting at Fort Eustis to discuss the scope of the project, key issues, Fort Eustis' project expectations, and deliverables. Meeting should take place within 2 weeks after delivery order authorization.
- **Draft Work Plan Meeting.** Meeting at Fort Eustis to discuss the comments made by the regulatory agencies.

- **Draft Treatability Test Report Meeting.** Meeting at Fort Eustis to discuss the comments made by the regulatory agencies.

Project Management

The A/E shall prepare monthly progress reports. The progress reports shall provide at a minimum the following information:

- Progress during the preceding work period.
- Notification of problems encountered or anticipated and resolutions.

5.0 DELIVERABLES

The A/E shall submit 8 1/2 by 11 inch bound copies of the below listed reports. Documents shall be delivered to all reviewers by overnight delivery. The document submittal list which contains distribution names and addresses is provided below.

Work Plan Addendum

- Preliminary Draft (14 calendar days from the receipt of delivery order)
- Draft (14 calendar days from receipt of comments to preliminary draft)
- Final (14 calendar days from receipt of final comments)

Treatability Test Work Plan

- Preliminary Draft (30 calendar days from completion of the preliminary screening of remedial technologies)
- Draft (14 calendar days from receipt of comments to preliminary draft)
- Final (14 calendar days from receipt of final comments)

Treatability Test Report

- Preliminary Draft (45 calendar days from completion of the testing)
- Draft (14 calendar days from receipt of comments to preliminary draft)
- Final (14 calendar days from receipt of final comments)

The deliverables previously discussed shall be distributed to the following agencies:

- Preliminary Draft: USACE - 3 copies
Fort Eustis - 3 copies

- Draft: USACE - 3 copies
Fort Eustis - 6 copies
VDEQ - 2 copies.
- Final: USACE - 3 copies
Fort Eustis - 6 copies
VDEQ - 2 copies
USACE MRD - 2 copies