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SECTION 18
TASK ORDER (TO) 0006 (TO0006) WORK PLAN ADDENDUM
AST UPGRADES, OUTFALL REUSE, INTERIM REMEDIAL ACTIONS AT SWMU B-3 AND AOC-65
CDRL A004

18.1 INTRODUCTION

18.1.1 Statement of Objective

This addendum to the Camp Stanley Environmental ***Work Plan*** describes interim remedial measures to be conducted at Solid Waste Management Unit (SWMU) SWMU B-3 and Area of Concern (AOC-65), including installation of multi-port monitoring wells (MPMWs), vapor extraction wells (VEWs), an injection well (IW), two groundwater pumping tests, expansion and operation of existing soil vapor extraction (SVE) systems, and removal of visibly affected soils/debris from the trenches at B-3, followed by the conversion of the trenches into bioreactor cells. Also addressed is construction of a wastewater reuse system for Outfall 001 and upgrades to an aboveground storage tank (AST) system. These activities will be conducted at U.S. Army's Camp Stanley Storage Activity (CSSA) located in Boerne, Texas. Additionally, cleanup of 2,700 cubic yards (CY) of CSSA road-improvement debris improperly managed at an off-post location is described.

The objectives of this task order are multi-fold and will be achieved through a range of construction and engineering activities designed to meet CSSA requirements. Interim remedial measures at SWMU B-3 and AOC-65 will be supported with the installation of an MPMW monitoring network for the upcoming bioreactor treatability study, and eight new VEWs expanding the existing SVE systems at SWMU B-3 and AOC-65. Groundwater pumping tests at CS-MW16-LGR and CS-MW16-CC will help determine aquifer characterization in the vicinity of the SWMU B-3 contaminant plume. A tracer study to asses the biodegradation of the SWMU B-3 contaminant plume can be enhanced by introduction of organic carbon substrates into the affected geologic formation through a monitoring well suitable for injection constructed under this task order. The tracer study will be included as part of the substrate injection treatability study, and will require the necessary permitting, subsequent injection process, and an appropriate monitoring period at SWMU B-3 and surrounding wells. The enhanced anaerobic biodegradation pilot test will involve injecting a metabolic substrate to stimulate microbial activity within the subsurface and underlying aquifer. The existing SVE systems will be expanded to accommodate the new VEWs and to increase contaminant mass recovery at the sites. Six months of operation and maintenance (O&M) at the SVE systems will be administered under TO0006.

The CSSA Outfall 001 wastewater effluent is to be greatly reduced or seasonally eliminated by reusing the treated wastewater as make-up water for chlorination and modifying the disinfection mechanism for the discharge. Upgrades of existing ASTs located at the CSSA

Motor Pool will enhance the system's compatibility with evolving safety and environmental concerns, and improve safe traffic flow in the area. The ASTs will not be relocated. Modification 01 was added to this task order to manage the removal of approximately 2,700 CY of road-paving asphalt debris that was improperly managed by an independent construction contractor at an off-post location. Under TO-06, this material will be removed, and disposed at a permitted facility. A quality control plan, "***TO0006 Construction Quality Control Plan Addendum***" (Parsons, June 2005) will be prepared as a companion document to this work plan, and will primarily cover activities related to those tasks involving engineering design and construction.

All necessary data validation, O&M documentation, geographic information system (GIS), database support, and photo documentation will be provided. Reports of findings consistent with the requirements of the CSSA Quality Assurance Project Plan (QAPP) and the Administrative Record, and other ancillary construction, inspection, and task-specific summary reports pertinent to corresponding work breakdown structures (WBSs) will be drafted and distributed as specified in the statement of work (SOW).

18.1.2 Scope

The scope of work as detailed in the task order authorizing this project includes:

- Preparation of project addenda including Work Plan addenda to conduct site activities and analysis, comprehensive updating and revising of the Encyclopedia's Health and Safety Plan (H&SP) and Waste Management Plan (WMP), a project-specific addendum to the CSSA Sampling and Analysis Plan (SAP), and Construction Quality Control Plans. These addenda will be incorporated into CSSA's Environmental Encyclopedia.
- Provide permitting support of selected remedial actions, data validation, and preparation of appropriate documentation necessary to optimize performance of the remedy planned for SWMU B-3.
- Providing support for the environmental management and geographical information systems; all data will be collected and recorded in a format compatible with CSSA's GIS.
- Performing interim remedial measures at AOC-65. This task includes expanding existing SVE capabilities with sampling and analysis of soil, water, and air samples during VEW construction, interim actions, and subsequent O&M activities.
- Performing interim remedial measures at SWMU B-3 consisting of completion of a substrate injection treatability and tracer study and associated aquifer monitoring, and expanded SVE capabilities with subsequent sampling and analysis of soil, water, and air samples to support the tracer study, interim actions, and O&M activities.
- Remove visibly affected soils and debris from the trenches identified at SWMU B-3 during previous investigations.
- Install a bioreactor at SWMU B-3 by placing organic material (i.e., predominantly wood chips) into the SWMU B-3 trenches and then constructing a water delivery system (from CS-MW16-LGR) that will be monitored to maintain a water level at a level

consistent with saturated conditions (initially planning 2-foot deep) across the base of each trench.

- Perform an Enhanced Anaerobic Biodegradation (EAB) treatability study by injecting a organic substrate (lactate and/or vegetable oil emulsion) and tracer into an injection well located proximal to CS WB05 between SWMU B-3 and CS-MW16.
- Install four MPMWs to evaluate the performance and effectiveness of treatability test methods employed to enhance biological degradation of chlorinated contaminants of concern in fractured media and groundwater.
- Conduct groundwater pumping tests at CS-MW16-LGR and CS-MW16-CC. This task will include preliminary water level measurements 2 weeks prior to starting the initial pumping tests on CS-MW16-CC, and at least 72 hour recovery before starting the second pumping test on CS-MW16-LGR. The pump testing will consist of a 72 hour pump test, and a 24 hour recovery test at each well.
- Upgrading CSSA motor pool AST system to include new site gages, overfill valves, and fill connection containment for the diesel and mogas tanks. Additionally, equipment capable of analog output will be used such that operational data of the AST system can be collected and possibly integrated into the CSSA SCADA system.
- Installation and commencement of operations at Outfall 001 reuse system by modifying the disinfection system. The original plan described in the scope of work and Parsons proposed technical approach involved installation of a day storage tank, pumps, piping to allow for reuse (for make-up purposes) of up to 20,000 gallons per day of sanitary wastewater effluent from CSSA's wastewater treatment plant (WWTP). This approach was modified by CSSA to focus the upgrade on the chlorination methodologies for the discharged effluent from the WWTP.
- Remove and properly dispose up to 2,700 cubic yards of asphalt road paving debris that was improperly managed at an off-post location.
- Submittal of deliverables to CSSA and AFCEE and the submittal of individual Environmental Restoration Program Information Management System (ERPIMS) data files (e.g., analytical results, groundwater level data, etc.).
- Perform operations and maintenance (O&M) for the active SVE systems already operating at SWMU B-3 and AOC-65, the expanded SVE system, and the bioreactor treatment unit per the Underground Injection Permit.

18.2 DATA QUALITY OBJECTIVES

The overall data quality goal for this project is to gather sufficient information to verify and monitor the performance of the interim corrective measures. Data quality is defined by its representativeness, precision, comparability, and completeness. Representativeness of data is dependent on site selection and the number of samples taken, which are addressed in the SAP. The requirements for precision, comparability, and completeness of the data vary between data types but all are enhanced by the use of standardized sampling and analysis protocols and standardized reporting procedures. Data quality objectives (DQOs) are dynamic documents that are continually being updated as a project progresses and data is generated. The most current

DQOs are presented in **Appendix A**. Detailed information on sampling techniques are in the "***Draft Sampling and Analysis Plan Addendum for TO0006***" (Parsons, July 2005).

The types of sampling data to be collected for this project are listed below, along with a discussion of their uses and requirements.

- Subsurface Vapor – Vapor samples will be collected during well extraction packer testing and SVE system expansion. Samples will be collected to provide "point in time" data to establish baseline conditions, evaluate subsurface zones with the highest levels of contamination, and determine zones where the greatest removal rates are anticipated. The DQO requirements for the subsurface soil gas samples are presented in the TO0006 DQOs in **Appendix A**.
- Groundwater Characterization – Groundwater samples will be collected from the MPMWs, nearby MWs, piezometers installed in the SWMU B-3 bioreactor, and possibly selected VEWs (depending on conditions) to evaluate local groundwater conditions, the migration of test tracers, and the effects of substrate injection through subsurface fracture networks. Natural attenuation parameters will also be measured periodically to assess the effectiveness of the substrate additives at creating conditions in the formation and aquifer that are conducive to reductive dechlorination. DQO requirements for groundwater samples are included in the TO0006 DQOs in **Appendix A**.
- Air Emissions – Air emissions samples will continue to be collected from the blowers attached to the Building 90 subslab ventilation and the SVE systems operating at AOC-65 and SWMU B-3 to validate the calculations made in support of the standard exemptions and to measure VOC removal rates. The requirements for the air emission sampling are included in the TO0006 DQOs in **Appendix A**.
- Investigation-derived Waste Characterization – Cuttings and fluids from drilling operations, decontamination fluids, liquid from SVE blower moisture separators, and purged liquids from groundwater wells needs to be characterized to determine applicable disposal requirements and appropriate waste handling procedures. Requirements for liquid and soil waste characterization are included in the TO0006 DQOs in **Appendix A**.
- Waste Characterization –Samples will be collected from materials excavated from SWMU B-3 trenches will be stockpiled *ex situ* within the limits of the SWMU B-3 boundaries to determine applicable disposal requirements and appropriate waste handling procedures. Requirements for the liquid and soil waste characterization are included in the TO0006 DQOs in **Appendix A**, but are also described in the CSSA Waste Management Plan (WMP),
- Samples will be collected from the groundwater removed from CS-MW16-LGR prior to its entry into either the granular activated carbon (GAC) unit or the constructed bioreactor to satisfy the UIC permit requirements. Additionally, samples from the piezometers installed in the bioreactor will be tested to evaluate the treatment effectiveness of the bioreactor at reducing the toxicity of the groundwater. DQO requirements for the bioreactor O&M will be prepared once the UIC permit is approved and the data requirements are defined.

- Field Measurements – Numerous data will be collected in the field including, but not limited to, groundwater levels in wells, hydraulic pressure head at discrete depth intervals in the multi-port wells, rain gauge levels, dissolved oxygen (DO) in groundwater. Additionally, monitoring for oxygen, carbon dioxide, total volatile hydrocarbons (TVH) in soil gas, SVE flow rates, pressure response of VEWs/VMPs, and ambient and soil temperatures will be obtained as part of SVE systems O&M. As most of these data are for screening purposes only, the use of standardized techniques and properly calibrated and maintained equipment will ensure that the data are of sufficient quality to be used for the intended purpose of screening. Requirements for these field measurements are included in the TO0006 DQOs in **Appendix A**.

18.3 ELECTRONIC DATA MANAGEMENT

Field data collected during the course of the project will be stored and submitted to CSSA in electronic format. The purpose of the electronic data management program is to provide a method through which field information and data can be stored, reviewed, and managed in electronic format. The electronic files will be incorporated into a database specifically designed to manage anticipated field data collected at CSSA. The electronic files will be generated by scanning field logbooks, inputting field measurements into electronic spreadsheets, and recording data through GPS, datalogger or other geophysical equipment. All field personnel involved in data collection activities will be familiarized with the electronic data management techniques that will be used under this task order.

18.3.1 Field Logbooks

Field logbooks will be used to record daily safety concerns, field activities, and field observations. Daily entries into the logbook may include work hours, field personnel, weather information, sampling times, pertinent communications, and observations. Logbook entries will be handwritten using permanent ink. A new page will be started at the beginning of each day of field activities and entries will continue onto successive pages as necessary. At the end of each day, the field team leader will sign the field logbook and unused portions of the last page will be marked through to prevent further entries.

In addition to the field logbooks, forms will be prepared, as applicable, to document design, construction and quality control inspections of construction activities planned under TO0006. The construction activities include, but are not limited to, the AST upgrades and Outfall 001 re-use system WBS tasks.

At the end of each week of field activities, the field team leader will electronically scan that week's field entries and applicable forms into the electronic logbook archives file. The pages will be scanned to create a graphics format electronic file (PDF, JPEG, or similar) using the electronic scanner in the CSSA environmental office. The hard copy of the field notes will be stored in Parsons field and project files.

18.3.2 Dataloggers/Geophysical Instrumentation

Management of data collected by specific instrumentation with datalogging capabilities, such as from the weather station datalogger and geophysical equipment, transducers, or by global positioning (GPS) will be stored within the internal memory of the instrument until it can be downloaded to a computer. Electronic file formats for the downloaded data will be determined by the format generated with each instrument. Data will be downloaded into the database at the end of each day that data is collected, at the end of a profile for geophysical surveys requiring multiple days, or at pre-established intervals for longer measurement events.

18.3.3 CHERP Database Application

The CHERP database application is currently designed to generate chain of custodies (COCs) and labels for collection of samples submitted for laboratory analyses. The database ensures that all required information for delivery of ERPIMS data is entered and in the proper format. The field screening data collected on a daily basis will be incorporated with the daily logs to provide a readily viewable version of data collected. The electronic database application is set up to allow synchronization between networks at CSSA and Parsons. This allows concurrent reviews and observations of weekly field activities by CSSA and Parsons managers.

18.4 GENERAL REQUIREMENTS

The following subsections describe the planned field activities and procedures. More detailed discussions on specific procedures are expounded in the individual task Design Work Plans.

18.4.1 Outfall Effluent Re-Use (WBS 03000)

This task includes the preparation of engineering specifications, permits, a final design plan, and subsequent construction of an effluent reuse system for Outfall 001. The objective of this project has been changed to only modifying the disinfection methodology for the effluent discharged at Outfall 01. Detailed construction design specifications and procedures, are found in the revised “Reuse System Design Work Plan” (November 2005, pending). Procedures for system operation and maintenance, plus permit and regulatory requirements, record keeping, and reporting requirements will be detailed in the “Reuse System O&M Manual” which will be prepared after the system modification has been completed. This manual will also include all manufacturers’ specifications and maintenance instructions for installed components.

Task deliverables include a Construction Quality Control Plan, the Design Work Plan, and the O&M Manual. The outfall reuse system will be designed and approved by a professional engineer. Parsons will provide notifications to the appropriate regulatory entities. Upon completion of the construction task, an inspection report will be prepared documenting construction activities and associated quality controls.

18.4.2 Remedial Optimization and Substrate Injection Treatability Testing (WBS 04000)

Parsons will conduct an aquifer test to evaluate the effectiveness of enhanced monitored natural attenuation (MNA) at the site and to estimate biological degradation rates that might be achieved in the groundwater utilizing an enhanced MNA approach. The treatability test will consist of injecting an organic substrate and tracer directly into the aquifer and then monitoring the concentration of the substrate, tracer, contaminants, and other indicator parameters over time to assess degradation rates. A monitoring well suitable for injection will be located within the SWMU B-3 source area and will be screened in one of the upper saturated permeable zones within the LGR formation. The location and screened interval for the monitoring well will be determined after review of site-specific geologic data, borehole geophysical data, and contaminant distribution information obtained during installation of the MPMWs scheduled to be installed under WBS 07000. Groundwater for mixing the substrate will be accessed directly from the injection well or from CS-MW16-LGR.

Monitoring well drilling will be carried out in conjunction with SWMU B-3 MPMW drilling program. The monitoring well suitable for injection will be located near the MPMW down gradient of SWMU B-3. The well will be drilled using air rotary methods and have an approximate diameter of 8-inch. The borehole may be video logged or geophysically logged using methods described in this WP (Section 18.2.5), based on observations made during drilling and well installation activities at the nearby MPMWs. The well riser will consist of Schedule 80 PVC with a nominal 4-inch ID with flush-threaded joints. The well screen will be constructed of 304 stainless steel wire-wrapped 0.020-slotted screen, and an intake not exceeding 25 feet in length. The annular space of the monitoring well suitable for injection will be filled with a 4/10-mesh filter pack from the base of the borehole to height of 2 feet above the top of the screened interval. A 100 percent sodium bentonite seal with a minimum thickness of 5 feet will be emplaced within the borehole annular space above the filter pack. The bentonite seal will be allowed to fully hydrate per the manufacturer's specifications before grouting activities commence. Beginning with small lifts, a Volclay® grout mixture will be slowly pumped into the annular space using a side-discharge tremie pipe. The grout will be allowed to cure for at least 48 hours prior to well development. The drilling subcontractor will develop the new well by surging, bailing, and pumping techniques. Upon completion of well development, the pumping apparatus will be installed in the well. The apparatus will include a ground-surface transfer pump system compatible with the push-pull requirements of the project.

Once the monitoring well suitable for injection and surrounding MPMWs have been installed, groundwater samples will be collected from them and selected, nearby conventional monitoring wells to determine baseline conditions in the formation (as part of WBS 07000). The baseline groundwater samples will be initially analyzed for VOCs, total organic carbon, fatty acids, methane, total iron, ferrous iron, nitrate/nitrite, sulfate, dissolved oxygen, redox, pH, and the selected tracer compound. Subsequent monitoring may consist of a reduced parameter list as described in the TO0006 SAP. Additionally, hydraulic data (hydraulic conductivity, thickness, hydraulic gradient, etc.) may be colleted from selected packer intervals to support predictive analytical modeling of groundwater flow within the planned injection zone. The predictive modeling would be performed to determine the most suitable injection interval, and the appropriate type and composition of substrate and tracer to be employed, to estimate the volume of material to be injected, and its residence time within the formation.

After completing the predictive modeling and baseline groundwater sampling, the injection equipment will be installed at the site. Extracted groundwater from the monitoring well used for injection or from CSSA Outfall 002 will be mixed with a volume of substrate and tracer compound, and will then be reintroduced into the well using a transfer pump to maintain a static head within the well near land surface. The head differential between the well and the formation will cause the mixture to flow in to the formation. Once all of the mixture has been injected into the formation, a volume of clean water will be injected into the well to substantially flush residual groundwater and substrate mixture from the well and its filter pack.

Following injection of the groundwater-substrate mixture into the formation, groundwater samples will be collected from the well used for injection and selected surrounding monitoring wells at evenly spaced intervals over a one to three month period as determined by the predictive modeling data. Data generated from this sampling will provide information relative to the effectiveness of biological degradation of the chlorinated compounds. Groundwater samples collected from the surrounding wells will be used to assess the impact of the substrate injection over a wider area and across different stratigraphic intervals. The frequency of sampling will be determined by the predictive modeling information and the distance from the injection site location, and climatic conditions. The groundwater samples will be analyzed for VOCs, dissolved oxygen, redox, tracer compound, and other potential indicator parameters. The data from this study will be analyzed to determine the effectiveness of enhancements to increasing biodegradation of the chlorinated contaminants currently within the contaminant plume and the formation. Specifics of the test design, apparatus, and procedures are described in a companion document to this work plan, the "***Draft Work Plan For Enhanced Anaerobic Biodegradation Pilot Test At SWMU B-3***" (Parsons, June 2005).

A summary report of findings will be prepared to present the results of the test and analysis of the study data. The primary focus of the report will be to determine the effectiveness of organic substrate injection to enhance biodegradation of chlorinated solvents in the contaminant plume. Its findings will be shared with any subsequent study that deals with treatment in fractured vadose media.

18.4.3 Aboveground Storage Tanks (WBS 05000)

This task includes the upgrade of two existing AST systems currently located adjacent to the Motor Pool buildings. Upgrades will include providing electronic sight gauges, overfill protection valves, remote fills with 3" pump-off lines, and spill containment for the fill connections for both the diesel and mogas tanks. Upgrading will also include modifications to the existing gas dispenser. Visible clock gauges marked for 85% full capacity will be installed on both tanks. An electronic fuel management system will be added to collect fuel usage quantities and vehicle-specific fuel consumption information.

The asphalt paving in front of the ASTs will be removed and replaced with a concrete service apron. The concrete paving will be expanded beyond the extent of existing asphalt to improve traffic movement to and from the tanks, and to prevent drip leakage from contaminating the underlying subsurface. The AST system upgrade requirements were designed and approved by a professional engineer, and are presented in the "***AST Design Work Plan***" (Parsons, June 2005). Detailed design specifications were prepared for the vendor bid packages.

Upon completion of the AST upgrade, an AST Technical Field Report and a Pre-Final AST Inspection Report will be prepared and distributed, followed by a Final AST Inspection Report.

18.4.4 AOC-65 & SWMU B-3 SVE System Expansion (WBS 06000)

Installation of new VEWs is planned at AOC-65 and SWMU B-3 to supplement performance of the existing SVE systems at both sites. The VEWs will be located in areas of elevated contaminant concentrations, faults, fractures, or karst features as identified by previous surveys conducted at the sites. Exact VEW locations, depths, screened interval placement, and design will be determined based on geophysical data, lithologic observations, soil gas packer testing, push-pull test results, and other site conditions noted as field activities progress. **Figure 18.1** illustrates the proposed drilling locations at AOC-65. Specific details of planned soil vapor extraction system expansions at both AOC-65 and SWMU B-3 are described in the "***Work Plan For SVE System Upgrades At AOC-65 and SWMU B-3***" (Parsons, October 2005, draft), being prepared as a companion document under this task order.

Vapor extraction packer tests are planned for the completed VEW boreholes prior to installation of the VEW completion material. Discrete soil gas samples may be collected from as many as four different depth intervals in the borehole and submitted for laboratory analysis. Decontamination of equipment will take place between drilling locations.

All boreholes for the VEWs will be drilled by air rotary using a 7-7/8-inch diameter bit to accommodate nominal 4-inch extraction wells. The actual installation depth will be determined by the on-site geologist based on results of the borehole lithology, geophysical logging, and soil gas packer sampling data if available. Each of the VEWs will be constructed with nominal 4-inch diameter Schedule 40 PVC, 0.050 slot screen, and 4-inch diameter Schedule 40 riser. Screened interval lengths may ranges from 25 to 50 feet. The well will be completed within an open 8-inch diameter borehole. Casing and screen will be centered within the borehole using stainless steel centralizers at 50-foot intervals. The casing of each VEW will be extended approximately 1.5 feet above land surface and will be fitted with below grade piping that connects the VEW to the SVE blower manifold. Once the geologic logs have been carefully reviewed, screened intervals may be adjusted as necessary to optimize efficiency of the vapor extraction process.

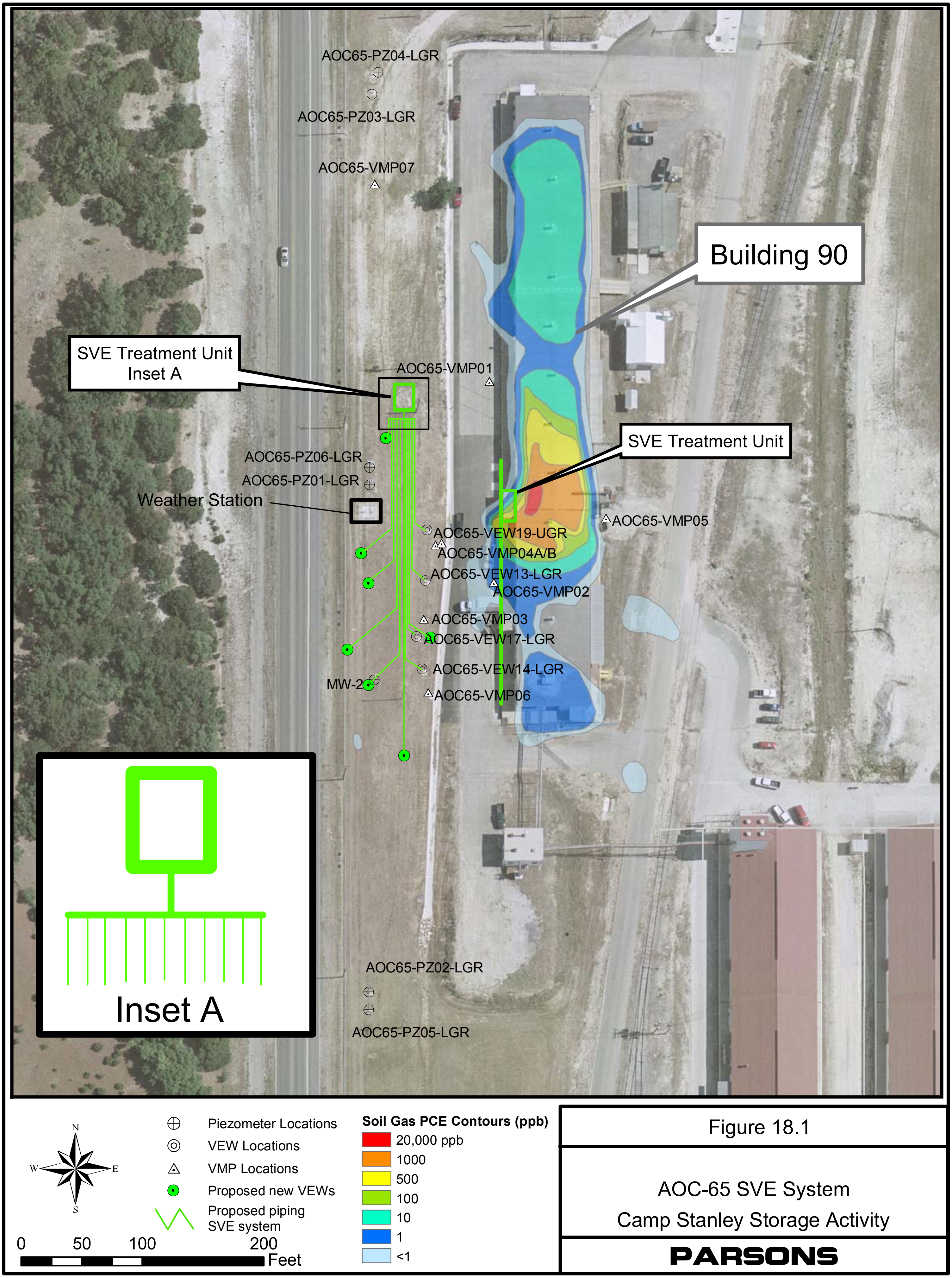

Figure 18.1

AOC-65 SVE System

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The annular space of each VEW will be filled with number 4/10 silica sand from the base of the borehole to a height of 1.5 to 2 feet above the top of the screened interval. The sand filter pack will be emplaced via tremie pipe from the base of the borehole to the top of the designated screened zone. The height of the filter pack will be monitored continuously during emplacement using a weighted measuring device.

A 100 percent sodium bentonite seal approximately 2 to 3 feet thick will be placed above the filter pack in each borehole. The bentonite will be dropped into the borehole from the surface at a rate sufficient to avoid clumping and bridging. The bentonite seal will be fully hydrated according to the manufacturer's specifications before grouting activities commence.

Beginning with small lifts, a Volclay® grout mixture will be slowly pumped into the annular space using a side-discharge tremie pipe. The grout mixture will be mixed in the following proportions: 50 pounds of Volclay grout to 24 gallons of potable water. This proportion of grout yields approximately 3.5 cubic feet per sack of Volclay cement. An estimated volume of grout needed will be calculated prior to emplacement at each well. The slurry will be injected until grout of proper consistency flows freely at the surface. The annular space will be checked periodically for settlement, and will be topped off as needed to no greater than 2 feet bgs. The grout will be allowed to cure for at least 48 hours prior to any well development. The presence of significant groundwater after completion of drilling may warrant development of a VEW, otherwise no well development is planned for new VEWs.

Surface completions of the VEWs will be modified from the standard MW completion to include 12-inch diameter, steel surface protectors extending 1.5 feet above pad surface, a lockable cap, and connection of the wellhead to the appropriate SVE piping network. A typical VEW surface completion diagram is presented on Figure 3.6, ***AOC-65 Treatability Test Plan***. Each of the new SWMU B-3 VEWs and AOC-65 VEWs will be connected to the corresponding SVE system manifolds.

Each well will be connected to the corresponding SVE manifold system by buried 2-inch PVC pipe. The existing blower unit at SWMU B-3 will be replaced by a more durable unit. At AOC-65, new VEWs west of the concrete drainage swale will be connected to a new blower system that will be installed on a concrete pad in the vicinity of the south weather station. Existing AOC-65 VEWs located west of the concrete swale will be disconnected from the Building 90 SVE manifold and evaluated for possible inclusion into the new SVE well network west of the drainage swale. If deemed appropriate, the surface completions will be refitted to connect to the new west side blower unit. The performance of each VEW attached to the new blower will be evaluated in that configuration. Complete VEW construction procedures and schematics are presented in the "***AOC-65 Treatability Test Plan***" (Parsons, April 2002), in the CSSA Environmental Encyclopedia.

One nested VEW is planned along the west dock of Building 90 near the current SVE manifold. The monitored zones in the nested well will be attached to the SVE system as per other new VEWs in the SVE system expansion plans. All VEWs will be completed as flush-mounted in traffic areas, and with 4-foot square concrete pads, a locking well protector, and protector posts in non-traffic areas in accordance with state regulations. A rounded brass monument will be placed on each VEW concrete pad to serve as a permanent benchmark. A registered land surveyor will survey each new well.

The AOC-65 O&M plan will be updated to incorporate the SWMU B-3 system, new wells, and recommendations from the "***Draft AOC-65 Soil Vapor Extraction Operations and Maintenance Assessment Report***" (Parsons, February 2005). The O&M activities include periodic optimization events of the SVE systems through use of air flow balancing and monitoring TVH, O_2, and CO_2 levels. They also include routine system checks, which will occur approximately once every week to ensure proper system operation, record gauge readings, change air filters as required, and perform system troubleshooting. TO0006 includes 6 months of O&M and sampling consisting of, but not limited to, bi-monthly system checks, monthly flow monitoring, quarterly pressure measurements and air samples collected from individual extraction wells.

A long-term SVE operations and monitoring report will be prepared for both SVE systems after 6 months of operation to summarize O&M activities during the operational period of this task order. The O&M activities will be conducted by Parsons. The O&M reports will also document fieldwork relative to new VEWs and system expansion.

18.4.5 SWMU B-3 Monitoring System (WBS 07000)

18.4.5.1 MWPW Drilling and Installation

The SWMU B-3 monitoring network drilling program contains four MWPWs. The MPMW wells will be situated around the perimeter of SWMU B-3, one up gradient and three down gradient. The MPMW wells will be completed within the upper 325 feet of the LGR member of the Middle Trinity aquifer, and will have up to 5 discrete interval monitoring devices installed. One down gradient MPMW will be drilled to the bottom of the Cow Creek (CC) Formation, between the SWMU B-3 source area and CS-MW16-CC, and will also be used for aquifer evaluation, and other hydrogeologic data collection relevant to overall CSSA environmental program objectives. Final drilling locations will be based on observations made during the SWMU B-3 well injection borehole testing program. The "***Draft Work Plan For Enhanced Anaerobic Biodegradation Pilot Test At SWMU B-3***" (Parsons, June 2005) includes specific details about the monitoring well network and subsequent monitoring programs and objectives. A supplemental site survey may be required prior to finalizing the MPMW locations. **Figure 18.2** illustrates the proposed MPMW drilling locations at SWMU B-3.

Actual drilling depth will be a function of each well's final location which includes land surface elevation and proximity to structural features (*e.g.*, faults). The estimated drilling depths are 325 feet bgs for each MPMW LGR well and 500 feet bgs for the proposed CC well (**Table 18.1**). Borehole diameter will be a nominal 4.25 inches. Borehole plumbness and alignment will be maintained to less than 2 degrees from vertical through TOTCO measurements

Aerial Photo Date: 2003

- Proposed WestbayÆ Well Location
- Proposed Injection Well Location
- Approximate Groundwater Flow Direction, Sept. 2004
- Faults (USGS)
- Creeks (Dashed where intermittent)
- Water Well Locations
- SWMU Boundary

Figure 18.2

Proposed Well Location Map

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J:\744223\GIS\b3-injection_well_location_map.mxd every 50 feet during drilling. When necessary, boreholes will be cased during drilling with temporary or permanent surface casing to minimize the downward migration of perched or shallow contaminants, or to prevent collapse. The up gradient well will be drilled first, then continue in locations of greatest to least estimated contamination. This drilling sequence will be used in order to find areas of contamination that need monitoring. Screening data from each MPMW borehole will be evaluated to assess whether contamination is present, and at which geologic intervals. This evaluation will identify the most appropriate intervals for monitoring. Decontamination of equipment will take place between drilling of different wells. Detailed well construction specifications and procedures (including TOTCO) are in the "***Sampling and Analysis Plan Addendum for TO-42***" (Parsons, September 2002).

Table 18.1
TO0006 Estimated Quantities of Drilling Requirements

Drilling Location	4.25" Borehole Depth *(feet)*	8" Borehole Depth *(feet)*	Declination Survey (Every 50' to less than 2 degrees)	4" Well with 25 - 50 feet of Screen *(feet)*	Soil Gas Packer Sampling – *(Qty)*	Geophysical Log	Camera Survey
B3-MPMW-05	325		7			1	1
B3-MPMW-06	325		7			1	1
B3-MPMW-07	325		7			1	1
B3-MPMW-08	460		9			1	1
B3-VEW-22		100	2	100	4		
B3-VEW-23		100	2	100	4		
B3-VEW-24		100	2	100	4		
B3-VEW-25		100	2	100	4		
B3-IW-01		200	4	200		1	1
AOC65-VEW-26		100	2	100	4	1	
AOC65-VEW-27		100	2	100	4	1	
AOC65-VEW-28		100	2	100	4	1	
AOC65-VEW-29		100	2	100	4	1	
Totals:	1,435	1,000	50	1,000	32	9	5

MPMW = multi-port monitoring well.

Multi-port monitoring systems will be utilized to obtain discrete pressure and groundwater data from isolated zones for profiling portions of the aquifer on the perimeter of SWMU B-3. To install a typical MPMW system, a nominal 4.25-inch diameter borehole will be drilled by air rotary methods. Each borehole will be geophysically logged prior to the installation of any discrete monitoring ports. Careful consideration with respect to faults, fractures, water-bearing zones, and karstic features will be considered when designing the specifications. All lithologic, geophysical, and video logs will be carefully reviewed before installation. The design for each well will be agreed upon by CSSA, the installers (Westbay® Instruments, Inc.), and Parsons before commencing installation.

Prior to installation of the monitoring ports the drilling subcontractor will develop the open boreholes to remove sediment and drilling fluids. Personnel from Westbay® will support installation the multi-port systems with the aid of the drilling crew and rig capable of suspending and lowering the components into the wells. Parsons will provide oversight. Westbay® will emplace the packers for each interval at depths directed by Parsons and CSSA project managers or their delegates. Each LGR MPMW may have up to 5 isolated monitoring intervals built-in, while the deeper CC MPMW may have up to 9 zones. Westbay® personnel will install the system apparatus, inflate the packers, and demonstrate to Parsons that the zones are hydraulically separated through pressure testing. Westbay® will also conduct QC examinations at each new MPMW to verify proper installation and that the monitoring ports are working as intended. After all monitoring ports and packers are set, the drilling subcontractor will build the surface completions. Schematics and details regarding assembly, function, and installation of Westbay® casing, couplings, sample ports, packers, and endcaps are described in the ***TO-42 SAP Addendum***. Following demobilization, Westbay® will submit a Well Completion Report documenting their installation activities, materials, and integrity testing of the four new MPMW systems.

A significant amount of time may elapse between MPMW borehole completion and mobilization of the multi-port well system installers. The boreholes will have to be tentatively sealed over the interim to eliminate potential vertical contaminant communication between separate hydrologic zones. To accomplish this, flexible FLUTe™ liners will be installed. The liners will be installed prior to scheduled inactivity in MPMW operations, then later removed the day before activities resume at a well. Ancillary installation and removal equipment will be rented from FLUTe.

After completion, each MPMW will be temporarily sealed by insertion of a FLUTe™ borehole liner system. A FLUTe system consists of a long, tubular, urethane-coated nylon fabric that is inserted into a borehole and held in place by being filled with clean water. The interior water pressure presses the liner tightly against the borehole wall, thus preventing potential vertical movement of contaminants within the borehole. The Westbay® installers will mobilize only after the boreholes are completed, and the liners will protect the different hydrogeologic zones from cross contamination in the interim between drilling and installation of the MWPW monitoring systems.

Liners are stored on large reels in an inverted (inside-out) state. Liner tops are clamped onto a metal head, which in turn is clamped to the rim of short, temporary surface casing at a wellhead. The liners are then filled with clean water causing them to descend into the hole. The liners evert (unroll outside-out) into the holes under the weight of the added water. Clean water inside the liners acts as pressurizing fluid. The liner material becomes pressed against the well walls, closing-off transmissive and permeable zones. Each liner's descent rate will depend upon the rate groundwater is forced back into the formation (permeability) ahead of the descending liner. A roller stationed at the wellhead guides the liner off its storage reel and into the well. Once installed, the flexible liners seal the boreholes against vertical flow of subsurface contaminants. The head of clean water within the liner will be maintained above the head of groundwater to maintain positive pressure of the liner against the borehole wall. Water levels in other neighboring wells will be monitored as needed to ensure the liners do not go slack due to possible groundwater fluctuations. Clean water can be added to the liner as needed to ensure the positive pressure.

Each liner comes with a tether attached to its inside bottom. The tethers extend from the inside bottom of an installed liner up to the ground surface, and will be used to pull the liners out. The process of liner removal is generally the opposite of installation. As the tether is pulled upward the liner is peeled off the well walls from the bottom up. The clean water will be periodically pumped out of the inside of the liner as it is pulled upward. The liner exits the wellhead inverted (inside-out) and will be flattened out as it rewinds onto its storage reel.

Westbay® systems are planned for the multi-port monitoring wells. These systems allow for monitoring of specific hydrogeologic zones within a formation. Data gained from Westbay® monitoring allows for accurate and detailed characterization of the vertical distribution of target parameters in a contaminant plume. This in turn provides information that allows remediation efforts to be concentrated in appropriate areas, and thus reduces the potential to waste resources through a blanket coverage approach.

There are currently four Westbay® wells actively monitored in the AOC-65 area. CSSA already owns the corresponding, highly specialized monitoring and sample collection equipment. By installing Westbay® wells at SWMU B-3 instead of another system, the need to purchase additional expensive monitoring equipment is eliminated. Installation of another system would result in having to maintain two incompatible, monitoring apparatuses, and would generate data compatibility issues.

All MPMW wells will be completed with 5-foot square concrete pads to accommodate a sample probe support tripod, a locking well protector, and 4 protector posts each in accordance with state regulations. A brass monument will be placed on each well concrete pad to serve as a permanent benchmark. A registered land surveyor will survey each well.

The SWMU B-3 monitoring well suitable for injection will be drilled 150 to 250 feet bgs, depending on local hydrogeologic characteristics determined after drilling and logging the boreholes for the multi-port monitoring wells. The borehole for this well will be drilled by air rotary using a 7-7/8-inch diameter bit to accommodate nominal 4-inch diameter casing. The actual installation depth will be determined by the on-site geologist based on results of the borehole lithology and any other relevant geophysical logging data. The well will be constructed with 4-inch inner diameter Schedule 40 PVC, 0.020 slot screen, and 4-inch diameter Schedule 40 riser. The estimated screened interval will be at least 10 feet, depending on borehole lithology and other geophysical logging results. The well will be completed within an open borehole no less than 7-7/8 inches in diameter. Casing and screen will be centered within the borehole using stainless steel centralizers at 50-foot intervals. The filter pack, seals, and grouting will be installed in a manner similar to that of the VEWs as portrayed in the above subsection and in the ***AOC-65 Treatability Test Plan***.

At ground surface the monitoring well designed for injection will be completed in the standard manner with a 4x4-foot square concrete pad, brass monument, a locking protective cover, and protector posts.

18.4.5.2 Borehole Geophysical Surveys and Discrete Sampling

The drilling subcontractor shall perform a full suite of geophysical logging at each borehole drilled for a MPMW consisting of natural gamma, electromagnetic, resistivity, spontaneous potential, optical televiewing, and analog video. The new VEWs will be logged by natural gamma, resistivity, spontaneous potential, and caliper. Video logging may be conducted in portions of the IW to more precisely identify potential injection zones. At least four packer injection tests are planned for the monitoring well suitable for injection. Each injection test will be basically the reverse of a discrete packer sampling procedure. Clean water will be injected under monitored and controlled conditions into packer-isolated hydrogeologic zones in the well. Data generated thereby will allow better assessment of the permeability and transmissive properties of the examined intervals.

Discrete interval groundwater samples will be collected from four intervals in each LGR MPMW, and from six intervals in the deepest MPMW. Due to the low yield of some targeted zones, sample collection may not be possible. Therefore, sampling attempts may outnumber the actual amount of samples successfully collected. Logging, injection testing, and discrete sampling procedures and standards are described in more detail in the "***Sampling and Analysis Plan Addendum for TO-42***" (Parsons, September 2002).

18.4.5.3 Well Development

The drilling subcontractor will develop the new MPMW wells by surging, bailing, and pumping techniques. The wells will be developed until clear water is achieved. The new VEWs and the IW will be cleaned by airlifting and surging the length of the borehole to the extent most feasible. TO0006 well development will follow the "***CSSA Sampling And Analysis Plan***" **Volume 1-4**, **CSSA Environmental Encyclopedia**.

18.4.5.4 Baseline Monitoring

After completion of drilling and well installations, baseline conditions at SWMU B-3 will be established for volatile organic compounds (VOCs), MNA parameters, and hydraulic pressure gradients by up to three rounds of monitoring of the MPMWs and other nearby monitoring wells. The monitoring will occur on a flexible monthly basis. Significant climatic changes (*e.g.*, precipitation) or results from previous sampling events may prompt adjustments to the monitoring schedule. The profiling data obtained from the wells will document local changes or static conditions of individual hydrogeologic zones within the monitored portion of the aquifer resulting from the injection of substrate via the new injection well or bioreactor at SWMU B-3. The SWMU B-3 baseline monitoring network will include the new MPMW wells, the new monitoring/injection well, and pre-existing CSSA wells CS-D, CS-MW1-LGR, and CS-MW16-LGR. Preliminary monitoring results and climatic conditions may also warrant widening the network to possibly include CS-MW2-LGR, CS-MW3-LGR, CS-MW5-LGR, CS-MW16-CC, CS-2, or CS-4.

18.4.5.5 Well Installation Technical Report

The deliverable specific to this WBS will consist of draft and final versions of a well construction report containing a summary of well construction data, analytical data summaries, testing results (geophysical and packer), and supporting appendices. The appendices will provide the geophysical borehole logs, lithologic logs, borehole geophysical reports, construction diagrams, and analytical documentation.

18.4.6 Weathered Asphalt Removal (WBS 08000)

This task includes the removal of approximately 2,700 CY of weathered asphalt materials improperly managed at an off-post location by a CSSA construction subcontractor. The asphalt was generated during road improvement work within CSSA. Parsons will supervise the loading, transport, disposal, and manifest management of the asphalt debris. The debris will be disposed of at Coval Gardens Waste Management disposal facility. The removal and disposal of the asphalt will be completed to the satisfaction of CSSA after visual inspection.

A removal action letter report will be prepared following the removal action. The report will document the removal activities, quantities, and final disposition of removed asphalt materials in order to demonstrate that substantial removal has been achieved. This report will include photo documentation of the removal activities.

18.4.7 Removal of Soil and Debris at B-3 Trenches (WBS 09000)

18.4.7.1 Background and Results from Previous Investigations

Historical information indicates that CSSA used the area now designated as SWMU B-3 as a waste disposal area. Previous investigations at the site have included the following:

- 1995 – Geophysical Surveys, Soil Gas Surveys, Soil Borings,
- February 1996 – Initial SVE Pilot Test;
- December 1996 – Expanded SVE Pilot Test; and
- September 2002 – Limited Removal Action.

18.4.7.1.1 Additional Details on the 1995 Investigation

The following tasks were included in the 1995 field investigations at SWMU B-3 to characterize and assess possible site contamination.

- Geophysical surveys (EM & GPR);
- Soil gas surveys;
- Drilled 7 soil borings to 30 feet;
- Majority of soil borings outside landfill limits; and
- 22 soil samples analyzed for VOCs, SVOCs and metals.
- The results of the 1995 field investigation include:

VOCs detected in soil samples include *cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, tetrachloroethene, trichloroethene, and xylenes; and

Metals detected in the samples above background include chromium, copper, lead and nickel.

18.4.7.1.2 Additional Details on the February 1996 Investigation

The following tasks were included in the February 1996 field investigations at SWMU B-3 to further characterize and assess site contamination determined during the 1995 investigations.

- 12 soil borings advanced to bedrock approximately 17 to 20 feet deep;
- 6 borings completed as VEWs and 6 borings completed as vapor monitoring points (VMPs) (locations shown in **Figure 18.3**); and
- 15 soil samples analyzed VOC and 10 samples analyzed for metals.
- The results of the February 1996 field investigation include:

VOCs detected include chlorobenzene, *cis*-1,2-dichloroethene (cis-1,2-DCE), tetrachloroethene (PCE), toluene, and trichloroethene (TCE) as indicated in **Table 18.1**;

Metals present above background include cadmium, chromium, copper, lead, nickel, and zinc; and

A summary of the analytical results relative to TRRP Tier 1 PCLs is presented in **Table 18.2**.

Table 18.2 – February 1996 Soil Sampling Summary

Compound	Maximum	Number of Samples Above TRRP Tier 1 Residential PCL*	Number of Samples Above Screening Assessment
Volatile Organic Compounds (µg/Kg))			
Chlorobenzene	2,000	1	0
cis-1,2-Dichloroethene	27,800	6	na
Tetrachloroethane	650	2	0
Toluene	12,300	1	0
Trichloroethene	220,000	11	4
Total Metals (mg/kg)			
Arsenic	15	2	0
Barium	160	0	0
Cadmium	12	4	2
Chromium	120	0	1
Copper	580	1	na
Lead	8,700	9	5
Mercury	0.21	1	0
Nickel	100	1	0
Zinc	4,200	1	na

* = Tier I Residential GWSoilIng PCL for 30 acre source
na = Class I Toxic Constituent Limit not available

18.4.7.1.3 Additional Details for the December 1996 Investigation

The following tasks were included in the December 1996 field investigations at SWMU B-3 to further characterize and assess site contamination determined during the 1995 and February 1996 investigations.

- 12 soil borings completed to depths ranging from 17 to 20 feet bgs;
- Borings completed as VEWs (VEW07 – VEW18); and
- 13 soil samples analyzed for VOCs and metals.

The results of the December 1996 field investigation include:

- VOCs detected in soils include cis-1,2-DCE, TCE, sec-butylbenzene, isopropylbenzene, 4-(cymene,p-)isopropyltoluene, and n-propylbenzene;
- Metals detected above background include cadmium, chromium, copper, lead, nickel, and zinc; and

A summary of the analytical results relative to TRRP Tier 1 PCLs is presented in **Table 18.3**.

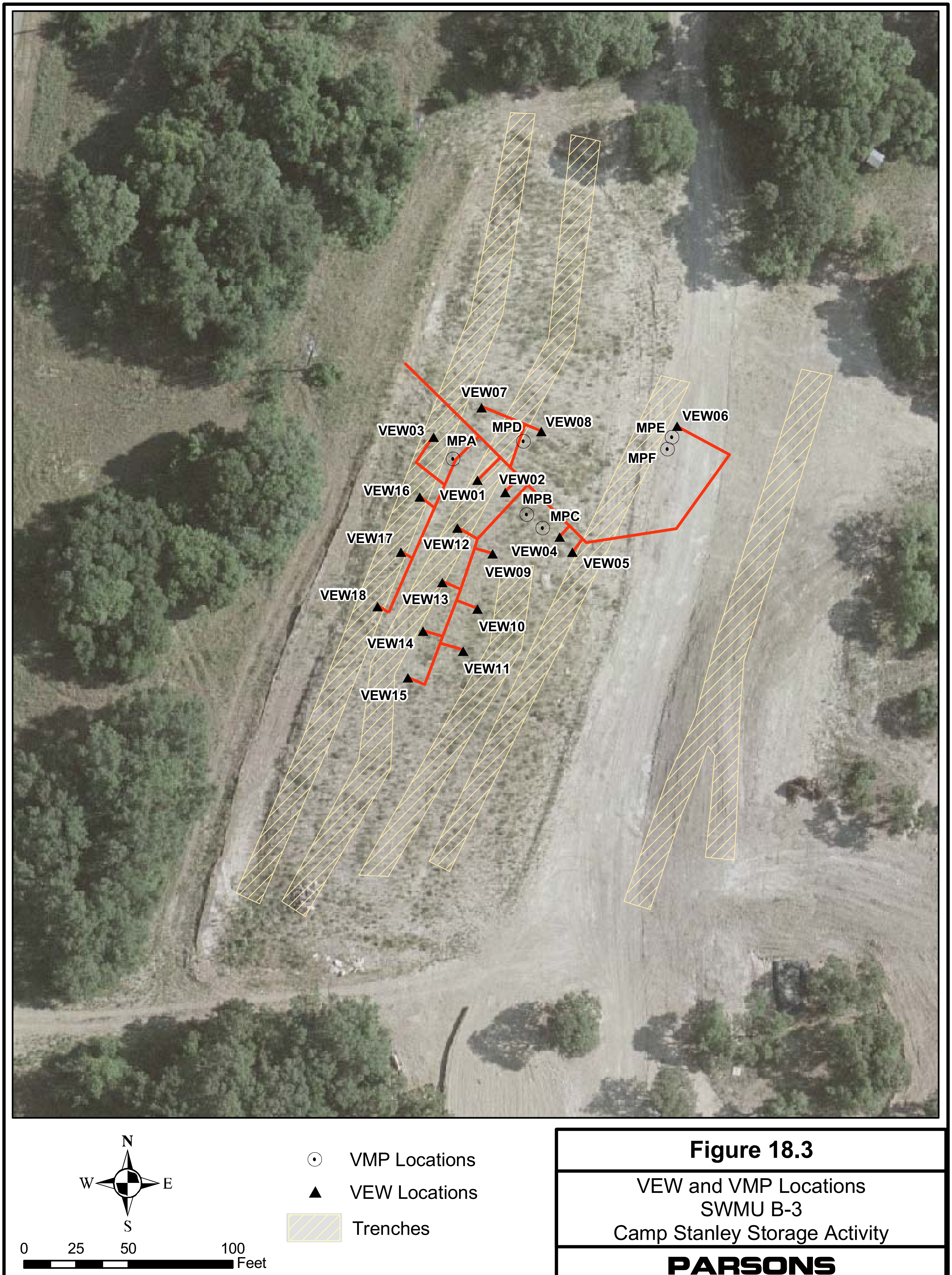


Figure 18.3

VEW and VMP Locations
SWMU B-3
Camp Stanley Storage Activity

PARSONS

J:\744\744223 B3 & AOC65\gis\b3-18.x_figs.mxd - 12/1/2005 @ 3:53:31 PM

Table 18.3 – December 1996 Investigation Soil Sample Summary

Compound	Maximum	Number of Samples Above TRRP Tier 1 Residential PCL*	Number of Samples Above Screening Assessment
Volatile Organic Compounds (µg/Kg))			
cis-1,2-Dichloroethene	1,674	3	na
Trichloroethene	33,400	3	2
sec-Butylbenzene	2,100	2	na
Isopropylbenzene	500	0	na
4-(Cymene,p-) Isopropyltoluene	3,600	0	na
n-Propylbenzene	2	0	na
Total Metals (mg/kg)			
Cadmium	185	2	2
Chromium	99	0	0
Copper	1,618	1	na
Lead	735	11	2
Nickel	69	0	0
Zinc	1,868	1	na

* = Tier I Residential GWSoilIng PCL for 30 acre source

na = Class I Toxic Constituent Limit not available

18.4.7.1.4 Additional Details for the 2002 Removal Action

In September 2002, a previous contractor identified five north-south trenches at the locations shown in **Figure 18.4**. The previous contractor completed the following tasks:

Limited soil and debris removal action completed for east trench where 696 CY of hazardous waste excavated and disposed and 1,242 CY of Class 2 nonhazardous waste excavated and disposed;

3 Exploratory trenches completed east to west across the site to identify the approximate locations of the four western trenches shown in **Figure 18.4**; and

18 soil samples collected at locations shown in **Figure 18.5** for waste characterization where one soil sample exceeded the TCLP standard for trichloroethene and one sample exceeded the TCLP standard for lead. Additional results are provided in **Figure 18.6**.

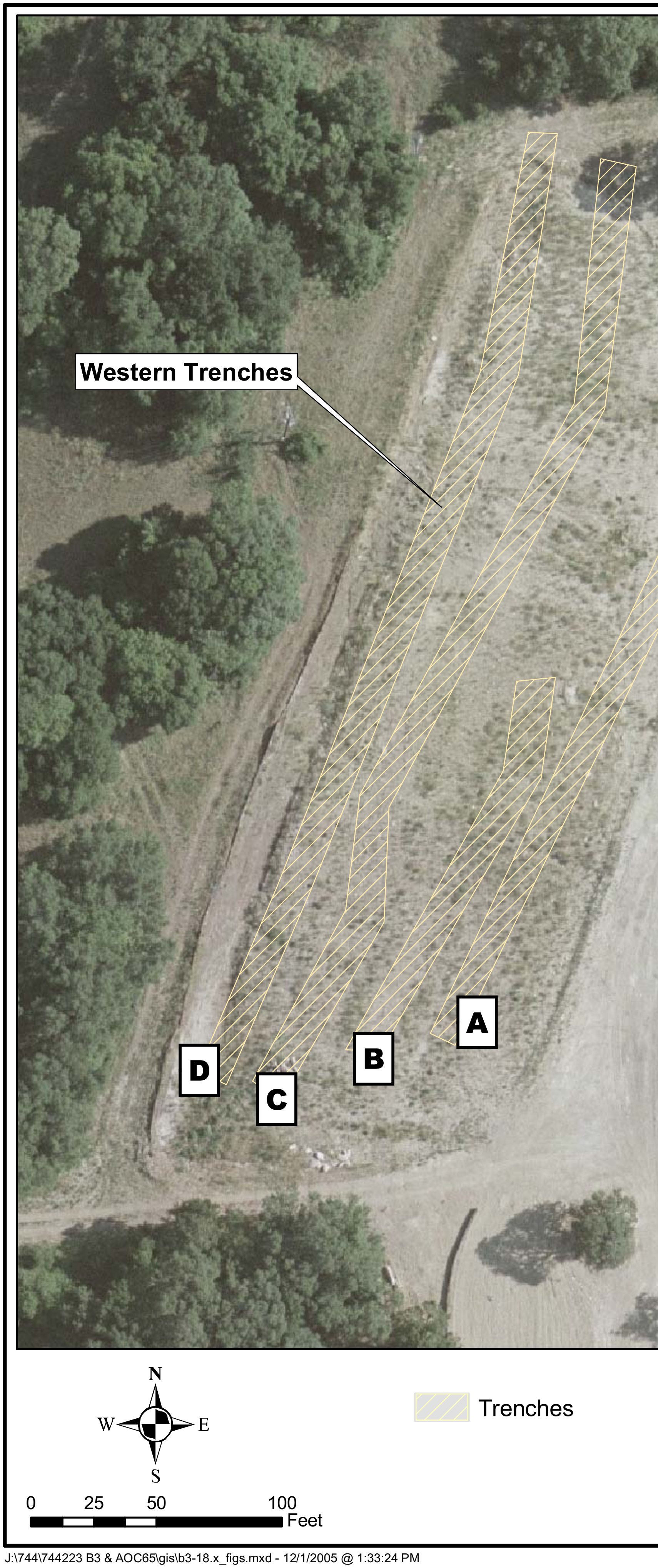
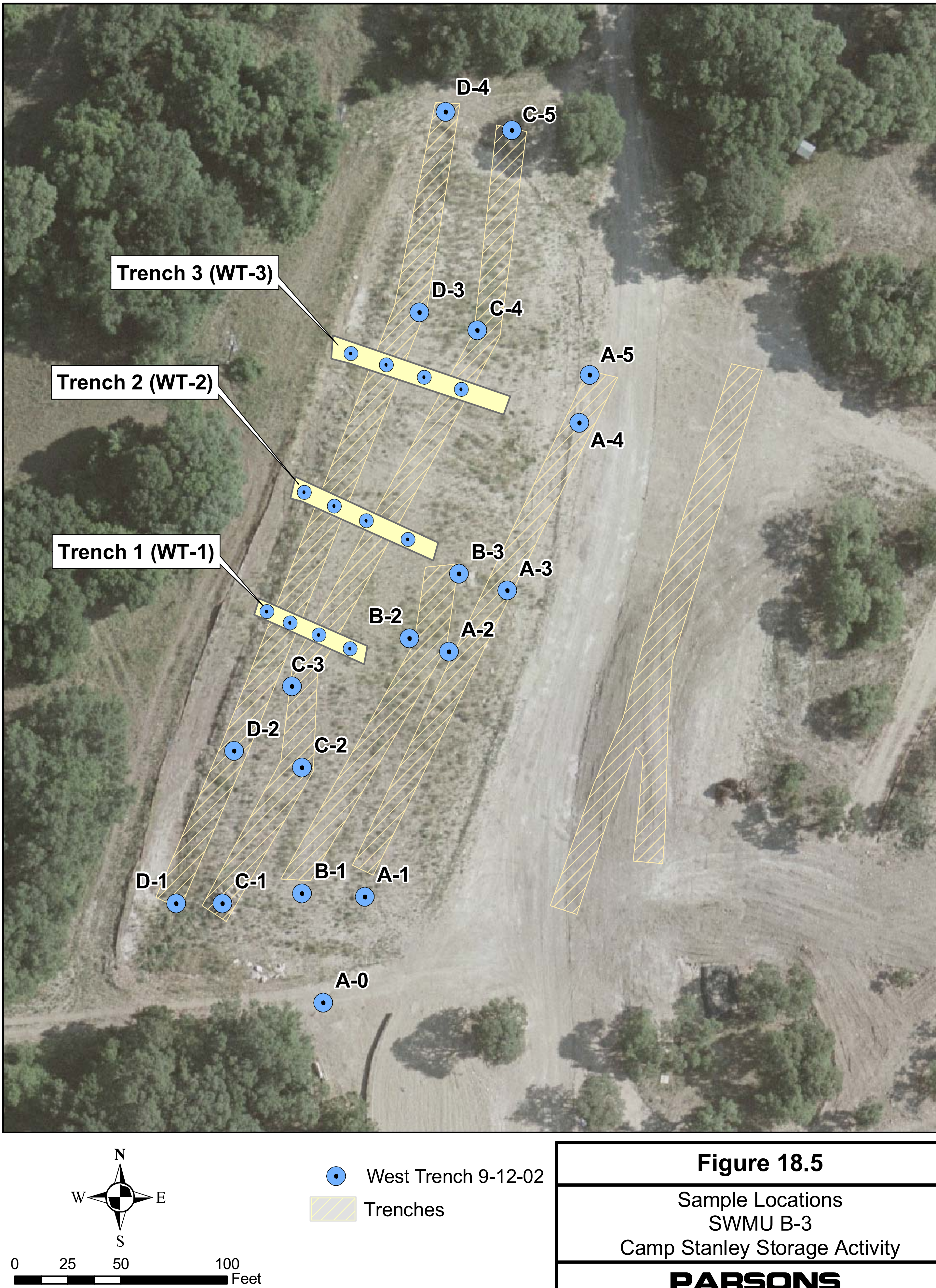


Figure 18.4

Trench Locations
SWMU B-3
Camp Stanley Storage Activity

PARSONS



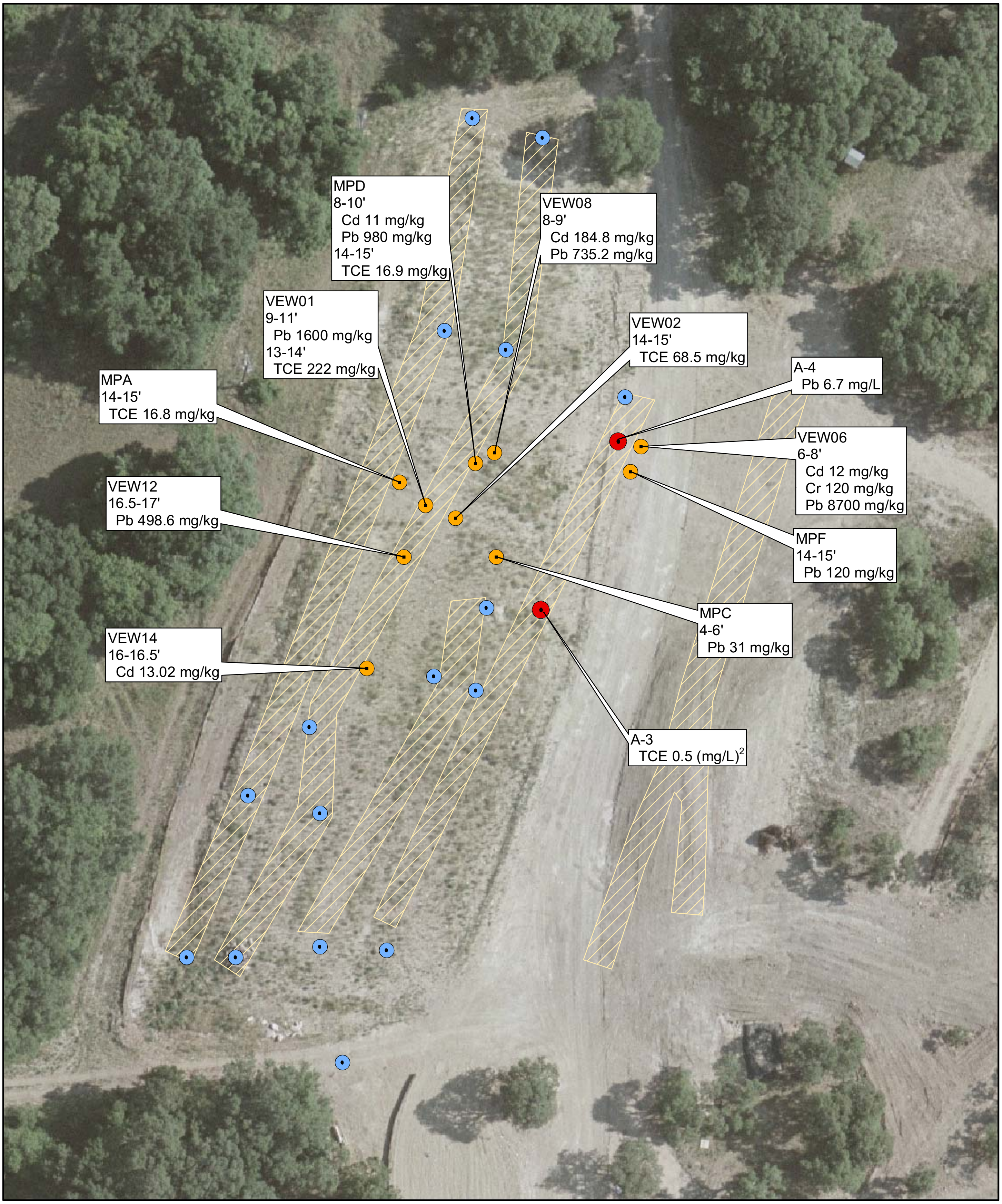
West Trench 9-12-02

Trenches

Figure 18.5

Sample Locations
SWMU B-3
Camp Stanley Storage Activity

PARSONS



N
W E
S

0 25 50 100
Feet

- Exceed TCLP
- Potentially exceed TCLP
- Below TCLP
- Trenches

Figure 18.6

Sampling Results
SWMU B-3
Camp Stanley Storage Activity

PARSONS

Based on the three exploratory trenches, the previous contractor estimated volumes of soil for the five trenches at B-3. Affected soils were removed from the eastern trench and backfilled with approximately 6,700 BCY of clean soils. The east-west exploratory trenches were used to develop the trench profile shown in **Figure 18.7** and from this profile along with estimated trench lengths, the volume of affected soil for the four western trenches was estimated to be 18,300 BCY.

18.4.7.1.5 Summary of Waste Characterization Estimation

Figure 18.6 shows the locations of samples collected *in situ* during the prior investigations, treatability studies and removal action that identified areas within the West trench that might indicate a potential to contain waste that would be considered characteristic hazard for toxicity. These locations were identified on the basis of either having TCLP data suggesting that the soil might be hazardous for either TCE or lead, or the total contaminant levels measured in the samples exceeded the 20 times rule.

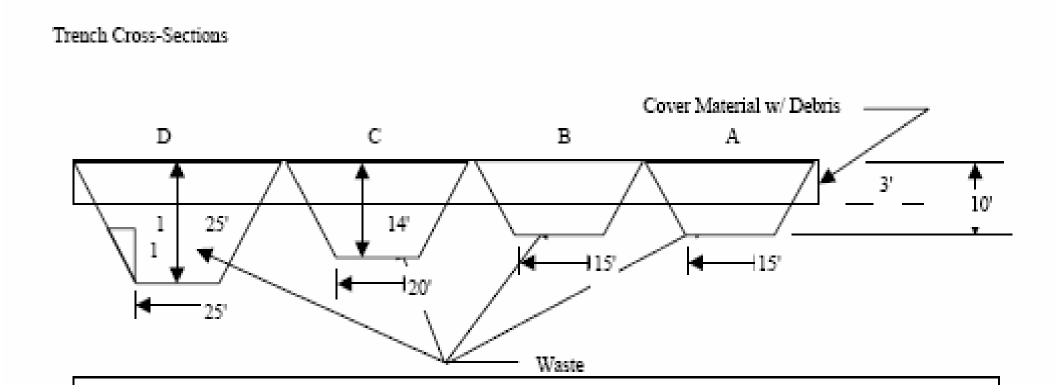
18.4.7.2 Permits to be Acquired Prior to Removal Action at B-3

The necessary permits including a UIC permit for the recirculation of groundwater into the bioreactor constructed in the SWMU B-3 excavation will be determined prior to starting the field activities.

18.4.7.3 NEPA Evaluation

A Record of Environmental Consideration (REC) will be prepared to describe the proposed action and anticipated timeframe, identify the proponent, and explain why further environmental analysis and documentation is not required. The REC will document whether the proposed action s exempt from the requirements of NEPA, or has been adequately assessed in existing documents and determined not to be environmentally significant. If appropriate, the REC will be used to document the use of a categorical exclusion.

Figure 18.7



18.4.7.4 Implementing Removal Action of Soils at B-3

Parsons will subcontract an excavation contractor to remove soils and waste debris from SWMU B-3 trenches. The soils that were placed in 2002 as backfill in the east trench are considered clean, and therefore, an estimated 6,700 BCY of clean soil from that backfilled trench will be excavated and stockpiled at the site for possible later use in construction of the bioreactor or other on-site use.

The soil and debris in the four western trenches will be excavated using the following guidelines:

- Soil/debris (approximately 18,400 BCY) excavated from the trenches will be stockpiled for *ex situ* waste characterization per the TO-006 SAP addendum;
- Based on results shown in **Figure 18.6**, areas of the trenches will be segregated so that the more affected soils associated with the exceedances for TCLP-TCE and TCLP-lead into 200 LCY lots and the soils for the remaining areas into 500 LCY lots if matching waste profile description per the SAP addendum;
- Soils determined by the *ex situ* sampling to have contaminant levels above TRRP residential standards, or that are mixed with debris will be transported for off-post disposal. Soil that is free of debris and meets residential standards will be stockpiled for eventual re-use in the construction of the bioreactor.
- Any materials encountered during removal action that deviate from waste description (staining, odors, *etc.*) along with debris such as metal banding will be segregated.
- Portions of the trenches identified as containing potentially hazardous materials will be excavated first. Excavations will continued to the top of the weathered limestone which is the target of the bioreactor treatment, and will not penetrate deeply underlying limestone bedrock.
- If necessary, security of the site will be maintained by constructing a perimeter fence. The purpose of the fence will be to protect personnel and equipment by preventing unauthorized entry .
- A traffic control plan will be devised and implemented on a daily basis. The plan will include the operational schedule of CSSA and will not interfere with the ongoing mission. The plan will be communicated to all personnel during the morning safety briefing each day or as necessary to accommodate changing conditions or schedules.
- Subcontractors will ensure that all precautions are taken to eliminate excessive dust during all excavation and waste transportation and disposal.

18.4.8 Construction of Bioreactor at B-3 (WBS 10000)

18.4.8.1 Design of Bioreactor

Construction of the bioreactor will consist of a design stage followed by the construction of the bioreactor. The contractor will use the information contained in this work plan addenda as a basis for design and submit a detailed design for review by both Parsons and CSSA. The objective of the bioreactor will be to create a liquid organic food source that gravity drains into the bedrock underlying SWMU B-3 and promotes anaerobic degradation of subsurface contaminants. Anaerobic degradation is an industry-accepted technology for *in-situ* subsurface remediation of TCE and related compounds. The general concept will be to pump water approximately 600 feet from well CS-16 to a network of pipes that overlay the five trenches identified during the 2002 field investigation at SWMU B-3. Downward-pointing discharge nozzles located throughout the piping network, will allow water to flow on demand into each trench which will be completely filled with sand/gravel/wood chip mixture. To ensure that a two to three-foot water level is maintained within each trench, water levels will be periodically monitored with piezometers installed into each of the five trenches currently identified at B-3. The capability of the bioreactor (combination of all five trenches) to reduce subsurface contaminant concentrations will be accessed through periodic sampling of ground water monitoring wells located around B-3. Details of the constituents that will be monitored and anticipated monitoring schedule are provided in the O& M section.

18.4.8.2 Implementation of Design

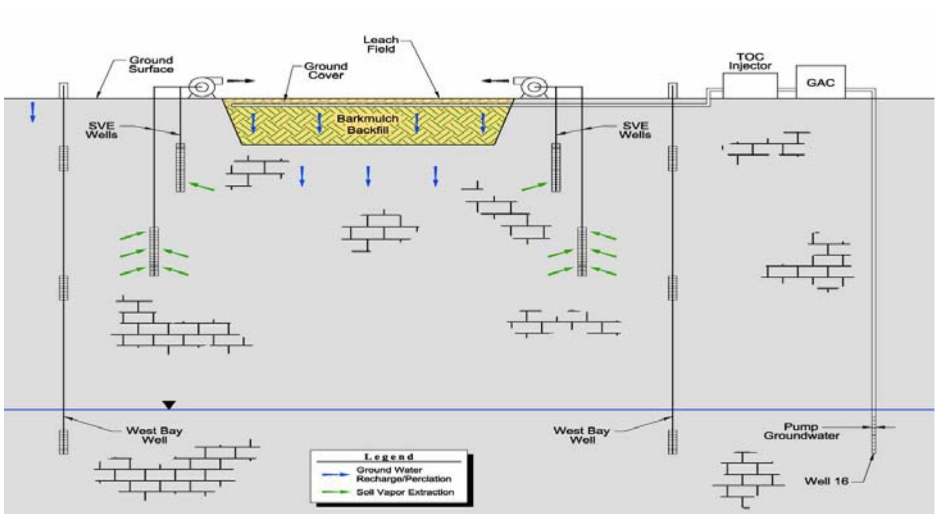
18.4.8.2.1 Backfilling of Bioreactor with Organic Material

Each trench will be backfilled with a mixture of sand and deciduous tree wood chips. PVC piezometers will be installed in each trench after substrate material and protective surface materials have been installed.

18.4.8.2.2 Piping Installation

A water delivery system will be installed to convey water from Well 16 to the north side of the trenches at B-3, a distance of approximately 600 feet. The general components of the system as shown by the conceptual model in **Figure 18.8**, includes the following sequence:

Figure 18.8



1) Starting at the CS-16 LGR wellhead, ground water will be pumped directly to the bioreactor for treatment and saturation of bioreactor substrate. Any additional water will be diverted to the Granulated Activated Carbon (GAC) treatment unit for treatment of possible VOCs in the ground water. Installation of all necessary equipment needed to maintain optimal flow rate to the bioreactor will be incorporated into the existing system. The well and GAC unit are currently operational at CSSA and therefore not part of the installation contractor's cost. The flow rate on the downstream side of the GAC unit, can be maintained at a rate of 70 gallons per minute (gpm). However, the contractor will confirm the effectiveness of the backflow preventer (between the well head and the GAC unit) which prevents water that has already passed the wellhead from backflowing into the well.

2) Approximately 600 feet of piping will be used to convey the treated water from the GAC unit to the north side of B-3. The contractor will install the piping through an existing north-south drainage culvert under Outer Road and the line will be buried to a depth of one to two feet below the surface. Parsons and their subcontractor will meet with personnel from CSSA to plan the final piping layout from the road to SWMU B-3, and to identify all buried utilities. If UXO is encountered, the proper response procedures identified in the CSSA Health and Safety Plan will be followed. The piping diameter will be based on the necessary flow and pressure requirements.

3) At the north side of B-3, the treated water will enter a Total Organic Carbon (TOC) Injector unit that will be capable of injecting an organic substrate into the water stream if it determined that the bioreactor material needs to be recharged. The substrate will be a commercially available fluid that would be stored in a storage tank adjacent to the TOC Injector unit and would be injected as deemed necessary. The purpose of the substrate will be to promote or enhance anaerobic degradation in the subsurface, however it is anticipated that initially, a substrate will not be necessary due to the organic-rich water created by water passing over wood chips in the bioreactor cell. If data reviews indicate that the addition of a substrate to the bioreactor system is necessary to enhance the anaerobic degradation of contaminants, then the substrate will be added upon approval by CSSA. A geosynthetic fabric will be placed over the mulch/sand mixture prior to placement of the piping

4) A network of pipes leading from the substrate additive unit to each of the five trenches will be installed to deliver the groundwater to the bioreactor. The current plans call for a main header that would run east-west across the north side of the trenches and five supply pipes perpendicular to the header would run lengthwise across the top of each of the trenches. At every five to ten-foot mark along each of the five supply lines, there will be perpendicular pipes extending the width of the trench. The pipes will be equipped with open nozzles that are capable of supplying an adequate amount of water to the bioreactor.

5) The system will be operated for a two to four month period to determine if the sprinkler heads used for this system provide an adequate flow rate of water into the bioreactor (i.e., water level reported in the piezometers is at a height of two to three feet above the base of the trench). For possible future maintenance issues, each piping intersection and sprinkler head will be surveyed. Once Parsons and CSSA are satisfied with the water levels recorded in the piezometers, then access ports will be installed above each valve so that the valves can be

accessed once the soil has been brought up to a final grade across the site. Then each trench will be covered with a second layer of geosynthetic fabric. An approximate two-foot thick layer of soil will be carefully placed over the fabric and all piping on the north side of the site. Flexible piping is currently proposed for the project, but special allowances may have to be made where the flexible piping extends over the soil/bark mulch contact (i.e., the bark mulch material will likely subside). The north/south road through the B-3 area will be retained. Soils excavated from the site during the construction of the bioreactor will be graded across the site to produce a gradual east to west slope.

18.4.9 Operation and Maintenance of Bioreactor (WBS 11000)

Periodic monitoring and maintenance will be implemented at SWMU B-3 to assess the effectiveness of the bioreactor to treat the contaminants in the groundwater being recirculated to the trench and contaminants present in the materials surrounding and underlying the excavation trenches. The primary monitoring will initially entail daily measurements of the water levels in the piezometers located in each of the trenches. Water samples will be collected from the piezometers to measure the effectiveness of treatment within the bioreactor while UIC permitting requirements will require periodic monitoring of the groundwater being recharged into the bioreactor. Additional sampling will be conducted from the surrounding monitoring wells and MPMWs installed to monitor the recharge of groundwater percolating through the more than 100 feet of formation. The samples will be collected as described in the SAP Addendum for TO-006 on a schedule defined by the UIC permit and detailed in the Bioreactor O&M Plan which will be prepared after bioreactor construction has been complete. A summary of the anticipated data collection efforts and projected frequency of sampling along with the parameters to be tested are provided in **Table 18.4**.

Table 18.4

Parameter(s)	Sample Type	Well Type	Frequency
Water level measurement	Measurement	Trench Piezometers, MWs, and MPMWs	Daily for first month, 3 times per week for second month and once per week for remainder
-TCE and TCE-related compounds - Dissolved OC - VOCs (8260) - DO - ORP - Methane - pH - TOC - Dissolved OC - Ions including Fe, Mn, SO4, and NO3	Water sample	MWs and MPMWs in vicinity of SWMU B-3	Once per month for first six months and then once every two months thereafter.

18.4.10 Pumping Tests (WBS 12000)

This task includes groundwater pumping tests of CS-MW16-LGR and CS-MW16-CC. The basis of the tests is to help determine aquifer characteristics in the vicinity of the SWMU B-3 groundwater contaminant plume. The intent of the pumping tests is the withdrawal of groundwater at a known rate, while simultaneously measuring drawdown levels at surrounding observation wells (MW-1 well cluster, MW-2 well cluster, MW-3, MW-4, MW-5, MW-9 well cluster, and one MPMW) observing the development of a cone of depression. The performance of this test will allow the collection of valuable hydraulic data that can be applied to the conceptual site model and future planning of remedial options at SWMU B-3.

Measurement of drawdown levels will be obtained by electronic transducers installed within the wells. Many of the wells have dedicated transducers installed. This will allow the collection and storage of much more data via an electronic datalogger. Pre-test activities will be conducted two weeks prior to the pump test and will include a survey of the pumping and observation wells for background water level data. The pumping test durations have been budgeted for 72 hours. This will allow the aquifers to achieve a near steady-state condition for the constant discharge flow rate. The discharge will be maintained at a constant rate that will be determined by pre-test observations. It is expected that the constant discharge rate will be approximately 25 gallons per minute (gpm). The pumping test at each well will be followed by a 24-hour recovery test.

Groundwater from both wells is contaminated with VOCs. Due to this fact, extracted groundwater will require treatment prior to discharge. Groundwater from the pumping tests will be pumped at 25 gpm directly to the adjacent existing granular activated carbon (GAC) unit for immediate treatment, before being discharged at 25 gpm to outfall 002.

18.5 GROUNDWATER SAMPLING REQUIREMENTS

Sampling of the wells will be based on AFCEE Handbook procedures with exceptions as appropriate for the new MPMW systems at the site. Multi-port system discrete intervals do not normally require purging. The MPMW systems will have discrete interval purging ports built-in should a zone or zones require purging. The sampling staff will follow the methods approved in the CSSA QAPP and the SAP as closely as practical. QA/QC sampling and analysis will be performed to meet the requirements of the SAP where applicable. Purge water will be containerized without sampling, and transported for treatment by the permitted on-post GAC treatment system prior to discharge at Outfall 002.

18.6 DECONTAMINATION PROCEDURES

To prevent sample contamination from the onsite sampling equipment and machinery, decontamination will be conducted using the following procedures outlined in the "***CSSA Sampling And Analysis Plan***". A decontamination pad, large enough to fully contain the drill rig and equipment to be cleaned, will be constructed. Several layers of heavy plastic sheeting will be used to cover the ground surface.

Drill rigs, drill pipe, and other equipment that does not come into contact with the sample medium will be decontaminated with a steam cleaner before initial use and after each borehole is completed. Drill bits will be decontaminated with a steam cleaner prior to use at each boring or monitoring well location. If hot water cleaning alone is found to be ineffective, the equipment may be scrubbed with laboratory-grade detergent, and then rinsed with high-pressure steam. All visible dirt, grime, grease, oil, loose paint, etc., will be scrubbed until it has been removed.

Casing pipe and stainless steel centralizers will either be certified clean by the manufacturers or if necessary, decontaminated by steam cleaning. Prior to packer sampling and well development, equipment such as piping, pumps or surge blocks will be decontaminated by flushing or pumping laboratory-grade detergent solution, potable water, then ASTM Type II reagent water through the internal components. The exterior of the development pump outlet hose will be steam cleaned.

Sampling and geophysical equipment including bailers, pH meters, conductivity meters, gamma tool, cables, etc., that directly contact sample media will be cleaned in accordance with the "***CSSA Sampling And Analysis Plan***".

18.7 INVESTIGATION-DERIVED WASTE MANAGEMENT

The IDW generated during this task order may include soil cuttings, drilling fluids, purged groundwater, well development water, decontamination fluids (water and other fluids), and disposable PPE. The drilling contractor will be responsible for constructing proper and adequate decontamination areas at the site sufficient for all drilling, as well as containing and managing produced solids and fluids.

Transportable 20 to 30-cubic yard, leak-proofed roll-off boxes will be temporarily placed at each drilling site to contain drilling fluids. Drill cuttings are placed directly into the containers from drill rig containment to settle and decant solids from the drilling mud. This process may take days for a single roll-off to sufficiently settle, and may become a capacity problem while drilling high production intervals. Once the solid fraction has sufficiently settled, the liquid fraction of a roll-off container can be characterized to determine if the water will meet surface discharge requirements according to stipulations outlined in the "***RFI And Interim Measures Waste Management Plan***" (WMP) revised by Parsons in June 2005. Once the roll-off has accumulated approximately 50 percent solids, the container should not be used to store additional fluids until the solid fraction can be characterized and removed from the roll-off. A roll-off that is filled with these types of drilling solids to greater than 50 percent capacity becomes difficult to handle and the risk of spillage becomes greatly increased. More detailed IDW handling procedures are described in the ***TO-42 SAP Addendum***.

18.8 ANALYTICAL VALIDATION AND VERIFICATION

The analytical validation and verification activities planned under this task order include oversight of sample collection and submittal efforts, interaction with the selected laboratory, data verification, data validation, and management of electronic analytical data. Most sampling for TO0006 is for screening purposes only. Use of QA/QC samples and laboratory reported data verification/validation efforts are not expected to be extensive. The required data quality objectives are in the TO0006 Data Quality Objectives provided in Appendix A of this work plan addendum. The analytical samples anticipated to be obtained and expected level of QC (definitive or screening) for this task order are listed in the "***Draft Sampling and Analysis Plan Addendum for TO0006***" (Parsons, June 2005).

A qualified geologist or scientist will oversee each sampling event, including reviewing each Chain-of-Custody (COC) for accuracy and completeness, verifying that the laboratory sample log-in sheets match the COC forms, addressing any sample receipt issues (such as broken sample containers), and maintaining continuous contact with the laboratory regarding scheduling.

Laboratory data packages will be reviewed by a qualified chemist for completeness and adherence to laboratory variances. The extent of data review, validation, and verification will be suitable for the DQO requirements of the specific data collection activity. All associated analytical QC data will be examined, and all exceptions will be noted in both the case narrative and data verification report (DVR). The sample results associated with noncompliant QC performance will be qualified in accordance with the AFCEE and CSSA QAPP.

Following verification of the laboratory data, the data usability as related to the project DQOs will be assessed. Validation will include examination of historical data (if available), laboratory data trends, and the reasons for data collection. Based on the overall assessment of the data, flags may be removed or changed to reflect usability of the data. The basis for such changes will be detailed in the project summary report.

Electronic data submitted by the laboratories will be loaded into the CSSA GIS database, verified for accuracy, and updated to reflect all data qualifier changes incurred through the data verification and validation process. The data are to be supplied in the ERPIMS data structure format.

18.9 REPORT AND PLAN DISTRIBUTION

Two design work plans (Outfall Reuse [WBS 03000], AST Upgrades [WBS 05000]) and two implementation work plans (Enhanced Anaerobic Biodegradation Pilot Test At SWMU B-3 [WBS 04000], Work Plan For SVE Upgrades At SWMU B-3 And AOC-65 [WBS 06000]) will be created in draft and final versions for TO0006. These plans will be prepared as companion documents to this work plan addendum: the TO0006 SAP addendum, the TO0006 Quality Control Plan, and the TO0006 H&S Plan addendum. From the field efforts covered in these work plans, reports will be submitted in draft and final versions as per the government SOW and Parsons' Technical Approach described in the task order proposals. The reports include technical reports, inspection reports, and environmental systems monitoring reports. In addition, all analytical reports will be submitted as appropriate. Three new manuals and one updated O&M manual will be produced for the outfall reuse system, AST upgrades, the Bioreactor reinjection system, and SVE system(s), respectively. The project deliverables will be prepared and submitted to the following entities as detailed in Table 18.3. The draft issue of each report will be followed by a comment and response period, after which the final documents will be incorporated into the CSSA Environmental Encyclopedia unless directed otherwise by CSSA.

Table 18.3
Project Deliverables and Distribution List for TO 06

Item	AFCEE/ IWA	AFCEE/ MSCD	HSW/ PKVW	Post POC
Report of Findings-Work Plan Addendum (CDRL A001A)	Draft: 2 Final: 1 Repro 1	Draft: 0 Final: LT Repro: 0	Draft: 0 Final: LT Repro: 0	Draft: 2 Final: 1 Repro: 1
Well Construction Report (CDRL A001D)	Draft: 2 Final: 1 Repro: 1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro: 1
Push/Pull Summary Report (CDRL A001E)	Draft: 2 Final: 1 Repro: 1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro: 1
Design Work Plans (CDRL A001F)	Draft: 2 Final: 1 Repro: 1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro: 1
SVE Long-Term Monitoring Report (CDRL A001G)	Draft: 2 Final: 1 Repro: 1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro: 1
Pre-Final Inspection Report -Outfall and AST (CDRL A001H)	Draft: 2 Final: 1 Repro: 1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro: 1
Final Inspection Report – Outfall and AST (CDRL A001I)	Draft: 2 Final: 1 Repro: 1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro: 1
Project Activities Work Plan Addenda (CDRL A004)	Draft: 2 Final: 1 Repro: 1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro: 1
Environmental HSP Addenda (CDRL A005)	Draft: 2 Final: 1 Repro: 1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro: 1
Environmental SAP Addenda (CDRL A006)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1
Construction Quality Plan (CDRL A007)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1
Outfall Design Work Plan (CDRL A009A)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1
AST Design Work Plan (CDRL A009B)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1
SVE Design Work Plan (CDRL A009C)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1
Recirculation Design Work Plan (CDRL A009D)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1

Item	AFCEE/ IWA	AFCEE/ MSCD	HSW/ PKVW	Post POC
SVE O&M Plan Update (CDRL A010A)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1
Outfall System O&M Plan (CDRL A010B)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1
Technical Field Report – Outfall (CDRL A011A)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1
Technical Field Report – AST Upgrade (CDRL A011B)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1
AST and Outfall Design Plans (CDRL A013)	Draft: 2 Final: 1 Repro:1	Draft: LT Final: LT Repro: 0	Draft: LT Final: LT Repro: 0	Draft: 2 Final: 1 Repro:1
AST and Outfall As-Built Drawings (CDRL A014)	Draft: 0 Final: 1 Repro:1	Draft: 0 Final: LT Repro: 0	Draft: 0 Final: LT Repro: 0	Draft: 0 Final: 1 Repro:1

18.10 SCHEDULE

A schedule for performance of work and submittal of deliverables is updated monthly by the project manager and will be included in the monthly man-hours and expenditure reports.

APPENDIX A
DQOS

1.0 STATE THE PROBLEM

1.1 History & Background

Past operations have resulted in contamination of soil, rock, and groundwater by volatile organic compounds (VOCs) at Camp Stanley Storage Activity (CSSA). Previous investigations have documented the presence of VOCs in all three media, as well as metals in soil. Characterization of the full extent of contamination at CSSA has not been completed.

Primary concerns at CSSA involve two main VOC source areas, Solid Waste Management Unit (SWMU) B-3 and Area of Concern 65 (AOC-65). These areas have been identified as sites that have contributed to soil and groundwater contamination. Results of soil and groundwater sampling and analysis programs have identified two VOC contaminant plumes corresponding to these two source areas. Past sampling and analysis programs have identified VOCs as impacting the groundwater at concentrations exceeding Federal Safe Drinking Water Act maximum contaminant levels (MCLs) within portions of these two plumes. Off-post domestic wells near the southwest boundary of CSSA have also exhibited VOC contamination. The suspected principal source of the off-post contamination is believed to be AOC-65. Contamination emanating from SWMU B-3 is believed to have contributed to CSSA Well-16 being taken off-line as a drinking water source. Other tasks included TO0006 work not requiring collection

1.2 Objectives

The overall objectives of the current program are to address VOC contamination in the vadose zone and groundwater at SWMU B-3 and AOC-65. Specifically, this project will further characterize the spatial distribution of the SWMU B-3 plume, investigate the effectiveness of substrate injection as a method for removing contaminant mass the aquifer and vadose formation (fractures), and improve contaminant removal rates via soil vapor extraction (SVE) methods at SWMU B-3 and AOC-65.

Parsons intends to achieve these objectives by installation of multi-port monitoring well systems at SWMU B-3, by conducting a substrate injection treatability study at SWMU B-3, and expansion of existing SVE systems and installation of additional vapor extraction wells (VEWs) at SWMU B-3 and AOC-65. Analysis of the Enhanced Anaerobic Bioremediation (EAB) treatability study results will be complemented by concurrent excavation of SWMU B-3 and subsequent construction of a bioreactor in the resulting excavation trench aimed at supplementing remedial efforts at SWMU B-3.

This data quality objective (DQO) document is focused on the monitoring, treatability testing, and remediation activities planned at SWMU B-3 and AOC-65 including multi-port monitoring well installations, VEW installations, soil vapor and groundwater sampling and analysis, and other associated activities.

1.3 The Planning Team

CSSA

Ms. Glaré Sanchez, Environmental Manager, CSSA

Mr. Jeff Aston, USACE

Mr. Chris Beal, PG, Portage Environmental

Air Force Center for Environmental Excellence (AFCEE)

Mr. Brian Sigfried, Environmental Restoration Division

Mr. Edward Brown, Chemist, Environmental Restoration Division

Mr. Joe Fernando, Chemist, Portage Environmental

Parsons

Mr. Brian Vanderglas, PG, TO 006 Project Manager

Ms. Julie Burdey, PG, Client Service Manager

Mr. Gary Cobb, PG, Task Manager

Mr. Scott Pearson, PG, Task Manager

Mr. Eric Tennyson, PG, Task Manager

Ms. Samantha Elliott, MS, Task Manager

Ms. Tammy Chang, Project Chemist

Mr. Kyle Caskey, Construction Manager

Mr. Ken Rice, PE, Project Engineer

Mr. Henry Dress, PE, Project Engineer

1.4 Decision Makers

Mr. Jason Shirley, Installation Manager, CSSA

Ms. Glaré Sanchez, Environmental Manager, CSSA

Mr. Greg Lyssy, U.S. EPA, Region 6

Mr. Sonny Rayos, TCEQ Corrective Action Section

2.0 IDENTIFY THE DECISIONS

2.1 Key Decisions

Determine preferred contaminant migration pathways in vadose and fractured media.

Identify areas and stratigraphic zones of high VOC concentrations underlying AOC-65 and SWMU B-3.

Determine characteristics of geologic structures and features that influence contaminant migration (both vapor and groundwater) and may influence injected substrate movement at SWMU B-3 through multi-port well installation and monitoring.

Determine the effectiveness of substrate injection as a remedial option at SWMU B-3 by monitoring biodegradation of chlorinated aliphatic hydrocarbons.

Determine the effectiveness of continued and expanded SVE efforts at AOC-65 and SWMU B-3.

2.2 Regulatory Decisions

Verify that SVE systems air emissions concentrations do not exceed standard air exemption criteria.

Determine injection well specifications for injection permit submission for recirculation of groundwater from CS-Well 16 LGR to the bioreactor media.

Determine the waste classification of the various wastes generated during task order field activities.

Determine waste classification for Outfall 002 GAC spent carbon.

Determine waste classification of project-generated drill cuttings.

Determine waste classification of project-generated drilling fluids and well purge fluids.

2.3 SWMU B-3 Monitoring Decisions

Determine optimal locations for multi-port monitoring wells (MPMWs).

Determine optimal intervals and time between events for discrete interval monitoring within each MPMW.

Determine pre-injection baseline characteristics of groundwater at the site.

Determine optimum location for treatability pilot test injection well.

Determine optimum injection horizon within the injection well.

Determine type(s) of tracer to be used.

Determine to the extent possible the final locations and depths of new VEWs based on MPMW data and observations.

Determine optimum mixing proportions and injection volumes of the substrate to be injected.

2.4 Treatability Study Decisions

Determine effectiveness of enhanced anaerobic bioremediation at SWMU B-3.

Determine degradation rates of substrate and CAHs.

2.5 SVE Systems Expansion Decisions

Determine most effective completion depths for VEWs for expanding the SVE system and optimizing contaminant mass removal..

Determine effective and sustainable rates of contaminant removal from individual extraction wells and or the entire system.

Determine optimum system performance settings for a long-term vapor extraction system operation based on the treatability study results.

Determine appropriate operation and maintenance data collection needs to enable continued evaluation of system effectiveness and performance.

2.6 SWMU B-3 Removal Action & Bioreactor Construction

Waste characterization of material removed from excavation activities will consist of one sample per 200 cubic yards of material suspected of containing hazardous waste and one sample per 500 cubic yards of material assumed to be non-hazardous. Determinations will be made based on field screening criteria such as PID readings or detectable odors, visible staining or discoloration, or any other significant differences noted by field personnel. Material suspected of containing hazardous waste will be separated and stockpiled in separate locations until analytical results determine accurate waste characterization. All analytical samples will consist of TCLP metals (Texas 11), TCLP VOCs, and TPH.

2.7 SWMU B-3 Biroeactor O&M

Operation and maintenance data collection will consist of monthly samples for groundwater for the first 3 months of operation and quarterly thereafter. Data reporting for the UIC permit require samples for the first 3 months of operation and quarterly thereafter. If anomalous or unusual results or circumstances arise, additional samples may be collected until the source of the problems is resolved.

2.8 Future Decisions

Evaluate fate and/or migration rates of contaminants and their associated breakdown products to evaluate implementability at AOC-65.

Determine feasibility of additional VEWs and their potential locations and intervals.

Determine if system design needs upgrading to higher capacity following long-term monitoring.

3.0 IDENTIFY INPUTS

4.0 GENERAL INPUTS

Conduct down-hole geophysical surveys of new boreholes to include a combination of spontaneous potential, resistivity, caliper, natural gamma, video, optical televiewing, and other geophysical measurement techniques deemed appropriate.

Collect discrete groundwater samples from proposed MPMW intervals during construction for determining suitability as final discrete monitoring zones.

Collect discrete groundwater samples from each completed MPMW interval and other conventional MWs located near SWMU B-3 and submit the samples for VOCs (each round), and natural attenuation parameters (at least three times) laboratory analyses. Samples will be collected prior to injection of substrate and construction of bioreactor to establish baseline aquifer conditions, and then following injection and bioreactor construction.

Collect pressure transducer data and manual water level data from existing, surrounding monitoring wells.

Perform multiple tracer tests as part of substrate injection study. The first will be performed to monitor travel time from injection well to monitoring ports, while the second one will be injected with the substrate as a conservative tracer.

Incorporate existing data collected at SWMU B-3 and AOC-65 from previous investigations into the data analyses.

Download weather station data to measure precipitation event frequency, duration, and intensity.

Collect data from bioreactor O&M for determining treatment effectiveness and performance of bioreactor, plus to monitor water levels within bioreactor and water level/contaminant level response to precipitation.

4.1 Regulatory Compliance Inputs

Collect a sample of the spent carbon contained within the carbon canisters inside the on-post GAC unit. Analyze the spent carbon for TCLP-VOCs to determine waste characterization. Spent carbon intended to be recycled by vendor.

Analyze geologic data from multi-port well logging and discrete sampling to finalize injection well specifications for injection permit.

Collect composite samples of investigation derived drill cuttings after the drilling program associated with TO-0006 is completed. Submit the composite samples for VOC analysis using EPA SW-846 Method 8260b to determine waste disposal options.

Collect samples of investigation derived drilling fluids, groundwater purge fluids, and decontamination activities fluids from within each fluid container and submit the sample for VOC analysis using EPA SW-846 Method 8260b to determine waste disposal options.

UIC permit data requirements???

4.2 SVE Systems Expansion Inputs

Evaluate lithologic and geophysical logs to identify relevant subsurface features prior to initiating drilling at each subsequent VEW borehole to ensure that all data collected to date is considered when selecting new VEW locations and screened intervals.

Conduct at least one discrete packer interval soil-vapor sample extraction from each new VEW for information supporting final screened interval determination. Air samples will be submitted for VOC analysis using EPA Method TO-15.

Continue SVE systems monitoring and sampling as per the updated SVE O&M Manual.

Calculate contaminant removal rates at the end of the planed O&M period.

5.0 DEFINE BOUNDARIES

5.1 AOC-65

The boundary of the area planned for continued interim remedial measures west of Building 90 is the present AOC-65 site. The only activities planned under this task order at AOC-65 are continued SVE O&M and expansion of the SVE system at AOC-65.

5.2 SWMU B-3

The enhanced anaerobic bioremediation pilot test boundary extends beyond the approximate assigned boundaries of the SWMU B-3 trench and includes the underlying contaminant plume in the aquifer. The monitoring area for the studies encompass existing monitoring wells CS-MW1-LGR, CS-MW16-LGR, and CS-Well D, extending vertically to the basal water-bearing zone of the LGR Formation. One deeper multi-port well will have two intervals in the Bexar Shale and two in the Cow Creek. The study boundary is sized to facilitate accurate determinations of conditions with bearing on the project scope. The study boundary area may be expanded as necessary to understand the subsurface geologic structural conditions that impact soil gas and groundwater contaminant migration; determining the progress of monitored natural attenuation for groundwater impacted by VOCs at SWMU B-3; and the relationship between precipitation event frequency, duration, and intensity and vertical infiltration.

The vertical extent of the study area extends through the vadose zone and into the lower most water-producing zone of the LGR.

5.3 Temporal Boundaries

Changes in climatic conditions such as severe weather may place time constraints on specific fieldwork subtasks, and may cause delays.

Normal turnaround time for screening sample laboratory analysis reports will be 21 days. Shorter turnaround times are available if the situation warrants it.

5.4 Work Agreement Boundaries

Timely execution of agreements between the government, prime contractor, and subcontractors is critical toward meeting the project completion schedule. Critical tasks such as well installation and injection testing rely on proper oversight at all levels and timely completion by the field personnel.

5.5 Regulatory Compliance Boundaries

Analytical testing results for all media generated may be expedited to facilitate timely material disposal to remain in compliance with temporary storage constraints.

5.6 SVE Systems Expansion Boundaries

Information made available through previous geophysical studies, logging, and conclusions of the ***Draft AOC-65 Soil Vapor Extraction Operations and Maintenance Assessment Report (2004),*** and discrete packer soil-vapor extraction data will be used to determine the optimum completion specifications of new VEWs.

Information made available through previous geophysical studies, logging of new multi-point wells, data from existing SWMU B-3 VEWs and discrete packer soil-vapor extraction data from new boreholes will be used to determine the optimum completion specifications of new VEWs.

6.0 DEVELOP A DECISION RULE

7.0 ARE THE DISCRETE MPMW INTERVALS AND SCREENED INTERVALS OF THE VEWS LOCATED IN THE MOST EFFECTIVE LOCATION (DEPTH INTERVAL AND LATERAL SPACING)?

Is the location of the injection interval in the injection well at the most appropriate location for effective distribution of substrate?

Does the enhanced anaerobic biodegredation pilot test show this method to be a effective at remediating contaminated groundwater in Plume 1 underlying SWMU B-3?

Are the emission controls for the expanded SVE ventilation systems in compliance with applicable requirements and below OSHA exposure criteria?

What are the apparent primary migration routes for contaminants to the groundwater and where are the largest deposits of contaminants located (depth intervals and lateral locations) at SWMU B-3?

How does the waste (drill cuttings, excavated material, water from drilling operations, water from SVE systems knock-out pots, etc) generated under this task order need be managed?

8.0 SPECIFY TOLERABLE LIMITS FOR DECISION ERRORS

Currently, the AFCEE QAPP version 3.0 is being utilized by CSSA. The QAPP specifies tolerable limits for errors.

Several types of data will be collected for the program that is considered screening level data. Decision errors are not assigned to screening level data as this data will not be used to formulate regulatory or closure decisions. The majority of the screening level information will be used to monitor and evaluate the effectiveness of substrate injection as a remedial measure. For this reason, typical QA/QC practices to assure confidence and reliability of the data is required, and extensive QA/QC for data used to demonstrate closure is not required.

9.0 OPTIMIZE THE DESIGN FOR OBTAINING DATA

Continue to evaluate the data collection program for opportunities to optimize data collection and to prevent or minimize collection of data that is not adding value to the evaluation of the studies or providing critical information for decisions described in these DQOs.