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Final

Treatability Study Work Plan
Operable Unit #1, Site 47 Interim Remedial Action for Groundwater Hotspot Remediation
Marine Corps Air Station
Cherry Point, North Carolina

Contract Task Order 0136

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Department of the Navy
Atlantic Division
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1.0 Introduction

This Work Plan describes the proposed groundwater treatability study to be conducted at Site 47, within the Stripper Barn area of Operable Unit 1 (OU1) at the Marine Corps Air Station Cherry Point (MCAS Cherry Point), near Havelock, North Carolina. The treatability study is being proposed as an Interim Remedial Action (IRA) at the site, consisting of enhanced, in-situ bioremediation of volatile organic compounds (VOCs) in the groundwater plume underlying the Stripper Barn. Groundwater contamination in the vicinity of the Stripper Barn consists of commonly used industrial solvents (1,1,1-trichloroethane [1,1,1-TCA], tetrachloroethene [PCE], and trichloroethene [TCE]), their anaerobic breakdown products (1,1-dichloroethane [1,1-DCA], 1,1-dichloroethene [1,1-DCE], 1,2-dichloroethene [1,2-DCE], and vinyl chloride [VC]), and some benzene, toluene, ethylbenzene, and xylene (BTEX). The chlorinated solvents, referred to in the Work Plan as chlorinated volatile organic compounds (CVOCs), are the principle contaminants of concern for this treatability study. The study will be performed to evaluate the effectiveness and implementability of treating these CVOCs by injecting Hydrogen Release Compound (HRC®) into the subsurface to enhance anaerobic biodegradation of CVOCs in the groundwater by indigenous microorganisms.

The overall project goal is to conduct a field treatability study designed to bioremediate CVOCs in the principal contaminant plume at Site 47 to levels consistent with the treatment goal. The primary project treatment goal is a total VOC concentration less than 1 milligram per liter (mg/L).

The specific objectives of the treatability study at Site 47 are to:

- Establish a system of groundwater monitoring wells for the treatability study and conduct an initial round of sampling and analysis (VOCs and other pertinent parameters) immediately prior to HRC injection to determine baseline water quality and conditions,
- Develop an injection grid plan and inject HRC into the target groundwater contamination plume within the upper Surficial Aquifer to enhance the anaerobic bioremediation of CVOCs,
- Conduct groundwater monitoring at selected intervals to track changes in VOC concentrations and other parameters over time, and
- Perform data analysis and interpretation to evaluate the effectiveness and progress of bioremediation.

This Work Plan is divided into five sections. The remainder of Section 1 describes the site location, general site hydrology, and environmental history of MCAS Cherry Point, OU1, and the Stripper Barn area. Section 2 presents the results of the data acquisition (DA) field investigation conducted in March 2000 on which this treatability study is based. Section 3 presents an analysis of enhanced bioremediation alternatives and the rationale for the chosen alternative. Section 4 presents the technical approach for the treatability study,

including the application of HRC; groundwater monitoring, sampling, and analysis to determine the effectiveness of remediation; data analysis, interpretation, and reporting; and management of residuals. Section 5 lists the references cited in this Work Plan.

1.1 Site Location

MCAS Cherry Point is part of a military installation located in southeastern Craven County, north of Havelock, North Carolina. The MCAS is located on an 11,485-acre tract of land bounded on the north by the Neuse River estuary, on the east by Hancock Creek and on the South by North Carolina Highway 101. The irregular west boundary lies approximately 0.75 miles west of Slocum Creek.

Operable Unit 1 (OU1) is an industrial area in the southern portion of the Air Station that was commissioned in 1942. OU1 covers 565 acres and is bounded to the northwest by "C" Street, to the southwest by the East Prong of Slocum Creek, to the southeast by Runway 5 and to the northeast by Sixth Avenue. It consists of five general areas: the Naval Aviation Depot (NADEP); Sandy Branch Landfill (Site 16); the Industrial Wastewater Treatment Plant (IWTP); the Defense Reutilization and Marketing Office (DRMO); and several support facilities including office and warehouse buildings, a gasoline station, and automobile and airplane maintenance shops. The ground surface in this area is relatively flat with an elevation that ranges from 18 to 24 feet above mean sea level (msl).

Site 47 is the Industrial Area Sewer System. Portions of the Site 47 sewer system are located beneath and around the Stripper Barn (Site 92) and in the vicinity of the former plating shop (Site 51). For the purposes of this project, these sites will be referred to as the Stripper Barn area, as presented in Figure 1-1.

1.2 General Site Hydrogeology

The facility is underlain by four non-saline aquifers composed primarily of sand and sandy limestone to a depth of approximately 500 feet. These aquifers from the shallowest to the deepest are the Surficial Aquifer, the Yorktown Aquifer, the Pungo River Aquifer, and the Castle Hayne Aquifer (used for industrial or potable water). Below a depth of 500 feet, the aquifers become saline. Four Confining Units separate the aquifers beneath the facility: the Yorktown Confining Unit, the Pungo River Confining Unit, the Upper Castle Hayne Confining Unit, and the Lower Castle Hayne Confining Unit. The scope of this IRA for this site is limited to the Surficial Aquifer. For this project, the Surficial Aquifer has been divided into two components, specifically the upper Surficial Aquifer and the lower Surficial Aquifer. The boundary between the upper Surficial Aquifer and the lower Surficial Aquifer is defined by a gradational contact in a coarsening-downward sequence. The upper Surficial Aquifer extends from the water table (approximately 7-10 feet below ground surface [bgs]) to approximately 35 feet bgs. The lower Surficial Aquifer extends from approximately 36 feet bgs to the top of the Yorktown Confining Unit, which ranges in depth from approximately 46 to 50 feet bgs at OU1.

1.3 Environmental History

1.3.1 MCAS Cherry Point

Environmental investigations have been conducted at MCAS Cherry Point under several regulatory and Navy programs. Initially, the investigations were conducted under the Navy Assessment and Control of Installation Pollutants (NACIP) Program. The NACIP Program was developed under the Comprehensive Department of Defense Installation Restoration (IR) Program, which was modeled after the U.S. Environmental Protection Agency (EPA) Superfund Program, authorized by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980. An Initial Assessment Study (IAS) was conducted in 1983 as the first step in the NACIP Program, and it identified 14 suspect sites that required further investigation. Investigation activities were conducted at several of these sites in the mid-1980s to determine through sampling and analyses whether specific contaminants existed at concentrations considered to be hazardous.

In 1988, the EPA performed a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) at MCAS Cherry Point, the first step under the RCRA corrective action process. The RFA identified 114 solid waste management units (SWMUs) and 2 areas of concern (AOCs). In 1989, the Navy entered into a RCRA Administrative Order on Consent with EPA to perform a RCRA Facility Investigation (RFI) at 35 of the 114 identified sites, including all sites that were being investigated as CERCLA sites under the Navy's IR Program. In 1994, MCAS Cherry Point was scored and ranked by EPA for inclusion on the National Priorities List (NPL) as a CERCLA Superfund site. Because of the NPL listing and the Consent Order, ongoing IR investigations are being conducted to meet the requirements of both RCRA and CERCLA.

1.3.2 OU1

In order to provide an efficient grouping of related sites, representatives of MCAS Cherry Point, Atlantic Division (LANTDIV), U.S. EPA, the State of North Carolina, and Halliburton NUS Corporation organized the sites into thirteen Operable Units. The rationale behind the organization of the sites into Operable Units is contained in the MCAS Cherry Point Installation Restoration Site Management Plan (LANTDIV, 3rd Quarter, Fiscal Year 1993).

Eight sites within OU1 were identified in the 1989 Consent Order. Additional sites and Points of Environmental Interest (POEIs) were identified since the Consent Order, including six sites that were identified as part of the Base Realignment and Closure (BRAC) program within OU1. There are many underground storage tanks (USTs) located within OU1 that are being addressed under the Air Station UST program.

In OU1, the most prevalent contaminants in groundwater are benzene and CVOCs. In particular, TCE, VC, and 1,2-DCE are present throughout OU1. Miscellaneous other VOCs exist in some of these areas.

In addition to the enhanced bioremediation IRA planned for the Stripper Barn area, the following steps have been taken to address remediation of these other portions of the OU1 plume:

- Hanger 130 Bldg. 3996: Product Recovery
- Building 137: Product Recovery
- Tank Farm C: Product Recovery
- Hanger 133: Product Recovery
- NADEP Central Hotspot: Groundwater Pump and Treat
- Site 16: Air Sparging/Vapor Extraction

Figure 1-2 shows where the enhanced bioremediation IRA at the Stripper Barn area is located relative to the other remediation systems. Tetra Tech NUS (TTNUS) is planning a Remedial Investigation and Feasibility Study (RI/FS) for the entire OU1 to begin in the near future. Investigation activities described in this Work Plan will be coordinated with TTNUS, and the results of the IRA will be used in the development of an overall remedy for OU1.

1.3.3 Stripper Barn area

Building 137, which measures 1,200 ft by 700 ft, was originally constructed in 1943 to serve as a corrosion control and clean shop. It has also housed a components shop, nonmetal fabrication and manufacturing shops, turbine accessories shop, engine test cell, metal components shop, engineering laboratory, and an aircraft rework shop. The Stripper Barn is located within the NADEP at the north end of Building 137. The groundwater plume at the Stripper Barn resides beneath three IR sites:

- **Site 47 (Industrial Area Sewer System):** Site 47 only encompasses the industrial sewers within OU1.
- **Site 51 (Building 137 Plating Shop):** Site 51 is located on the southeast side of Building 137 in the NADEP, to the southeast of Site 92.
- **Site 92 (Stripper Barn):** Site 92 is located within the NADEP at the north end of Building 137, and is due north of Site 51.

A brief history of each of the three Stripper Barn sites is presented in the following subsections.

1.3.3.1 Site 47 – Industrial Area Sewer System

Since 1942, the industrial sewer system has transferred wastewater from various parts of OU1 to the Industrial Wastewater Treatment Plant (IWTP) for pretreatment. Industrial processes that may result in discharges to this system include metal plating, metal finishing, solvent degreasing, paint stripping, painting, fuel storage, fueling, aircraft washing, and general maintenance. The waste streams include inorganic and organic chemical wastes generated from industrial activities at NADEP. All waste streams containing organic chemicals are batch tested prior to discharge to the sewer lines. The batch testing results are sent to EAD for approval to discharge. Approval is granted only if the batch testing results indicate a concentration of total toxic organics of less than 2.13 mg/L, which is the pre-treatment limit for the sanitary sewer system at the Air Station. Inorganic waste streams tend to be generated routinely and their makeup is known and consistent. Therefore, inorganic waste streams are not batch tested before being discharged to the sewer lines and conveyed to the IWTP.

RFI activities conducted in 1991 and 1993 included infiltration and inflow studies, television camera inspection, smoke and dye testing, and pressure testing. These studies concluded that the Stripper Barn area had significant sewer leakage problems. Of all areas investigated, the sewers in the Stripper Barn area were in the worst condition and the leaking chemicals (solvents, plating chemicals, and cleaning solutions) were the most concentrated. Of the 20 sewer line segments, 8 were given a condition rating of "Poor" indicating the presence of a problem area. These studies instigated the collection of groundwater and soil samples at numerous locations along the active portion of the industrial sewer system. Segment 198 of the industrial sewer system, a 6-inch pipeline in the Building 137 Stripper Barn area, has been repaired. Repair of other segments of the sewer line is an ongoing Air Station activity. Reportedly, the IWTP discharge to the Sewage Treatment Plant (STP) formerly ran to the southwest along "A" Street and then ran north along Cunningham Avenue or Roosevelt Boulevard. This abandoned section of the industrial sewer system has not been investigated.

The industrial sewer lines shown in Figure 1-1 are still in place with one exception. The line shown running diagonally between Sites 51 and 92 is no longer in use, having been abandoned in place during construction activities in 2000 to install an autoclave in the former Plating Shop (Site 51). The abandonment activities reportedly consisted of the excavation and removal of the portion of the sewer line beneath the autoclave foundation and the abandonment in place of the remainder of the line segment by capping it at both ends. The significance of this is that the abandoned sewer line was the only segment of industrial sewer line located immediately within the project boundaries of this treatability study and the VOC plume to be addressed by the project. The other sewer lines are located upgradient of the VOC plume beneath the former plating shop, and are not the source of the groundwater contamination to be addressed by the treatability study.

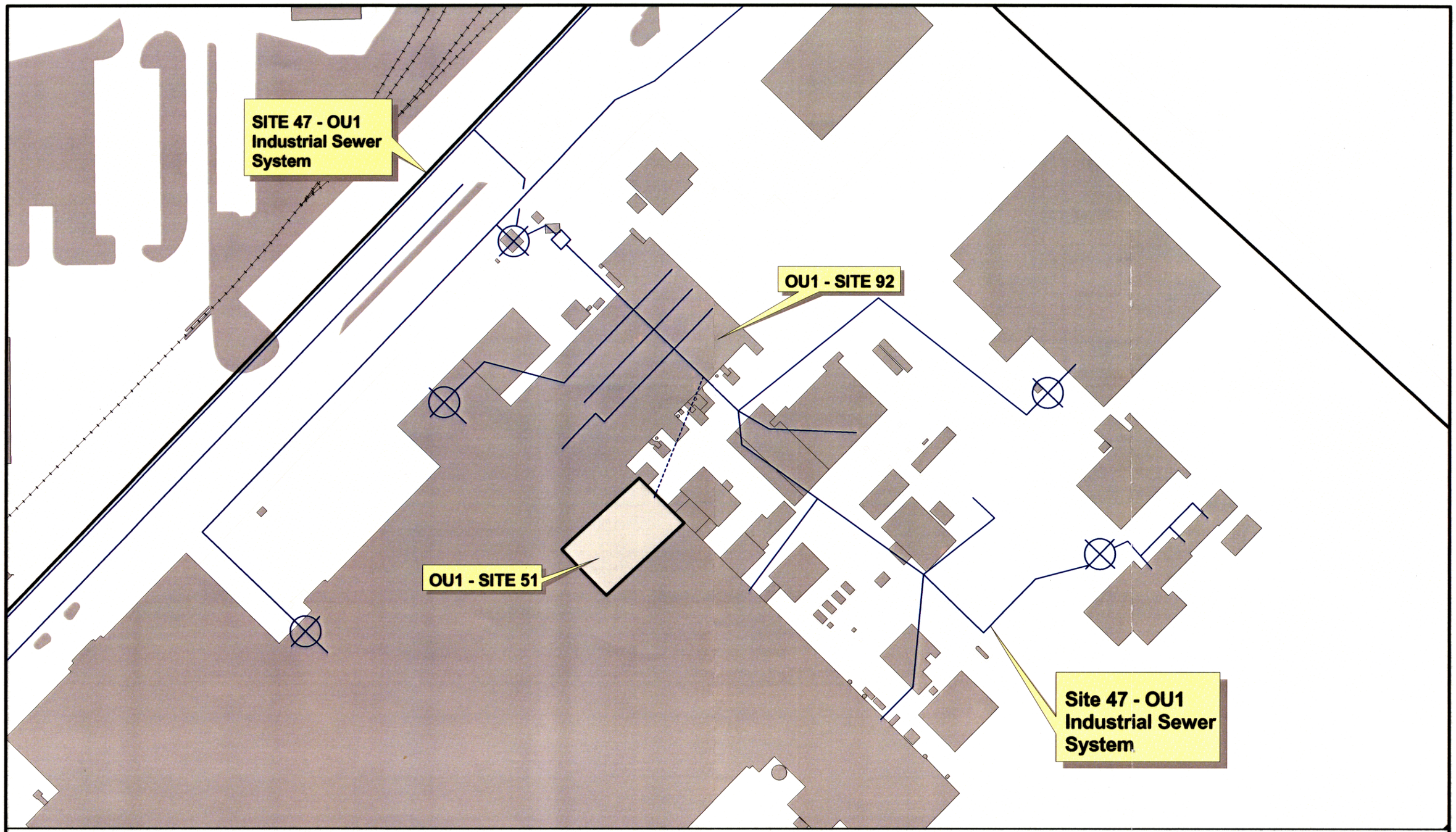
1.3.3.2 Site 51 – Building 137 Plating Shop

Site 51, Plating Shop 93103A, was located south of the Stripper Barn at the north end of Building 137 until 1990. It was built in 1942 for plating operations such as acid rinses, chromic dips, and cadmium plating. The shop contained a concrete and terra cotta sump approximately two and a half feet below the floor, with concrete piers spaced throughout for supporting tanks and plating equipment. The sump was covered with wooden grating to allow workers access to the tanks and plating equipment, and it drained to the industrial sewer system (Site 47) lines that lead to the IWTP. The plating shop was in operation from 1942 to 1990 when it was formally closed and plating operations were moved to a new location. The drain from the sump to the IWTP was plugged in 1987. Investigations in 1991 and 1992 included soil and groundwater sampling to support the removal, renovation, and disposal activities. The sump was removed, the area was backfilled, and a concrete floor was constructed. The plating shop was decontaminated and renovated in 1996, and the area is now used for storage of nonhazardous parts and supplies. An autoclave is currently under construction at Site 51. Contaminated soil below the vertical limits of excavation remains at the site, beneath the concrete floor.

1.3.3.3 Site 92 – Stripper Barn

Site 92 is located within the NADEP at the north end of Building 137, and is due north of Site 51. The area around the site is covered with buildings and concrete. Portions of the industrial sewer system (Site 47) are located beneath and around the Stripper Barn. The

primary operation inside the Stripper Barn is the stripping of paint from aircraft. In the past, large quantities of solvent were used to remove the paint, and the spent solvent flowed into the industrial sewer system. Today, methods that minimize the use of chemicals are used. A storm drain is located northeast of the Stripper Barn area. Spills that occurred outside the building could have flowed toward this drain.



LEGEND

- Sites
- Buildings
- Railroad
- Industrial Sewer System
- Industrial Sewer System - Abandoned

N

50 0 50 100 150 200 Feet

Figure 1-1
STRIPPER BARN AREA
SITE 47 IRA
MCAS CHERRY POINT

CH2MHILL

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0242IAB14

Hanger 130
Building 3996
Product Recovery

Stripper Barn
Enhanced Bioremediation

Tank Farm C
Recovery

Hanger 133
Product Recovery

Site 16 AS/VE

Building 137
Product Recovery

NADEP Central Hotspot
Groundwater Pump and Treat System

LEGEND

Total CVOC Contours
by TtNUS - 1998

- 10 ppb
- 100 ppb
- 1000 ppb
- 10000 ppb

- CH2MHILL Investigation Areas
- TtNUS Investigation Areas
- Buildings
- Railroad

N

500 0 500 1000 1500 2000 2500 3000 3500 Feet

Figure 1-2
OU1 GROUNDWATER
REMEDIATION SYSTEMS
SITE 47 IRA
MCAS CHERRY POINT

CH2MHILL

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2.0 Results from the Data Acquisition Field Investigation

2.1 Introduction

The data acquisition (DA) field activities were performed at the Stripper Barn area of OU1, at MCAS Cherry Point from March 3 to March 24, 2000. The primary objective of the DA investigation was to gather additional information necessary to assess the nature and extent of groundwater contamination and develop the IRA at Site 47. This was accomplished by installing and monitoring an array of temporary and permanent monitoring wells at the site.

The DA field investigation activities included the following tasks:

- Installation and sampling of 13 temporary monitoring wells;
- Installation and sampling of 12 permanent groundwater monitoring wells based on the results of sampling the temporary wells; and
- Soil sampling.

All field investigation activities were conducted in accordance with the Master Field Sampling Plan (FSP) for MCAS Cherry Point (Brown and Root Environmental, April 1998a) and the site-specific FSP (CH2M HILL, Inc., January 2000).

This section summarizes the field activities that took place during the DA investigation, as well as the results of the DA investigation. Section 2.2 describes the field activities and sampling results associated with the temporary wells (screening phase) and Section 2.3 describes the field activities and sampling results associated with the permanent wells (data acquisition phase). A summary of validated analytical results is provided in Appendix A. The full data validation report is presented in Appendix B.

2.2 Screening Phase

This section describes the activities associated with the installation of 13 temporary wells in the upper portion of the Surficial Aquifer as part of the screening phase of the DA investigation. The purpose of the screening phase was to help determine the extent of the chlorinated volatile organic compound (CVOC) plume at the Stripper Barn and assist in selecting the final number and locations of the permanent monitoring wells at OU1.

2.2.1 Temporary Monitoring Well Installation

During the screening phase of the DA investigation, 13 temporary wells (OU1-47TW01 through OU1-47TW13) were installed in and around the Stripper Barn area using a dual-equipped, direct-push/hollow stem auger rig. The dual rig was capable of collecting soil samples through the use of a 4-foot split spoon lined with an acetate sleeve. Split spoon samples were collected from the entire length of the boring. A photoionization detector

(PID) was used to screen the soils for organic vapors. Lithologic descriptions of each of the borings, along with the PID measurements for the temporary wells are provided in Appendix C. Figure 2-1 presents the locations of the temporary monitoring wells at OU1. Table 2-1 presents the total depths of each of the temporary monitoring wells.

The temporary wells were constructed of 1-inch diameter Schedule 40 PVC pipe with a 10-foot screened interval. The screened interval consisted of 0.01-inch wide slots. Silica sand was placed in the annular space of the boring. The sand was placed from the bottom of the well up to a depth of 1 foot below ground surface (bgs), at which point a bentonite hole-plug was installed. The bentonite hole-plug was hydrated with potable water to form a water-tight seal and prevent any infiltration of surface runoff into the temporary well. Due to the high traffic associated with activities at OU1, the wells were completed just below grade, sealed with a water-tight cap or tape, and covered to prevent damage from equipment.

Each temporary well was developed with the use of a peristaltic pump and new tubing. During the development phase of the wells, the following geochemical parameters were measured in the field: dissolved iron II (ferrous iron), sulfide, pH, conductivity, turbidity, dissolved oxygen (DO), temperature, total dissolved solids (TDS), and oxidation/reduction potential (ORP). The measured field parameters are presented in Appendix D.

2.2.2 Temporary Monitoring Well Sampling

The 13 temporary monitoring wells were sampled within 24 hours of installation. In cases where development reduced turbidity sufficiently, samples were collected immediately following development for offsite analysis. In the event of elevated turbidity, the monitoring wells were sampled the next day to allow turbidity in the well to reduce. To minimize aeration and agitation of the groundwater sample, the samples were collected using the "straw method". This method involved inserting the sample tubing to the depth of the well screen. The sampler's hand would then be placed over the top of the tubing, creating a vacuum. The sample tubing would then be removed from the well and the sample transferred into the samp. containers. The samples were packed and shipped to STL/Quanterra Laboratories (North Canton, Ohio), and analyzed within 24 hours after sample receipt. Chains of custody for these samples are provided in Appendix E.

2.2.3 Temporary Monitoring Well Abandonment

Following confirmation of sample receipt by the analytical laboratory, each temporary well was abandoned. Abandonment consisted of removing the PVC piping and immediately filling the hole with bentonite pellets. Each boring was then capped with a concrete plug.

2.2.4 Screening Phase Results

Analytical results indicate that the highest concentrations of VOCs were detected in the immediate vicinity of the Stripper Barn and former plating shop. The validated analytical results for the groundwater samples are summarized in Tables A1 and A2 of Appendix A. Figure 2-2 shows the VOC detections in the temporary wells.

The only detection of 1,1,1-trichloroethane (1,1,1-TCA) was in temporary well TW-09. The transformation products of 1,1,1-TCA include 1,1-dichloroethene (1,1-DCE) (abiotic transformation) and 1,1-dichloroethane (1,1-DCA) and chloroethane (CA) (biological

transformation). CA was not detected in any of the temporary wells. 1,1-DCE was detected in temporary well TW-09, and 1,1-DCA was detected in temporary wells TW-09 and TW-13.

The highest concentration of tetrachloroethene (PCE) was detected in temporary well TW-07. However, due to the low levels of PCE and the lack of other VOC detections in the vicinity of TW-07, this area was not considered the "hotspot" of contamination at the site. The highest concentration of trichloroethene (TCE) was detected in temporary well TW-13. TCE can be formed by anaerobic biodegradation of PCE, but also can be found as a result of a direct release. The anaerobic biodegradation of TCE produces daughter products of primarily cis-1,2-DCE and VC. Total 1,2-DCE was detected in temporary wells TW-01, TW-02, TW-05, TW-08, and TW-13, with a maximum concentration of 22 micrograms per liter (µg/L) in temporary well TW-13. VC was detected in temporary wells TW-05 and TW-08, with a maximum concentration of 21 µg/L in temporary well TW-05.

The presence of anaerobic biodegradation daughter products indicate that reductive dechlorination (RD), the principal mechanism responsible for transformation of CVOCs in contaminated groundwater, is taking place at the site, at least in some areas, and that there are indigenous microorganisms capable of RD at the site.

Field-measured geochemical parameters, such as oxidation-reduction potential (ORP), dissolved oxygen (DO), ferrous iron, and sulfide are presented in Figure 2-3 and Table D1 of Appendix D. Highly reducing conditions (i.e. low ORP), groundwater deficient in competing electron acceptors, such as DO and Fe(III), or ferric iron, and elevated concentrations of Fe(II), or ferrous iron and sulfide suggest conditions conducive to anaerobic biodegradation. Among the temporary wells where anaerobic biodegradation daughter products were detected (as summarized above), the low ORPs suggest moderately favorable to favorable conditions for RD (ORP <-100 mV suggests the reductive pathway is favorable, ORP <50 mV suggests the reductive pathway is moderately favorable).[1] Half the DO concentrations among these same temporary wells are unfavorable for RD, specifically above 0.5 mg/L (DO concentrations below 0.5 mg/L suggest favorable conditions for RD).[1] On the other hand, the presence of ferrous iron in concentrations greater than 1 mg/L indicates the reduction of the competing electron acceptor ferric iron.[1] The lack of sulfide is not favorable for RD.

Although certain geochemical parameters are not ideal for supporting intrinsic RD, the presence of anaerobic degradation daughter products (CVOCs) indicate that RD is possible and is taking place to some degree within certain areas of the site. The data suggest that addition of an electron donor is necessary to deplete competing electron acceptors (DO) and enhance RD of CVOCs.

2.3 Data Acquisition Phase

This section describes the activities associated with the installation of 12 permanent groundwater monitoring wells within the Surficial Aquifer at OU1. The purpose of the permanent monitoring well installation was to determine the extent of the CVOC plume in the Stripper Barn area and to provide subsequent routine monitoring locations.

[1] U.S. EPA, September 1998.

2.3.1 Permanent Monitoring Well Installation

Eight of the 12 permanent monitoring wells were installed within or alongside the former plating shop and Stripper Barn based on the consistent detection of elevated levels of most VOCs in these areas. The remaining four permanent monitoring wells were situated along the perimeters of the site in order to better define the lateral extent of the contamination.

Twelve soil borings were completed for the purposes of obtaining lithologic descriptions, collecting soil samples, and installing the permanent groundwater monitoring wells. To obtain samples for lithologic descriptions and for offsite analyses of the soil, split spoon samples were obtained using a dual rig and a 4-foot split spoon lined with an acetate sleeve. During the description of the soils, a photoionization detector (PID) was used to screen the soils for organic vapors. Lithologic descriptions of each of the borings, along with PID measurements, for the permanent monitoring wells are provided as Appendix F.

Following completion of the soil sampling, a 9-inch diameter boring was completed using a 4.25-inch inside diameter (ID) hollow stem auger. For borings in which monitoring wells were to be installed in the lower portion of the Surficial Aquifer, the lead auger was fit with a wooden plug to prevent the movement of material into the augers. Once the desired well depth was reached, the plug was pushed out of the bottom of the augers.

The permanent groundwater monitoring wells (OU1-47GW01 through OU1-47GW12) were installed in both the upper (no greater than 25 feet bgs) and lower (no greater than 50 feet bgs) portions of the aquifer to determine the vertical extent of CVOC contamination. Figure 2-1 presents the locations of the newly installed and existing permanent monitoring wells at OU1.

The monitoring wells consist of 2-inch inside diameter Schedule 40 PVC pipe with a 10-foot screened interval. The screened interval consisted of 0.01-inch wide slots. The well screens installed in the upper Surficial Aquifer were installed such that the top of the well screen was approximately 5 to 14.5 feet bgs. The lower Surficial Aquifer monitoring wells were installed with 10-foot screen lengths with the bottom of each screen intersecting the top of the Yorktown Confining Unit, which ranged in depth from 46 to 50 feet bgs at OU1. Table 2-2 summarizes construction information for both the new and existing permanent monitoring wells.

Each well was constructed with a sand filter pack, which extended from the bottom of the well to at least 2 feet above the top of the screen. A minimum of 2 feet of bentonite hole-plug was placed on the filter pack and then allowed to hydrate. The remainder of the annular space was filled with a cement-bentonite grout to a depth of 1 foot bgs. Once the grout had cured, a stainless steel flush mounted well cover was installed over the PVC pipe. The flush casing was cemented in place with high pressure (5,000 pounds per square inch) Quikrete cement. The top of each well was fit with a locking pressure cap. The permanent well construction logs are provided in Appendix G. The permanent wells were thoroughly developed after installation.

2.3.2 Permanent Monitoring Well Groundwater Sampling

Groundwater parameters were monitored in the field in accordance with Section 2.6 of the Master FSP for MCAS Cherry Point. A total of 17 permanent wells (12 newly installed and five existing) were sampled using a low-flow purging technique. The 12 newly installed

wells that were sampled were OU1-47GW01 through OU1-47GW12. The five existing wells that were sampled were OU1-51GW02 and OU1-MW22 through OU1-MW25. During purging of the wells, the following geochemical parameters were measured in the field; ferrous iron, sulfide, pH, conductivity, turbidity, DO, temperature, TDS, and ORP. The measured field parameters are presented in Appendix H.

Samples were analyzed at an offsite analytical laboratory (STL/Quanterra Laboratories) for Target Compound List (TCL) VOCs, nitrate, nitrite, sulfate, dissolved manganese, methane, ethane, ethene, chloride, chemical oxygen demand (COD), total organic carbon (TOC), and total alkalinity.

2.3.3 Permanent Monitoring Well Sampling Results

The validated analytical results for the groundwater samples are summarized in Tables A3 and A4 of Appendix A. VOCs were detected in 11 of 17 permanent monitoring wells, as shown in Figure 2-4. Detected compounds include chlorinated ethenes (TCE; 1,1-DCE; 1,2-DCE; VC), chlorinated ethanes (1,1,1-TCA; 1,1-DCA; CA), methylene chloride, aromatic hydrocarbons (benzene, toluene, xylenes, ethylbenzene), and acetone. Figures 2-5 and 2-6 present the concentrations of ethene and ethane compounds, respectively, as well as the concentrations of chloride and TOC.

TCE and 1,1,1-TCA were the highest-level chlorinated ethene and ethane compounds detected in the monitoring wells. These contaminants and their degradation daughter compounds persist primarily in the shallow upper Surficial Aquifer in proximity to the Stripper Barn, former plating shop, and areas immediately downgradient. The highest concentrations of both TCE (8,500 µg/L) and 1,1,1-TCA (49,000 µg/L) were detected in the upper Surficial Aquifer at monitoring well OU1-47GW07 in the former plating shop.

The transformation products of 1,1,1-TCA include 1,1-DCE (abiotic transformation) and 1,1-DCA and CA (biological transformation). Although none of the daughter products were detected in monitoring well OU1-47GW07, the daughter products were detected in one upper Surficial Aquifer monitoring well upgradient of OU1-47GW07 (OU1-47GW05), and in two upper Surficial Aquifer monitoring wells downgradient of OU1-47GW07 (OU1-51GW02 and OU1-47GW12). The maximum concentration of 1,1-DCA (350 µg/L) was detected in the downgradient monitoring well OU1-51GW02. CA was only detected in the upgradient monitoring well OU1-47GW05, at a concentration of 21 µg/L. The anaerobic biodegradation of TCE produces daughter products of primarily cis-1,2-DCE and VC. One or more of these daughter products were detected in two upper Surficial Aquifer monitoring wells (OU1-47GW05 and OU1-47GW09) upgradient of OU1-47GW07, and in one upper Surficial Aquifer monitoring well (OU1-51GW02) downgradient of OU1-47GW07. The maximum concentration of VC (160 µg/L) and total 1,2-DCE (39 µg/L) was detected in the downgradient upper Surficial Aquifer monitoring well OU1-51GW02.

Concentrations of CVOCs tend to be relatively low or nondetectable in these areas in the deeper lower Surficial Aquifer. The exception is monitoring well OU1-MW23 (located northwest of Building 137), where elevated levels of TCE (1,500 µg/L) and related daughter compounds were detected. Low-level ethane was also detected at this well. Unlike that associated with the Stripper Barn and former plating shop, the contamination at OU1-MW23 exists in the lower Surficial Aquifer. No chlorinated ethenes or ethanes were detected at shallower depths in nearby monitoring well OU1-MW22, which is screened in

the upper Surficial Aquifer. Based on surrounding concentrations, it is unlikely that the source of contamination detected at OU1-MW23 is from the Stripper Barn/former plating shop areas. Because no PCE, TCE, DCE, or VC were detected in the historical sampling data for this well, the recent detection of chlorinated ethenes at OU1-MW23 suggests a possible release since 1996, likely from the adjacent segment of Industrial Sewer System pipe.

As with the temporary well data, the presence of anaerobic biodegradation daughter products indicate that RD, the principal mechanism responsible for transformation of CVOCs in contaminated groundwater, is taking place at the site, at least in some areas, and that there are indigenous microorganisms capable of RD at the site.

Total CVOC concentrations exceeding the primary clean-up goal of 1 mg/L in the upper Surficial Aquifer occur beneath the former plating shop, as illustrated in Figure 2-7. Shown in Figure 2-8, total CVOC concentrations exceeding 1 mg/L in the lower Surficial Aquifer exist adjacent to the segment of Industrial Sewer System pipe at OU1-MW23. With the exception of OU1-51GW02 in the upper Surficial Aquifer, total CVOC concentrations were less than 0.5 mg/L in both the upper and lower Surficial Aquifers at the remaining monitoring wells sampled.

Figure 2-9 and Table H-1 of Appendix H present the field-measured values for DO, ORP, ferrous iron and sulfide. Highly reducing conditions (i.e., low ORP), and groundwater deficient in competing electron acceptors, such as DO, nitrate, and nitrite, and elevated concentrations of Fe(II), or ferrous iron, and sulfide suggest conditions favorable for anaerobic biodegradation. Among the upper Surficial Aquifer monitoring wells where anaerobic biodegradation daughter products were detected (as summarized above), some had low ORP values, favorable for reductive dehalogenation, whereas other monitoring wells had high ORP values, unfavorable for reductive dehalogenation (ORP <-100 mV is favorable and ORP <50 mV is moderately favorable). DO concentrations are well above 0.5 mg/L, which is unfavorable for reductive dehalogenation. On the other hand, concentrations of the other competing electron acceptors, nitrate and nitrite, were virtually undetected. The presence of ferrous iron greater than 1 mg/L, and detections of Mn(III) also indicate the reduction of competing electron acceptors Fe(III) or ferric iron, and Mn(IV), respectively. The lack of sulfide is not favorable for RD.

The presence of methane in the upgradient monitoring well OU1-47GW05 greater than 0.5 mg/L is indicative of methanogenic conditions. Redox conditions associated with methanogenesis are generally required for complete dechlorination of CVOCs. Chloride, an end product of reductive dehalogenation is present in elevated concentrations across the site. Lastly, the presence of ethane and ethene at the site is an indication that some VOCs have been completely dechlorinated.

As with the temporary well data, although certain geochemical parameters are not ideal for supporting intrinsic RD, the presence of anaerobic degradation daughter products (CVOCs) indicate that RD is possible and is taking place to some degree within certain areas of the site. The data suggest that addition of an electron donor is necessary to enhance RD of CVOCs by depleting competing electron acceptors (DO) and lowering the ORP.

2.3.4 Groundwater Level Monitoring

Depth-to-groundwater level measurements were taken on March 24, 2000, from 8 existing and 12 newly installed permanent monitoring wells. The corresponding water level elevations are provided in Table 2-3. These elevations were used to generate water level contour maps of the upper and lower Surficial Aquifers.

2.3.4.1 Groundwater Flow Directions and Velocities in the upper Surficial Aquifer

The contour map of groundwater elevations (water table) in the upper Surficial Aquifer is shown in Figure 2-10. The overall groundwater flow direction is to the southwest. Local flow directions vary from southeast to southwest. Relatively flat horizontal hydraulic gradients exist near the Stripper Barn and former plating shop, which may be attributed to relatively flat topography and to reduced infiltration of precipitation via pavement and buildings in this area. The steeper horizontal hydraulic gradients in the vicinity of monitoring wells OU1-51GW09, OU1-MW22, and OU1-MW20 appear to be associated with a low-relief topographic high near these wells.

Estimated horizontal hydraulic gradients in the upper Surficial Aquifer range from approximately 0.00137 to 0.01164 foot/foot, or an average of approximately 0.005 foot/foot (as estimated from the groundwater contours developed for the site). The United States Geological Survey (USGS) used a hydraulic conductivity of 10 feet per day (ft/day) in developing a ground-water flow model for the MCAS (Eimers, et al., 1994). Using the average horizontal hydraulic gradient calculated for the site, an estimated porosity of 25 percent, and a hydraulic conductivity of 10 ft/day, the average linear velocity of groundwater in the upper Surficial Aquifer beneath the site is approximately 0.20 feet/day [(10 ft/day x 0.0049 ft/ft)/0.25 = 0.2 ft/day].

The average linear velocity of groundwater in the upper Surficial Aquifer along the area of highest contamination (monitoring wells OU1-47GW09 to OU1-47GW12) is estimated to be approximately 0.05 feet/day, using a hydraulic gradient of 0.0013 foot/foot (as estimated from the groundwater contours from monitoring wells OU1-47GW09 to OU1-47GW12), an estimated porosity of 25 percent, and a hydraulic conductivity of 10 ft/day.

2.3.4.2 Groundwater Flow Directions and Velocities in the lower Surficial Aquifer

The contour map of groundwater elevations in the lower Surficial Aquifer is shown in Figure 2-11. Similar to that of the upper Surficial Aquifer, the overall groundwater flow direction is to the southwest. Local flow directions vary from southeast to west-northwest. Relatively flat horizontal hydraulic gradients exist near and to the northeast of the Stripper Barn. The steepest horizontal hydraulic gradients in the lower Surficial Aquifer exist near monitoring wells OU1-47GW06, OU1-47GW10, and OU1-MW25. Where the steepest hydraulic gradients exist in the upper Surficial (near OU1-51GW09, OU1-MW22, and OU1-MW20), hydraulic gradients are an order of magnitude lower in the lower Surficial. Conversely, where the some of the flattest hydraulic gradients exist in the upper Surficial (to the east of OU1-47GW07), hydraulic gradients are nearly an order of magnitude greater in the lower Surficial. These differences suggest that the upper and lower Surficial Aquifers are hydraulically separated to some degree.

Estimated horizontal hydraulic gradients in the lower Surficial Aquifer range from 0.00131 to 0.00992 (foot/foot), or an average of 0.0046 foot/foot. Additionally, primarily downward

vertical hydraulic gradients between the upper and lower Surficial Aquifers are apparent in comparing groundwater elevations at nested wells such as OU1-47GW07 and OU1-47GW08. Using the average horizontal hydraulic gradient, an estimated porosity of 25 percent, and an average hydraulic conductivity of 45.65 ft/day, the average linear velocity of groundwater in the lower Surficial Aquifer beneath the site is approximately 0.84 feet/day [(45.65 ft/day x 0.0046 ft/ft)/0.25 = 0.84 ft/day].

2.3.5 Soil Sampling and Results

Subsurface soil samples were collected at 5 locations for analysis of TOC to assist in future groundwater modeling. The locations and depths (in feet bgs) of each of the five TOC samples were as follows: 47TW08-SB (7-9'), 47GW09-SB (21-23'), 47GW04-SB (26-28'), 47GW08-SB (35-37'), and 47GW02-SB (48-50'). The locations and depths were chosen to distribute the samples both horizontally and vertically throughout OU1. The analytical results for TOC soil samples are provided in Table A5 in Appendix A.

In addition to the TOC data collected as part of the DA investigation, soil samples also were collected as part of a Tetra Tech NUS investigation of the site. Samples were collected in areas where PID, odor, or visual indications of contamination were present. Samples also were collected in areas where no apparent sign of contamination occurred. The samples and depths collected were as follows: 47TW07-SB (7-9'), 47TW04-SB (7-9'), 47TW06-SB (6-8'), 47TW10-SB (6-8'), 47TW09-SB (6-8'), 47GW05-SB (1-3'), and 47GW08-SB (10-12'). Soil samples were analyzed for VOCs, base/neutral and acid-extractable compounds (SVOCs), pesticides, PCBs, and metals, where enough soil could be recovered. Samples were shipped to STL/Quanterrra's Pittsburgh, Pennsylvania laboratory for analysis. These results will be reported in the RI/FS.

2.4 Focus of the Treatability Study

Based on the results of the DA investigation, the highest levels of CVOCs are present in the upper Surficial Aquifer beneath the site. Where CVOCs were detected in the lower Surficial Aquifer, the levels were less than 0.5 mg/L of total CVOCs, with the exception of monitoring well OU1-MW23, where elevated levels of TCE (1,500 µg/L) and related daughter compounds were detected. The contamination at this well appears to be associated with the Industrial Sewer System, rather than the Stripper Barn.

The approximate core of the hotspot appears to be at the location of monitoring well OU1-47GW07, with a total VOC concentration of approximately 50 mg/L. The closest monitoring well directly upgradient from this presumed hotspot is the former monitoring well OU1-51GW01, which contained a total VOC concentration of approximately 6 mg/L. Based on this data, the assumption is that the total VOC concentration exceeds the cleanup level of 1 mg/L over the entire distance from monitoring well OU1-47GW07 to monitoring well OU1-51GW01. Data from temporary well TW-13 (located near former well OU1-51GW01), temporary well TW-08, and temporary well TW-11 indicated low levels of total VOCs, suggesting this area to be the lateral upgradient edge of the plume. Data from the downgradient monitoring well OU1-51GW02, showing total VOC concentrations slightly under 1 mg/L, suggests this location to be the downgradient edge of the plume. Data from the lower Surficial Aquifer wells OU1-47GW08 and OU1-47GW11 indicate the vertical

distribution of CVOCs is limited to the upper Surficial Aquifer. The boundary of the target plume is presented in Figure 2-12.

Table 2-1
Temporary Well Depth Information
Site 47 IRA
MCAS Cherry Point

Location	Total Depth[2] (feet BGS)	Screen Placement[1]
47TW01	24.5	US
47TW02	25	US
47TW03	25	US
47TW04	24	US
47TW05	25	US
47TW06	24	US
47TW07	24	US
47TW08	25	US
47TW09	24	US
47TW10	24	US
47TW11	25	US
47TW12	25	US
47TW13	25	US

1- US (Upper Surficial)

2- Temporary well depths taken from field notebooks.

Table 2-2
New and Existing Permanent Well Construction Information
Site 47 IRA
MCAS Cherry Point

Location	Ground Surface Elevation (feet MSL)	TOC[3] Elevation (feet MSL)	Total Depth[2] (feet BGS)	Screened Interval (feet BGS)	Screen Placement[1]
New Wells					
OU1-47GW01	23.10	22.78	17	7-17	US
OU1-47GW02	23.11	22.77	50	40-50	LS
OU1-47GW03	22.25	21.88	24	14-24	US
OU1-47GW04	22.22	21.99	47	37-47	LS
OU1-47GW05	23.67	23.40	19	9-19	US
OU1-47GW06	23.70	23.45	48	38-48	LS
OU1-47GW07	23.65	23.34	17	7-17	US
OU1-47GW08	23.63	23.26	48	38-48	LS
OU1-47GW09	22.67	22.47	25	14.5-24.5	US
OU1-47GW10	22.69	22.42	48	37.5-47.5	LS
OU1-47GW11	23.45	23.21	50	40-50	LS
OU1-47GW12	23.63	23.51	17	7-17	US
Existing Wells					
OU1-MW20	23.19	23.06	15.6	5.6-15.6	US
OU1-MW21	23.21	23.01	48.79	38.79-48.79	LS
OU1-MW22	23.44	23.20	16.25	6-16	US
OU1-MW23	23.44	23.28	48.16	38-48	LS
OU1-MW24	24.08	23.91	42.22	32.22-42.22	LS
OU1-MW25	23.69	23.36	51.6	41.6-51.6	LS
OU1-MW26	23.43	23.16	31.39	21.39-31.39	MS
OU1-MW27	23.46	23.19	45.85	5.85-45.85	S
OU1-16GW25	23.67	23.43	111	90-100	LY
OU1-51GW02	23.33	23.02	14.89	4.89-14.89	US
51GW09	21.19	20.57	14.77	4.77-14.77	US

1- US (Upper Surficial), MS (Middle Surficial-as defined by Brown & Root, March, 1997), LS (Lower Surficial), S (Surficial), LY (Lower Yorktown)

2- New permanent well depths taken from field notebooks. Existing monitoring well depths taken from groundwater sampling measurements.

3- TOC = top of casing

Table 2-3
Monitoring Well Water Level Elevations
Site 47 IRA
MCAS Cherry Point

Location	TOC[1] Elevation (feet MSL)	Depth to Water Level (feet below TOC)	Groundwater Level Elevation (feet MSL)
New Wells			
OU1-47GW01	22.78	8.38	14.40
OU1-47GW02	22.77	8.30	14.47
OU1-47GW03	21.88	7.03	14.85
OU1-47GW04	21.99	7.56	14.43
OU1-47GW05	23.40	9.21	14.19
OU1-47GW06	23.45	9.49	13.96
OU1-47GW07	23.34	9.21	14.13
OU1-47GW08	23.26	9.29	13.97
OU1-47GW09	22.47	8.03	14.44
OU1-47GW10	22.42	8.28	14.14
OU1-47GW11	23.21	9.30	13.91
OU1-47GW12	23.51	9.57	13.94
Existing Wells			
OU1-MW20	23.06	8.00	15.06
OU1-MW21	23.01	8.65	14.36
OU1-MW22	23.20	8.35	14.85
OU1-MW23	23.28	9.00	14.28
OU1-MW24	23.91	9.15	14.76
OU1-MW25	23.36	7.93	15.43
OU1-51GW02	23.02	8.85	14.17
51GW09	20.57	7.94	12.63

1- TOC = top of casing

The monitoring well water level elevations were measured on March 24, 2000.

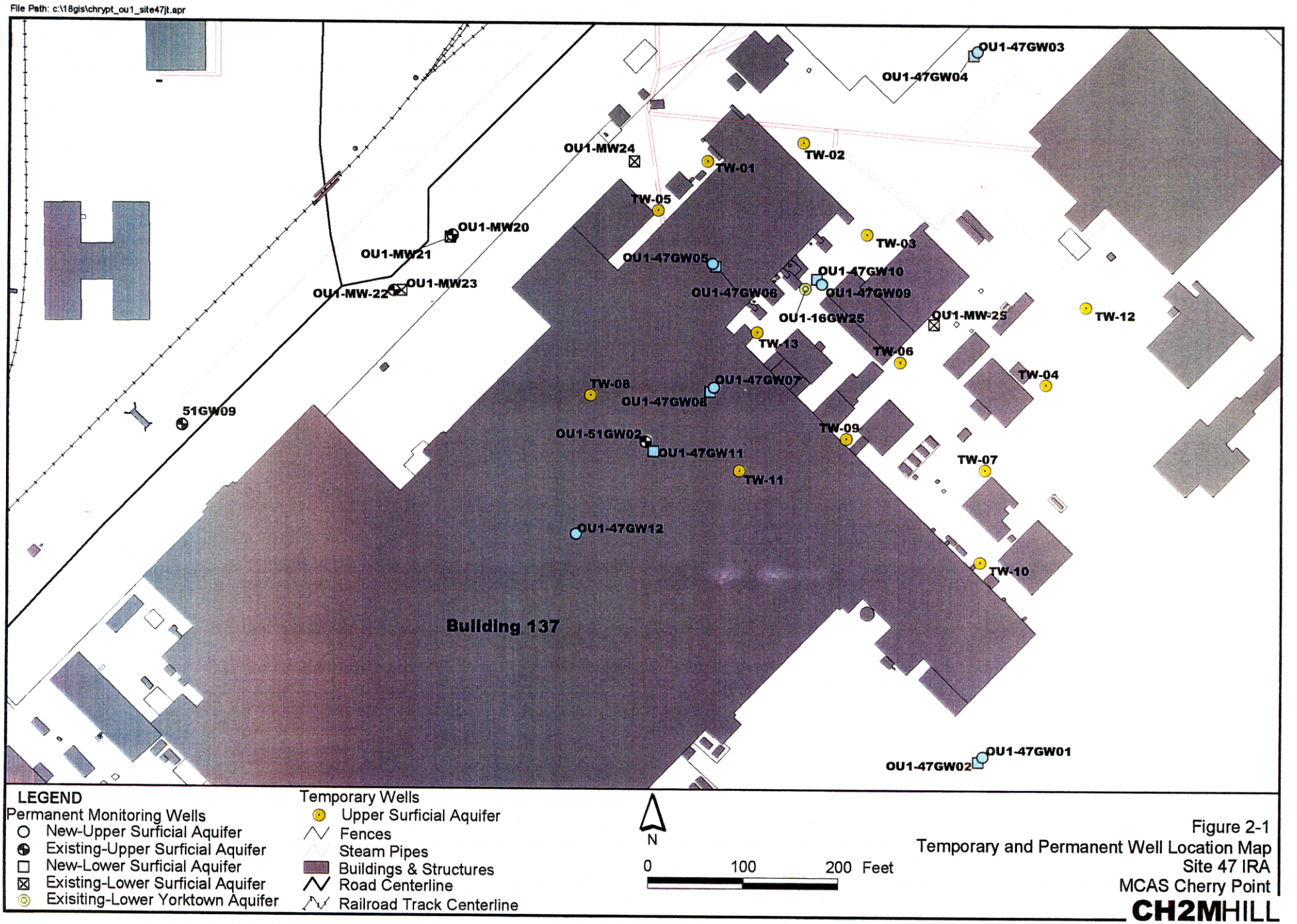

Figure 2-1
Temporary and Permanent Well Location Map
Site 47 IRA
MCAS Cherry Point

CH2MHILL

OU1-47GW01

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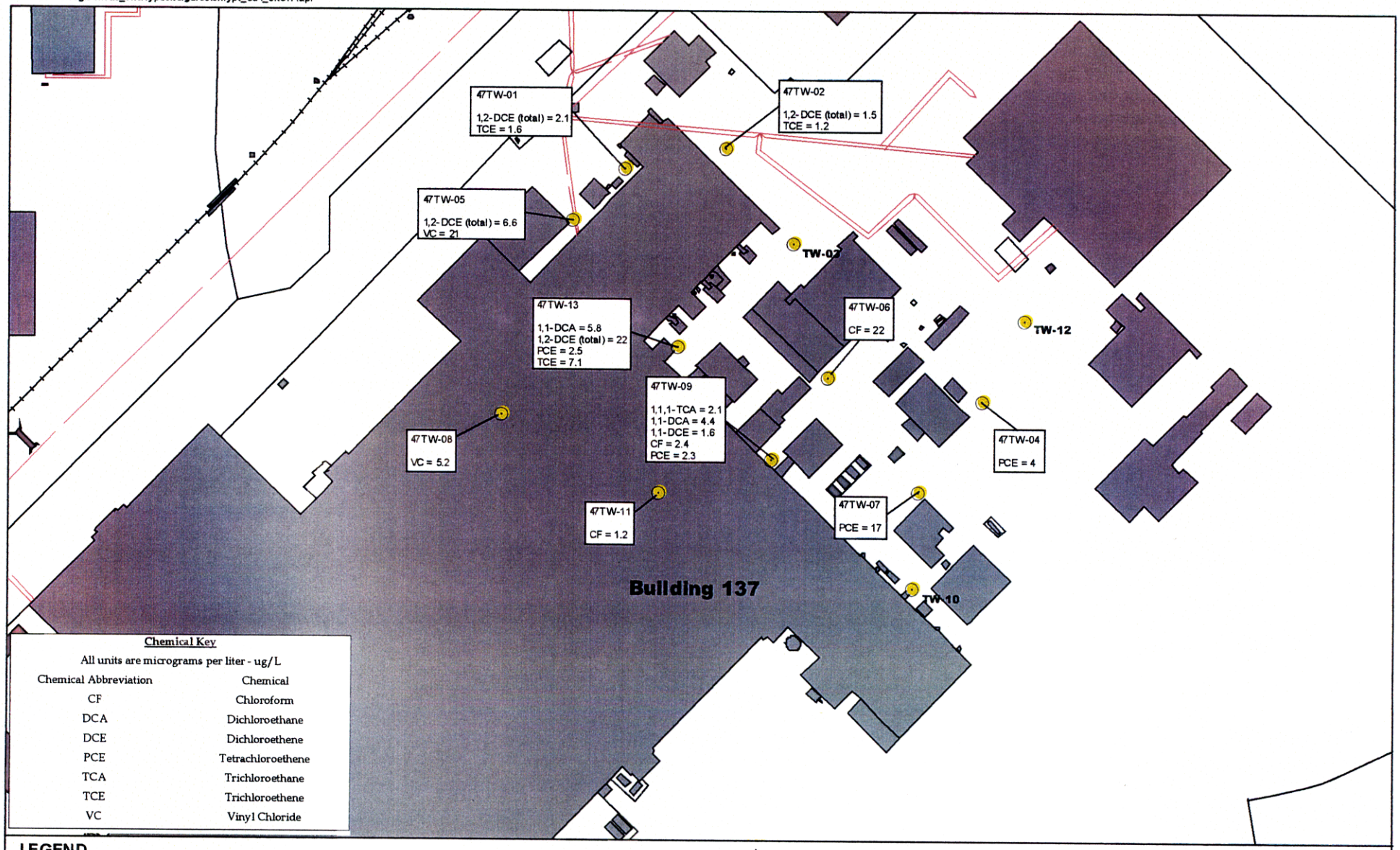
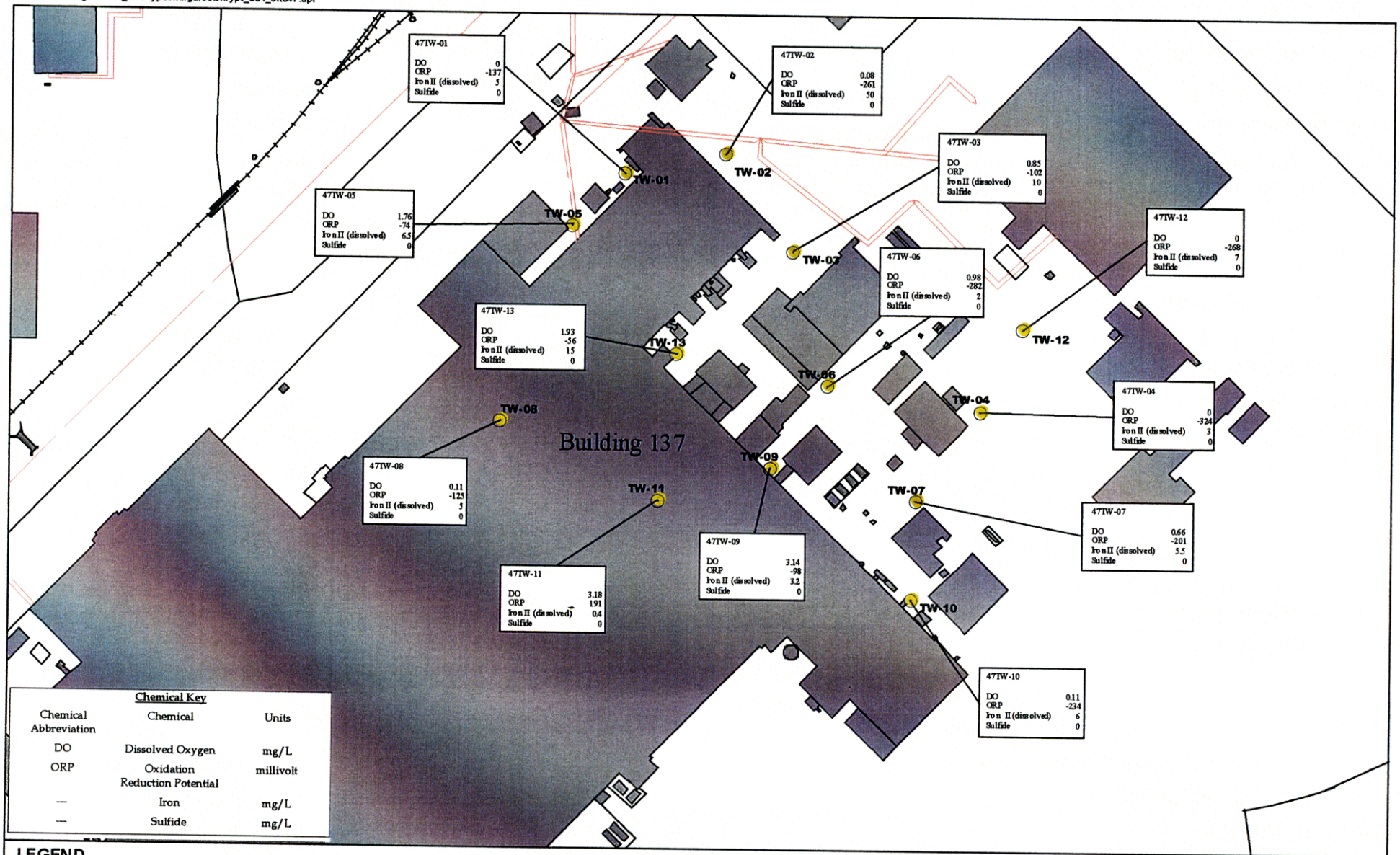


Figure 2-2
VOC Detections in Temporary Wells
Site 47 IRA
MCAS Cherry Point

CH2MHILL

File Path: v:\18gis\mcas_cherrypoint\figures\chrypt_ou1_site47.apr



Chemical Key

Chemical Abbreviation	Chemical	Units
DO	Dissolved Oxygen	mg/L
ORP	Oxidation Reduction Potential	millivolt
—	Iron	mg/L
—	Sulfide	mg/L

LEGEND

- Upper Surficial Aquifer Temporary Well
- Railroad Track Centerline
- Fences
- Steam Pipes
- Buildings & Structures
- Road Centerline

N

0 60 120 Feet

Figure 2-3
Geochemical Parameters at Temporary Wells
Site 47 IRA
MCAS Cherry Point

CH2MHILL

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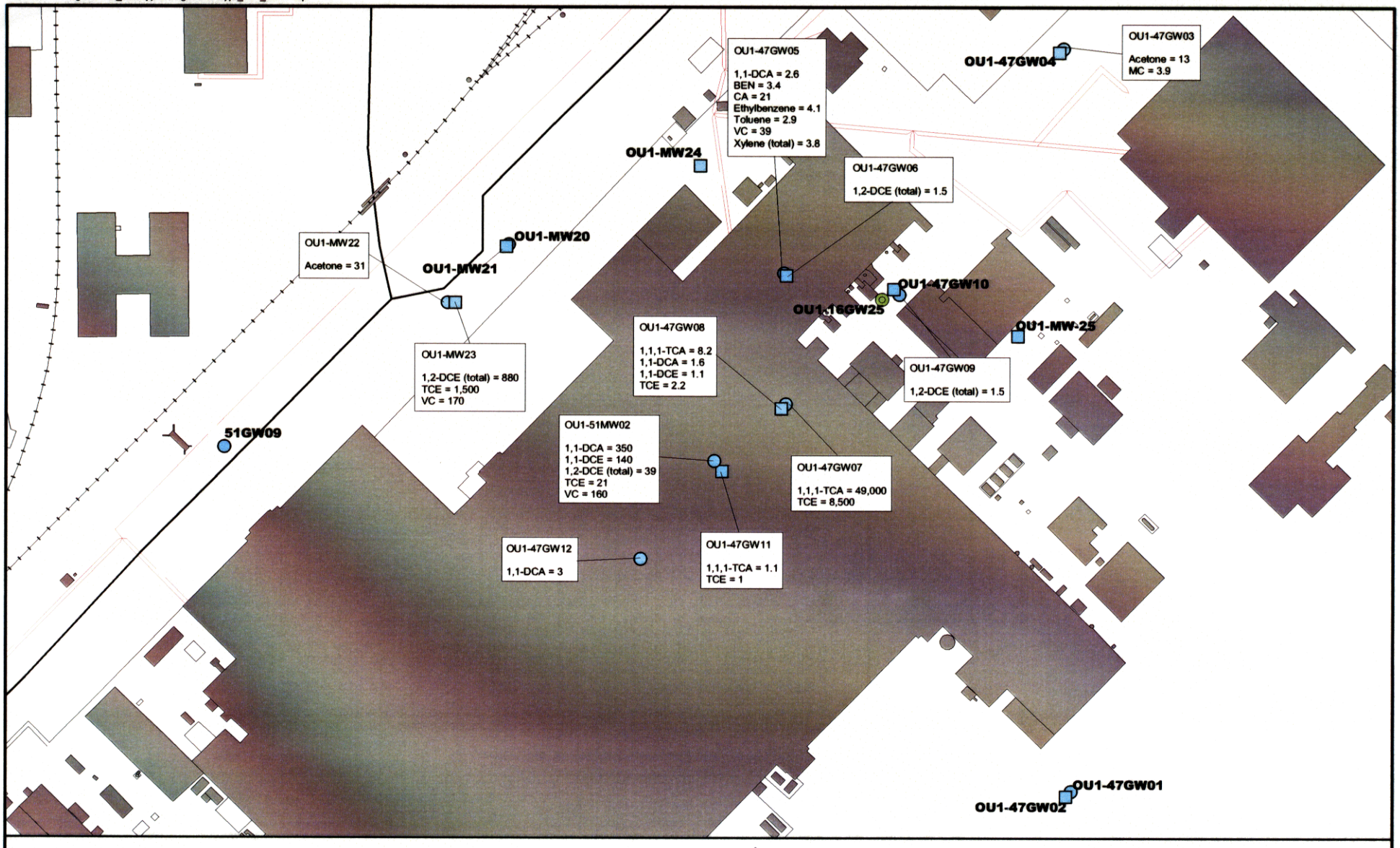

LEGEND

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well
- Lower Yorktown Aquifer Monitoring Well
- Fences
- Steam Pipes
- Buildings & Structures
- Road Centerline
- Railroad Track Centerline

N

0 90 180 Feet

Figure 2-4
VOC Detections in Monitoring Wells
Site 47 IRA
MCAS Cherry Point

CH2MHILL

File Path: v:\18gis\mcas_cherrypoint\figures\chrypt_ou1_site47.apr

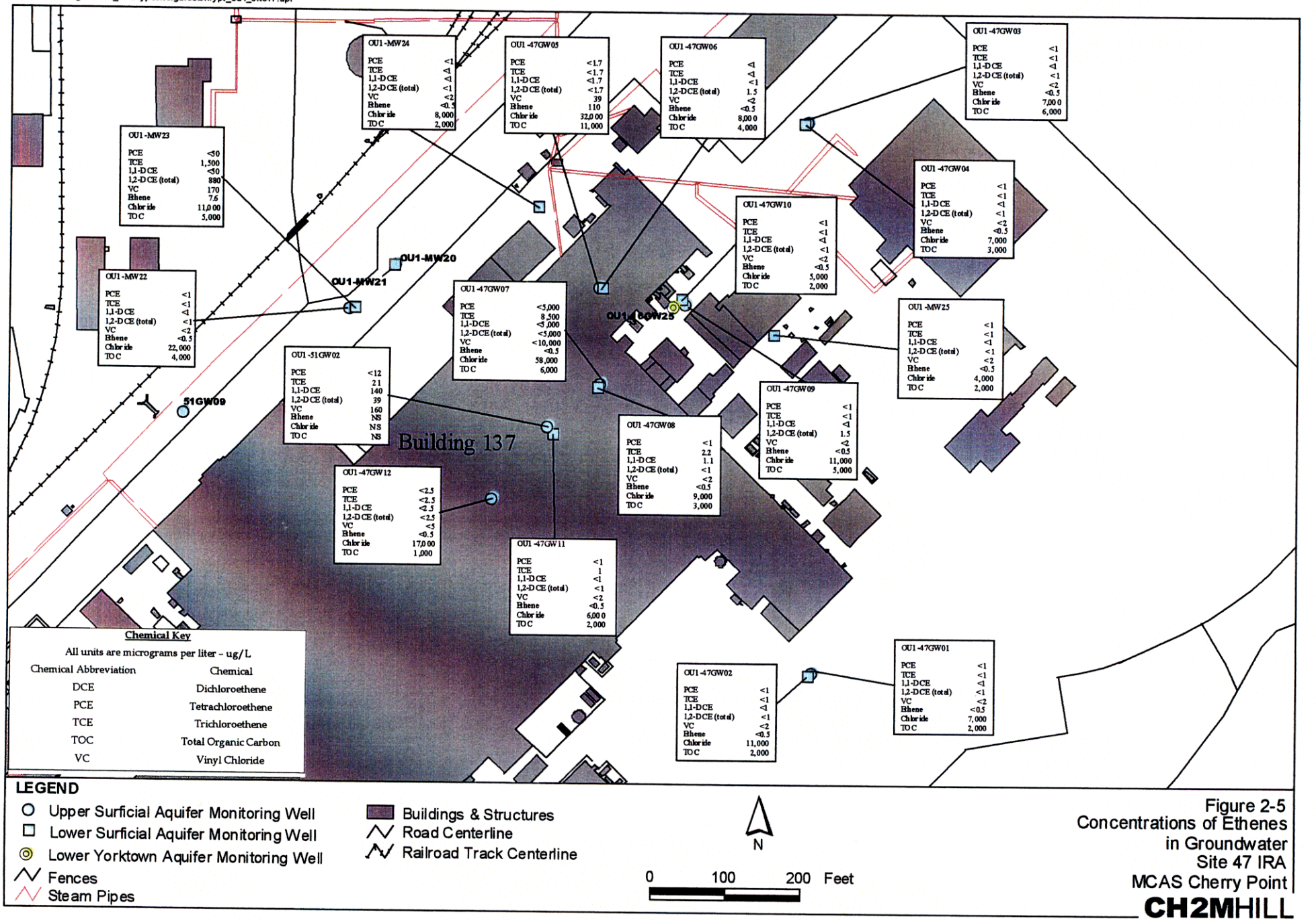

Figure 2-5
Concentrations of Ethenes
in Groundwater
Site 47 IRA
MCAS Cherry Point

CH2MHILL

File Path: v:\18gis\mcas_cherrypoint\figures\chrypt_ou1_site47.apr

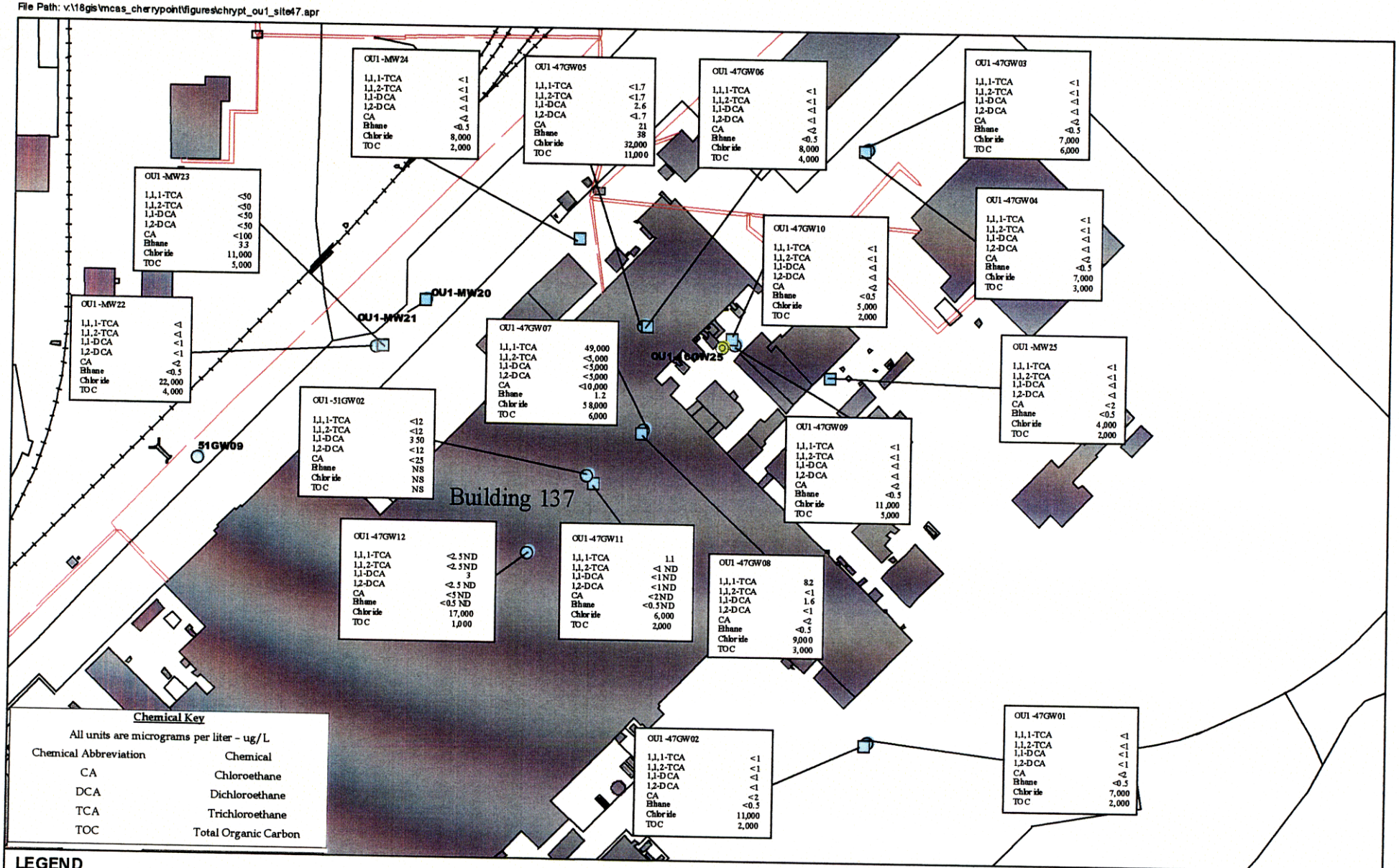

Figure 2-6
Concentration of Ethanes
in Groundwater
Site 47 IRA
MCAS Cherry Point

CH2MHILL

File Path: C:\18gis\chrypt_ou1_site47jt.apr

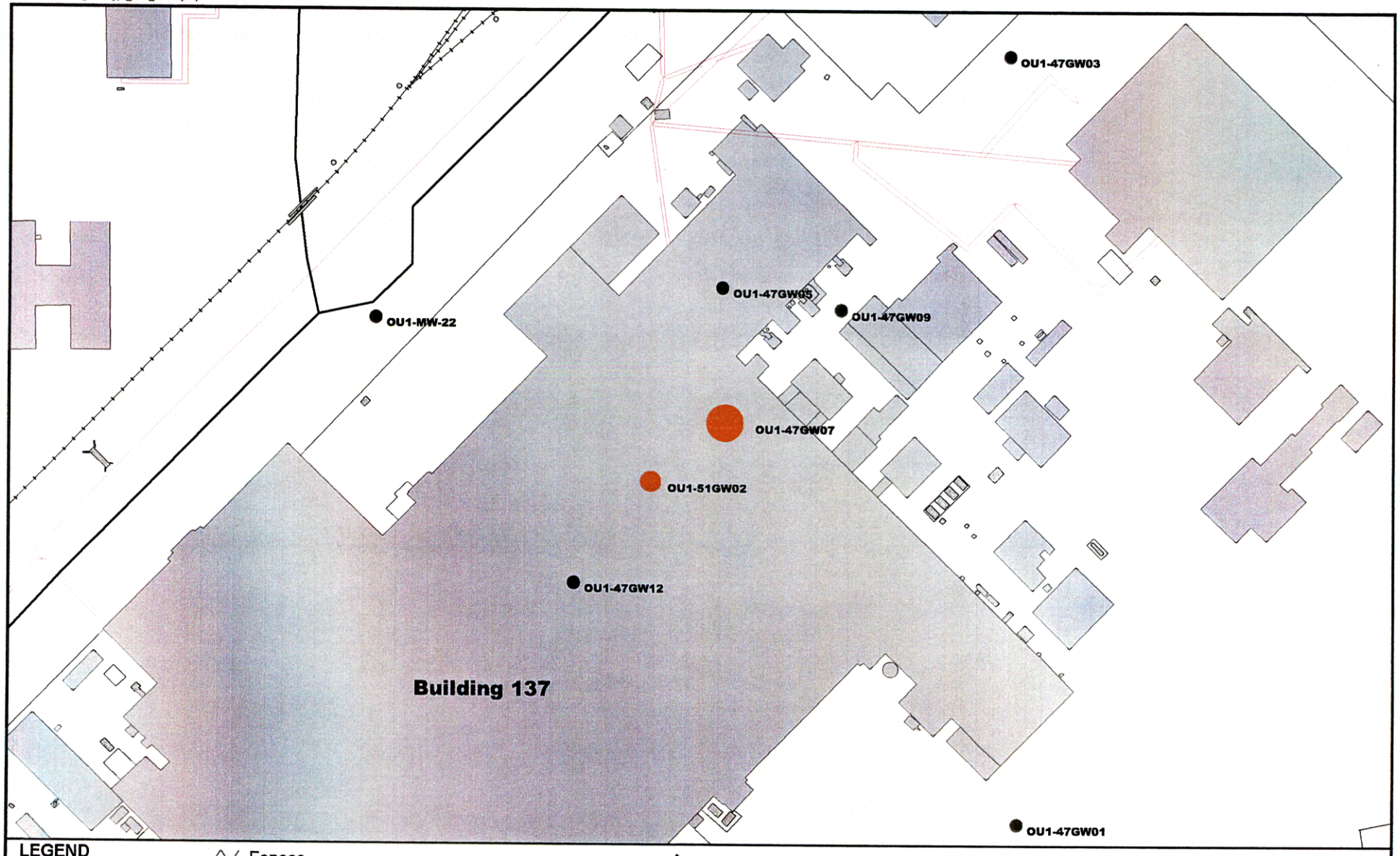

Figure 2-7
Total Chlorinated VOCs in Upper Surficial Aquifer
Site 47 IRA
MCAS Cherry Point

CH2MHILL

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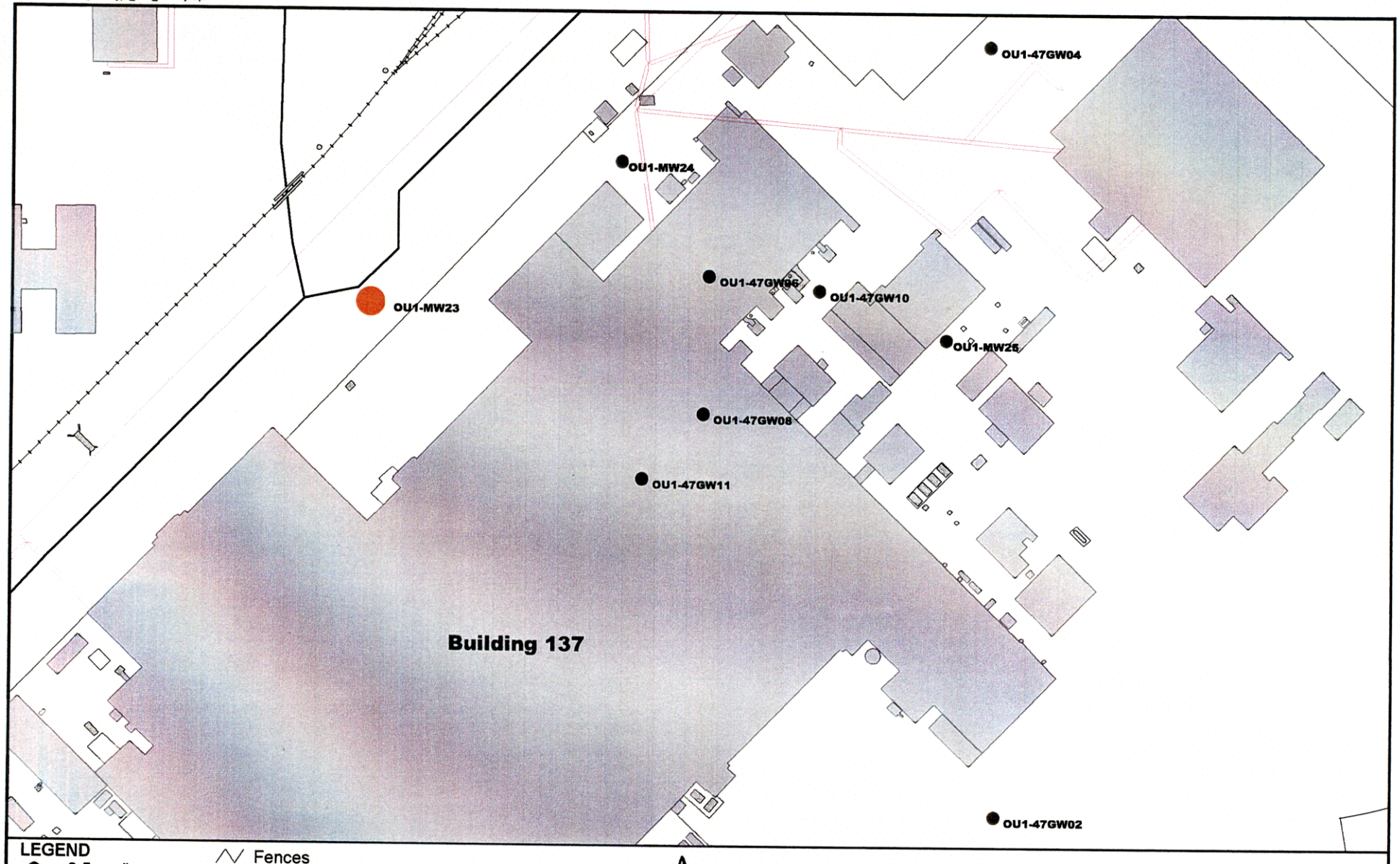

Figure 2-8
Total Chlorinated VOCs in Lower Surficial Aquifer
Site 47 IRA
MCAS Cherry Point

CH2MHILL

File Path: v:\18gis\mcas_cherrypoint\figures\chrypt_ou1_site47.apr

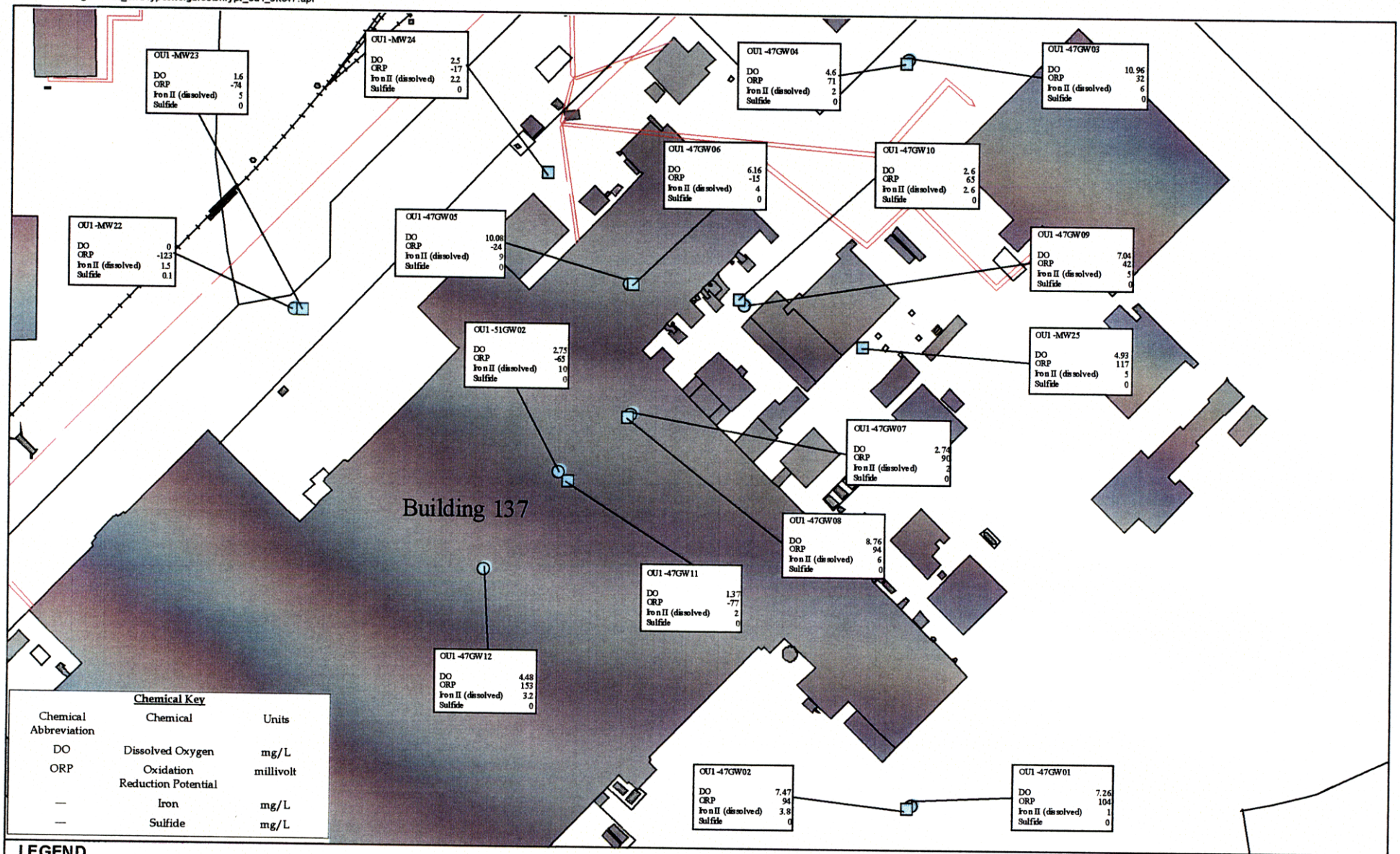

Figure 2-9
Geochemical Parameters
at Monitoring Wells
Site 47 IRA
MCAS Cherry Point

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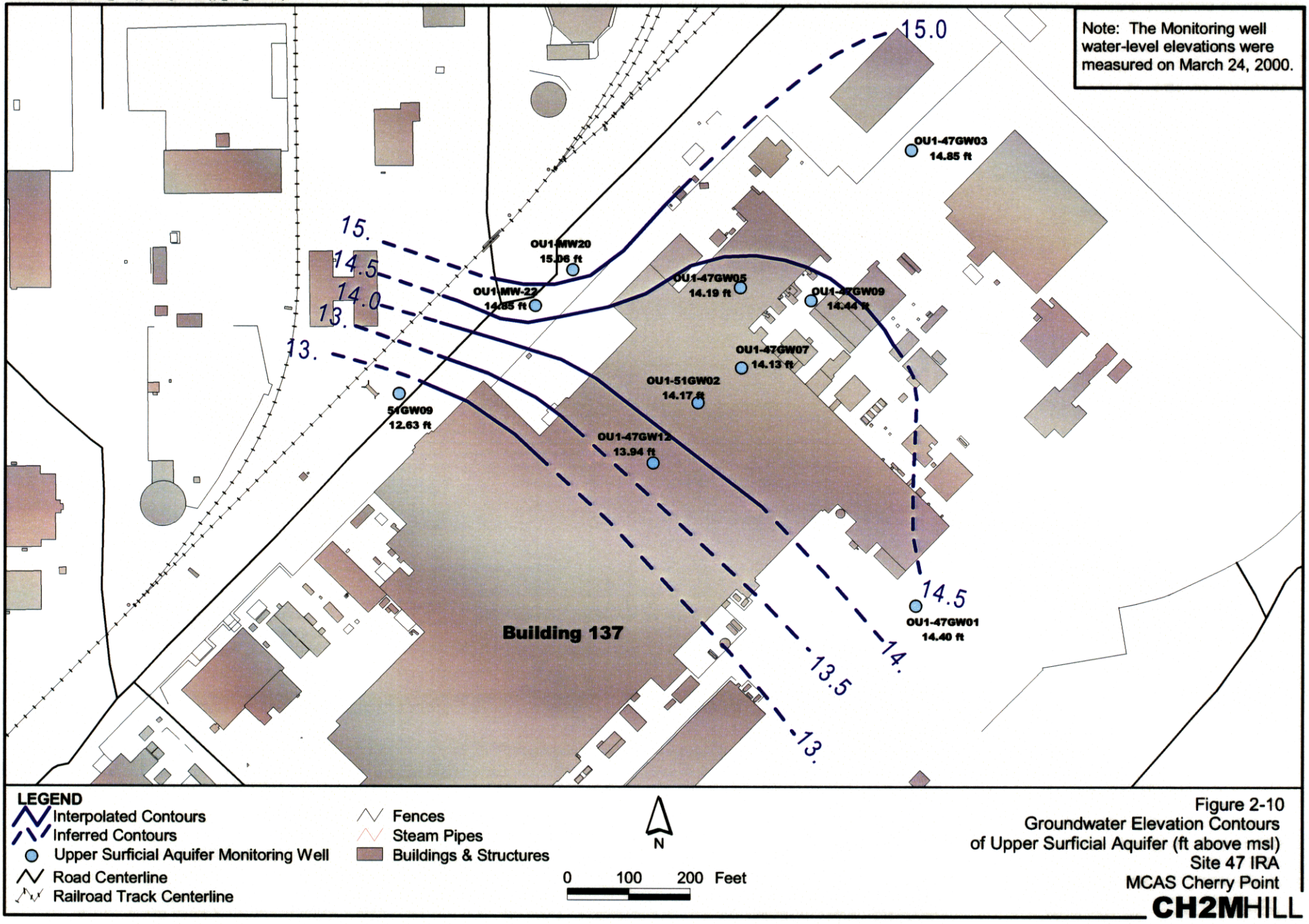
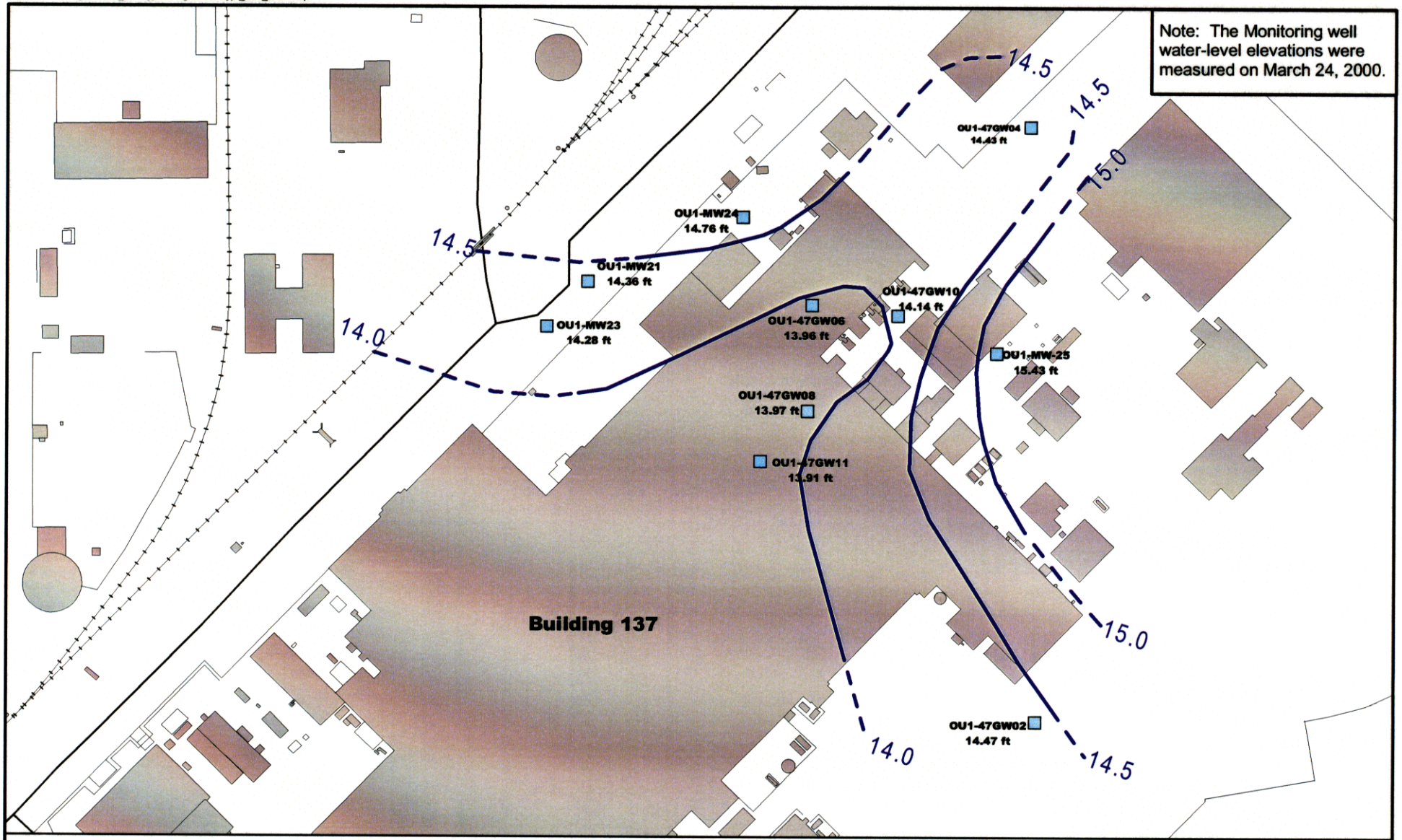


Figure 2-10
Groundwater Elevation Contours
of Upper Surficial Aquifer (ft above msl)
Site 47 IRA
MCAS Cherry Point

CH2MHILL

File Path: v:\18gis\mcas_cherrypoint\figures\chrypt_ou1_site47.apr



LEGEND

- Interpolated Contour
- Inferred Contour
- Lower Surficial Aquifer Monitoring Well
- Road Centerline
- Railroad Track Centerline
- Fences
- Steam Pipes
- Buildings & Structures

N

0 100 200 Feet

Figure 2-11
Groundwater Elevation Contours
of Lower Surficial Aquifer (ft above msl)
Site 47 IRA
MCAS Cherry Point

CH2MHILL

File Path: V:\18gis\MCAS_CherryPoint\Figures\chrypt_ou1_site47.apr

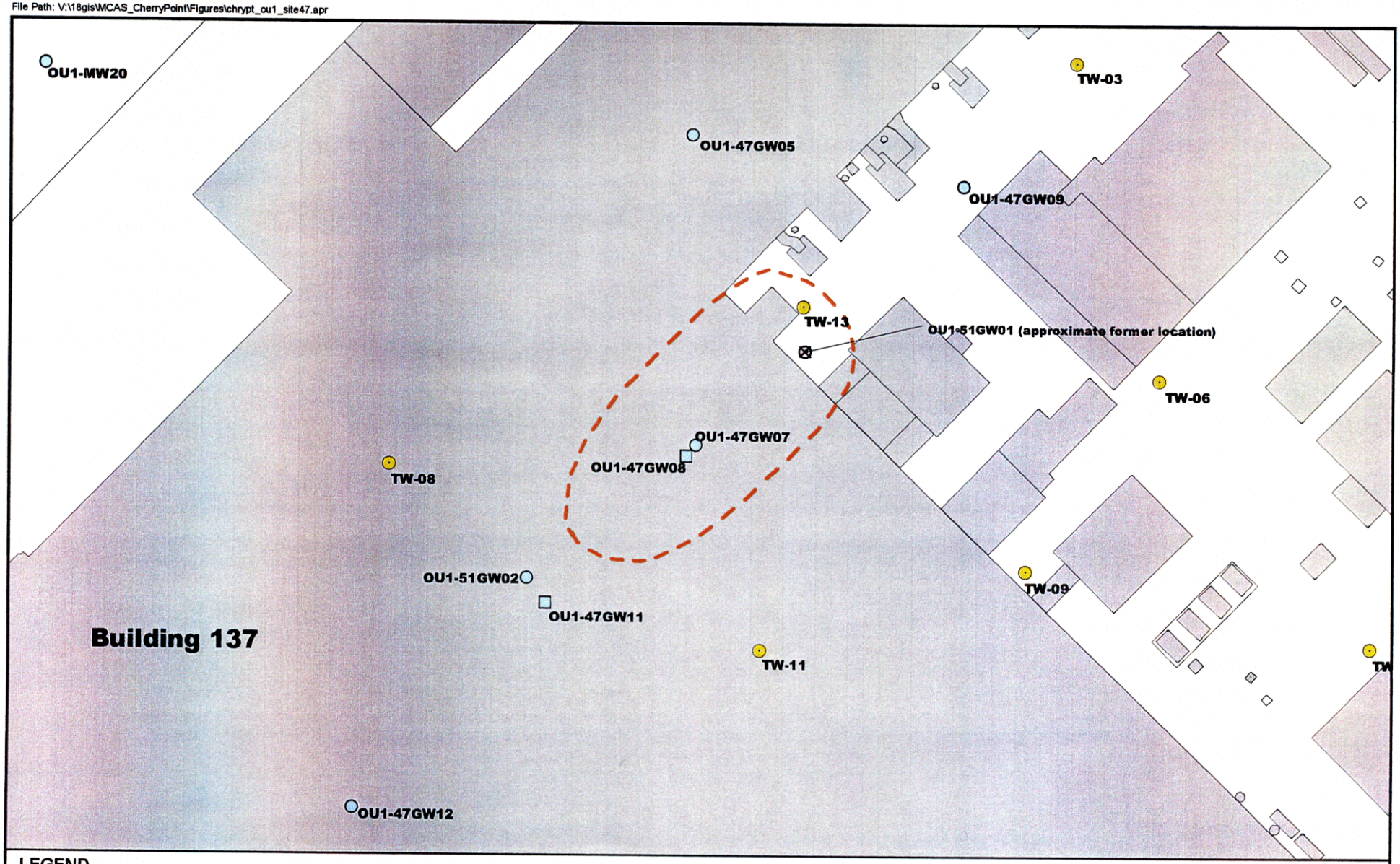


Figure 2-12
Target Groundwater Plume
Upper Surficial Aquifer
Site 47 IRA
MCAS Cherry Point

CH2MHILL

3.0 Evaluation of Alternatives

Bioremediation alternatives were screened early in the project to focus in on the most promising and practical approach for remediating chlorinated volatile organic compounds (CVOCs) in the Stripper Barn plume. Ex situ techniques were considered impractical because the contaminated material lies beneath Building 137, which is heavily used for aircraft maintenance activities. Thus, only in situ approaches were considered further. The general categories of in situ bioremediation alternatives are aerobic, anaerobic, and sequential anaerobic/aerobic processes. These are discussed below, followed by a brief summary of the screening and selection rationale.

3.1 Aerobic Processes

Aerobic biodegradation of organic compounds can occur through two basic processes: (1) direct oxidation, in which an organic compound, or primary substrate, is metabolized to obtain energy and carbon for cell growth; and (2) cometabolism, in which a nonspecific enzyme produced to metabolize a primary substrate fortuitously initiates transformation of another organic compound. By definition, the microorganism effecting cometabolism receives no direct benefit from this transformation reaction. Most multi-halogenated chlorinated aliphatic hydrocarbons, such as carbon tetrachloride, chloroform, tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), and probably the dichloroethene (DCE) isomers, are not amenable to aerobic biodegradation via direct oxidation. Similarly, the fully chlorinated compounds PCE and carbon tetrachloride are not amenable to aerobic cometabolism. However, TCE and it's anaerobic breakdown products (cis-1,2-DCE and vinyl chloride [VC]), as well as certain other CVOCs, are biodegradable under aerobic conditions by cometabolism.

Cometabolism is a naturally occurring process that has been used for in situ bioremediation purposes by introducing a primary substrate and oxygen into groundwater to enhance biotransformation of otherwise recalcitrant CVOCs. The many primary substrates used to support cometabolism include methane, phenol, toluene, propane, propene, butane, and others. CVOCs found in the target Stripper Barn plume include TCE, 1,1-DCE, cis-1,2-DCE, VC, 1,1,1-TCA, and 1,1-dichloroethane (1,1-DCA). The list of CVOCs biodegraded by aerobic cometabolism varies depending on what group of microorganisms is stimulated by the addition of the chosen primary substrate. For example, 1,1-DCE, 1,1,1-TCA, and 1,1-DCA have been shown to be resistant to biotransformation by, or cause cell inactivation/toxicity to, microbial culture/primary substrate systems stimulated by methane, toluene, or phenol, which cometabolize TCE and its transformation products. In contrast, other microbe/substrate systems, activated using butane or propene, have been found to cometabolize TCA, but have shown little or no ability to degrade TCE. Consequently, the mixture of CVOCs in the Stripper Barn plume makes it difficult to select a single microbe/primary substrate system to enhance bioremediation of the entire suite of contaminants present. Other constraints to implementing aerobic cometabolism include the need to deliver sufficient dissolved oxygen to groundwater and potential regulatory resistance to injecting primary substrates into the aquifer.

3.2 Anaerobic Processes

Anaerobic biodegradation by the process known as reductive dehalogenation or dechlorination (RD) is the principal mechanism responsible for transformation of CVOCs in contaminated groundwater. Biological RD is a naturally-occurring, microbially-mediated process that results in sequential replacement of chlorine on the CVOC molecule with hydrogen. Each dechlorination step requires the transfer of two electrons, so an external electron donor is required to "drive" the reaction. The CVOC molecule functions as the electron acceptor in the process.

Highly reducing conditions (i.e. low oxidation-reduction potential [ORP]) are required for biological RD of most chlorinated ethenes and ethanes. Redox conditions associated with methanogenesis are generally required for complete dechlorination of these CVOCs, while conditions associated with sulfate reduction will support partial dechlorination. Thus, complete dechlorination requires groundwater to be deficient in competing electron acceptors, such as dissolved oxygen, nitrate, nitrite, sulfate, Fe(III), and Mn(IV).

All of the CVOCs present in the Stripper Barn plume are potentially susceptible to anaerobic biodegradation. Figure 3-1 shows anaerobic transformation pathways for chlorinated ethenes and ethanes. The potential exists for all of the CVOCs shown to be completely dechlorinated to relatively innocuous compounds. While complete dechlorination of CVOCs has been demonstrated in both lab and field studies, transformation rates tend to be faster for the more highly chlorinated CVOCs, and become slower as the number of chlorine atoms on the CVOC molecule decreases. Consequently, less chlorinated CVOCs such as cis-1,2-DCE, VC, 1,1-DCE, and 1,1-DCA, sometimes accumulate in groundwater as biological RD proceeds. The possibility also exists that some subsurface microbial communities may lack organisms capable of complete dechlorination.

In enhanced anaerobic bioremediation, an organic substrate is introduced into the groundwater to deplete competing electron acceptors, lower the ORP, and serve as an electron donor for RD. A wide variety of organic substrates has been found to support RD. Basically, any organic that is anaerobically degraded by fermentative bacteria which dispose of electrons by reducing protons to hydrogen (H_2) can potentially be effective since H_2 is considered to be the principal "carrier" for electron transfer in the process. More complex substrates that must first be hydrolyzed and then fermented are also feasible. Techniques for enhancing RD are discussed as three general categories below.

Soluble substrates. These include benzoate, lactate, acetate, propionate, butyrate, methanol, ethanol, sucrose, molasses, and H_2. Several of these have been demonstrated in lab studies and/or field applications to effectively enhance RD. However, because they are generally water-soluble and are transported with groundwater flow, they typically require continuous or at least intermittent injection at fairly frequent intervals. Consequently, using a soluble substrate would require either fixed injection equipment (substrate tank, pumps, piping, and controls) or intermittent mobilization of a portable injection system. Because of the logistical constraints of the site imposed by heavy activity in and around Building 137, approaches using soluble substrates were considered relatively impractical.

Hydrogen Release Compound (HRC). HRC is a "time-release" substrate sold by Regenesis (San Clemente, CA) for the purpose of enhancing in situ RD of CVOCs. It is a biodegradable, food grade glycerol polylactate ester which, when injected into an aquifer, is

hydrolyzed over time to yield lactate. The lactate is subsequentiy termented by indigenous microorganisms to lower molecular weight organic acids and H_2. HRC can be injected as a semi-viscous liquid using direct-push technologies, and will reportedly serve as an electron donor to support RD for 6 months to 1 year or more. The advantages of this type of approach at the site include eliminating the need for fixed injection equipment or frequent injection activities and reducing operating costs. HRC has been studied fairly extensively in the lab and field over the last few years and is currently in use at a number of sites.

Other "insoluble" substrates. Currently, the most prevalent of this type of substrate is vegetable oil. Like HRC, vegetable oils engender a time-release concept. When injected into groundwater, they exist as a non-aqueous phase liquid and slowly dissolve over time. The solubilized oil can be biodegraded to reduce the ORP by consuming competing electron acceptors and provide electrons for RD. This is a relatively new process that is currently being evaluated in lab and field studies; consequently, the level of experience and understanding is lower than for the two approaches above. A potential advantage is that the unit cost of vegetable oil is considerably lower than the cost of HRC.

3.3 Sequential Anaerobic/Aerobic Process

This process is implemented by establishing separate anaerobic and aerobic zones in the subsurface in sequence along the groundwater flow gradient. This approach has particular merit in cases where anaerobic treatment stops short of complete dechlorination and CVOCs amenable to aerobic biodegradation persist. As these persistent compounds migrate downgradient of the anaerobic zone, they can be degraded in the aerobic zone either by direct oxidation (compounds such as VC, 1,2-DCA, and CA) or by cometabolism if a primary substrate is added. Considering the extra level of complexity of the sequential anaerobic/aerobic process, it is not warranted except in cases where anaerobic bioremediation alone fails to achieve the project cleanup objectives.

3.4 Alternative Screening

In situ anaerobic bioremediation was considered more feasible than aerobic treatment because of the mixture of chlorinated ethenes and ethanes present in the Stripper Barn plume and the variation of effectiveness of different primary substrates for individual chlorinated ethenes and ethanes, and because of the large oxygen demand associated with degradation of the high concentrations of CVOCs present. Of the anaerobic processes, HRC or other insoluble substrates were considered to be more practical logistically than the soluble substrates. Because of the higher level of development and experience with HRC compared to vegetable oil, HRC was considered to have a higher probability of success in remediating the Stripper Barn plume. Consequently, in situ anaerobic biodegradation using HRC injection to provide an electron donor source to stimulate RD was selected as the approach for this enhanced bioremediation project.

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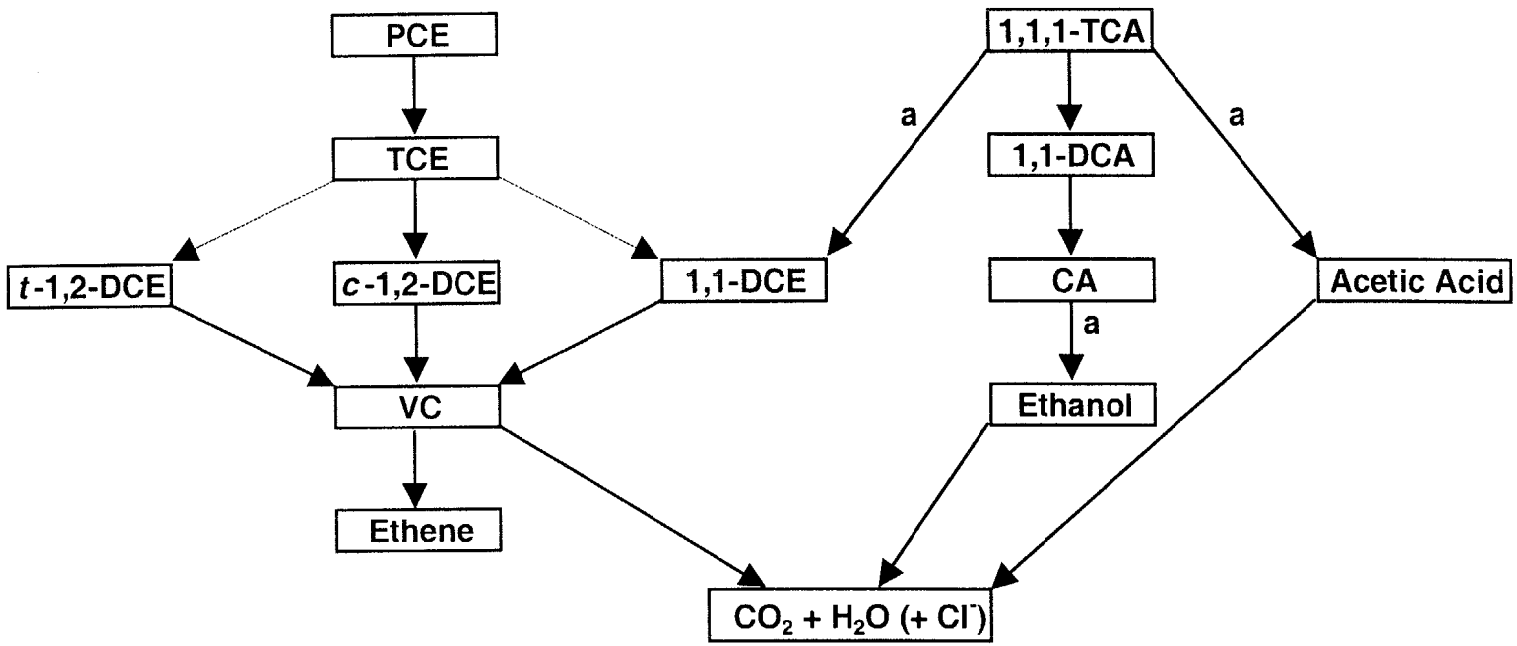

a = abiotic pathway

-----▶ minor pathway

Sources: McCarty and Semprini, 1993

Figure 3-1
Anaerobic Transformation of Chlorinated Aliphatic Hydrocarbons
Site 47 IRA
MCAS Cherry Point

WDC003670334.ZIP

4.0 Treatability Study Approach

4.1 Introduction

This treatability study involves the application of Hydrogen Release Compound (HRC®), supplied by Regenesis Bioremediation Products of San Clemente, California, within the hotspot of the chlorinated volatile organic compounds (CVOC) plume in the upper Surficial Aquifer under Site 47, the Stripper Barn (delineated during the DA Investigation). HRC will be injected at selected locations within the plume to serve as an electron donor to accelerate biological reductive dehalogenation (RD) of CVOCs by indigenous microorganisms. Groundwater monitoring will be conducted to track the progress of RD and overall system performance. The overall goal at the site is to enhance reduction of the CVOC mass and concentrations and achieve the primary cleanup objective of less than 1 mg/L total volatile organic compounds (VOCs).

Specifically, treatability study activities will include:

- Establishing an adequate groundwater monitoring network of existing and new wells;
- Performing an initial round of groundwater monitoring (prior to HRC injection) to establish baseline characteristics (CVOC concentrations and geochemical conditions);
- Injecting HRC into the formation at selected locations within the upper Surficial Aquifer target plume to enhance anaerobic biodegradation of CVOCs;
- Conducting groundwater monitoring at selected intervals to assess changes in CVOC concentrations and other pertinent parameters over time;
- Evaluating the effectiveness and progress of bioremediation and reporting results; and
- Managing residuals generated during the study.

4.2 Field Treatability Study

The scope of this treatability study includes a one-time injection of HRC in the target contaminated groundwater plume, and monitoring the status of bioremediation for a one-year duration. Although re-injection of HRC, in conjunction with continued monitoring, may be necessary to achieve the cleanup goal (especially in the vicinity of monitoring well OU1-47GW07, because of the likely presence of free product), it is not included within the present scope of this treatability study. All aspects outlined in this Work Plan pertaining to the HRC injection at the site have been reviewed and accepted by Regenesis technical staff.

According to Regenesis, bench-scale testing is not necessary to confirm the effectiveness of HRC as long as anaerobic biodegradation daughter products are detected in the target groundwater plume. Daughter products of both 1,1,1-trichloroethane (1,1,1-TCA) and trichloroethene (TCE) have been detected in the target groundwater plume at the site;

therefore a bench-scale test is not deemed necessary prior to initiating the field treatability study, and has not been included in this scope.

In the State of North Carolina, an Underground Injection Control (UIC) Class V injection permit application must be submitted and approved prior to injection of HRC. This permitting process should be initiated as soon as possible after approval of the treatability study Work Plan.

4.2.1 HRC Application

The following subsections present the proposed HRC application design grid, the injection amounts, the injection well installation, and HRC injection methodologies.

4.2.1.1 Design Grid and Rationale

The high viscosity liquid HRC formulation will be injected directly into the aquifer matrix in a grid pattern over the aerial extent and across the vertical zone of the contaminant plume. The treatability study will involve the injection of HRC into the aquifer from the top of the saturated zone (water table) to approximately 35 feet bgs (upper Surficial Aquifer). The top of the saturated zone was assumed to be 10 feet bgs for design purposes, although this may vary depending on the season and rainfall.

The target groundwater plume was subdivided into two application areas, based on CVOC and geochemical data, referred to as the "core" area, and the "non-core" area. The core area is a roughly 30 x 30 ft. square centered around the monitoring well with by far the highest measured CVOC concentrations (OU1-47GW07). The non-core area is an approximate rectangle extending from just upgradient of the former monitoring well OU1-51GW01, downgradient to nearly OU1-51GW02, and cross-gradient to a distance of nearly 35 ft. laterally from OU1-47GW07, and representing an area of influence at least 75 x 135 ft. (Figure 4-1). The total application area was chosen to cover the area of the plume expected to contain CVOC concentrations exceeding the cleanup goal of 1 mg/L total VOCs, based on the groundwater data from the DA phase of this project along with historical data from the former OU1-51GW01 (last sampled in December 1998 before being accidentally destroyed). The total application area was subdivided due to the varying CVOC concentrations within the center (core area) and toward the edges (non-core area) of the target plume, which warrant different injection point spacing and HRC application rates. The area of injection may be adjusted based on the results of the proposed baseline sampling.

CVOC and geochemical data from well OU1-47GW07 (March 2000) were used to represent conditions in the core area. The HRC Grid Design worksheet developed by Regenesis was used as guidance in selecting the injection point spacing and the HRC injection rates. The completed worksheet, including the aquifer characteristics and design concentrations modeled, is presented in Appendix I. As shown in Figure 4-1, eight injection points will be used to cover this area. Injection point locations were selected to provide spatial coverage of the core area while avoiding transport of HRC into the monitoring well (OU1-47GW07).

For the non-core area, CVOC data from well OU1-51GW01 (December 1998) were used to represent contaminant levels within the area. Geochemical data from well OU1-47GW07 (March 2000) were used to represent geochemical conditions in the area, since these data were not available for well OU1-51GW01. The Regenesis HRC Grid Design worksheet also was completed for this area in order to determine the injection point spacing and the HRC

injection amount (Appendix I). As shown in Figure 4-1, 27 injection points are proposed for this area, with each point located approximately 20 ft. (cross-gradient) by 15 ft. (with-gradient). Although this spacing was followed across a majority of the non-core area, select injection points were strategically staggered to avoid HRC seepage into proposed new monitoring wells during injection and to ensure that there is proper spatial coverage closer to the core area.

4.2.1.2 HRC Application Amounts

As shown in the Regenesis HRC Grid Design worksheets (Appendix I), the recommended HRC injection amount in the core area is approximately 14 lb/ft of well depth. This injection amount is considered high relative to the typical injection range of 6-8 lb/ft, but Regenesis reports that injections of up to two times the typical range is feasible in soil types similar to those at the site, specifically, fine to medium sand with varying minor amounts of silt. The proposal is to inject as much of the required amount that is practical. The recommended HRC injection amount per injection point in the non-core area is approximately 7 lb/ft.

Given the injection point spacing and HRC injection amount (lb/ft), the total initial-application amount of HRC required in each of the subdivided areas of the targeted plume will be:

(8 injection points) x (14 lbs/ft) x (25 ft/injection point) = 2,800 lbs in the core-area,

and

(27 injection points) x (7 lbs/ft) x (25 ft/injection point) = 4,725 lbs in the non-core area.

Thus, the total amount of HRC to be injected, to the extent practical, is approximately 7,525 pounds.

4.2.1.3 Injection Well Installation and HRC Application Methods

Re-usable injection wells will be installed in the core area, since it is expected that re-injection will be necessary (due to the high TCA concentration and likelihood of free product present). The re-usable injection wells will be installed to a depth of approximately 35 feet bgs using a direct push rig, and will consist of 2-inch diameter Schedule 80 PVC pipe and 25 feet of 40- or 50-slot screens. Each well will be finished with a flush mount well cover. The design of the well is illustrated in Appendix J. If visual observations and/or organic vapor detector readings in the field indicate that a pocket of non-aqueous phase liquids (NAPLs) has been encountered, samples will be collected and considered for analysis. These injection wells potentially could be used as monitoring wells in the future, once the residual HRC has biodegraded (as determined by the absence of organic metabolic acids in samples collected during periodic monitoring from the bottom of the well, where the dense residual HRC tends to persist the longest).

The likelihood that re-injection of HRC will be needed in the non-core area is not as high in the core area, based on the available CVOC data and the assumption that concentrations are highest in the immediate vicinity of monitoring well OU1-47GW07 and that they decline rapidly with distance away from the core area. This cannot be confirmed without installing and sampling additional wells. Consequently, the extra expense of re-usable injection points

does not seem warranted, and a standard drive rod will be used to inject HRC into the 27 locations within the non-core area. The drive rod will be withdrawn after the HRC is injected. The HRC will be injected from 35 feet bgs to the water table (approximately 7-10-feet bgs) at each of the 27 locations in the non-core area).

The HRC will be heated for injection to reduce the viscosity and allow improved migration of the HRC into the formation. The HRC will be heated to 100 degrees F using a heated grout pump prior to injection.

4.2.2 Groundwater Monitoring, Sampling, and Analysis

Bioremediation effectiveness will be monitored by collecting and analyzing groundwater samples from selected wells prior to, and throughout the duration of, the treatability study. The monitoring network will be made up of three existing and two new wells, screened in the upper Surficial Aquifer and located within and downgradient of the target contaminated plume. In addition, two existing wells screened in the lower Surficial Aquifer and located beneath the contaminant plume will be monitored on a less frequent basis (quarterly) to check for downward migration of CVOCs or substrate. Table 4-1 and Figure 4-2 identify the wells that make up the groundwater monitoring network. The following subsections describe the monitoring well installation, the groundwater monitoring frequency, and the groundwater sampling and analysis.

4.2.2.1 Monitoring Well Installation

Two new monitoring wells will be installed prior to injection of HRC; one roughly midway between existing wells OU1-47GW07 and OU1-51GW02 (OU1-47GW13), and one near the former location of monitoring well OU1-51GW01 (OU1-47GW14), as shown in Figure 4-2. The first location, OU1-47GW13, was selected to allow monitoring of remediation effectiveness within the contaminant plume downgradient of the core area. Although conditions in the field may require a modification, the proposed total depth of monitoring well OU1-47GW13 is 17 feet, with a 10-foot screen. The second location, OU1-47GW14, was selected to replace the former well OU1-51GW01, which has been destroyed. Historical data at this well showed relatively high levels of CVOC concentrations, with decreasing CVOC concentrations over time. The proposed total depth of monitoring well OU1-47GW14 is also 17 feet, with a 10-foot screen. The wells will be installed using a dual-purpose, direct-push/hollow stem auger rig. These wells will consist of 2-inch inside diameter Schedule 40 PVC pipe with a 10-foot screened interval. The screened interval will consist of 0.01-inch wide slots. The well screens for the upper Surficial Aquifer wells will be installed such that the top of the screen approximately coincides with the water table aquifer. Each well will be thoroughly developed after installation. Details of the monitoring well installation, well development, and groundwater sampling procedures can be found in Sections 2.4.1, 2.4.1.2 and 2.9.1 of the Master FSP for MCAS Cherry Point.

4.2.2.2 Groundwater Monitoring Frequency

Seven rounds of groundwater sampling are tentatively planned for the treatability study to evaluate the performance of the HRC in reducing concentrations of CVOCs in groundwater. Baseline sampling will be conducted prior to the injection of the HRC, and then at 6, 12, 18, 24, 36, and 48 weeks after injection. Regenesis's experience has shown that it commonly takes approximately 30 days before significant reductive dechlorination (RD) is detected.

The sampling intervals have been chosen to represent durations after which the remediated groundwater will pass through the monitoring wells based on the estimated groundwater linear velocity in this area. As indicated in Section 2.3.4.1, the average linear velocity of groundwater in the upper Surficial Aquifer along the area of highest contamination (monitoring wells OU1-47GW09 to OU1-47GW12) is only about 0.05 feet/day, 1.4 feet per month, or 18 feet in a one-year period. There is, however, some degree of uncertainty associated with this velocity estimate, and the calculated velocity could be as much as five times or more higher. If the former (and ostensibly best) velocity estimate is accurate, it is possible that no influence of the HRC injection will be observable at monitoring wells OU1-51GW01 and OU1-47GW07 until the second or third sampling event, and that no influence will be detectable in monitoring well OU1-51GW02 until the last sampling event. However, according to Regenesis, the extent of extrusion of HRC into the formation upon injection is 15 feet on centers (for sands, silts), or 7.5 feet from each injection point, which effectively decreases the distance from the presence of HRC to the closest monitoring well, and may allow for influence to be detected in the monitoring wells at an earlier-than-predicted sampling event.

The frequency of sampling events may be adjusted based on the results of the early sampling events. If influence of the HRC injection is not detectable in the monitoring wells by the expected sampling intervals (as a result of slower groundwater velocities with respect to travel times from substrate injection points to monitoring wells), the study duration may need to be extended to obtain an accurate evaluation of bioremediation effectiveness. The interval between sampling events will be increased accordingly.

4.2.2.3 Groundwater Sampling and Analysis

After installation and development of the new permanent monitoring wells, groundwater samples will be collected from each of the five existing wells and the two newly installed wells in the monitoring network listed in Table 4-1 to establish baseline groundwater characteristics. This will be done prior to injection of HRC and at least 24 hours after the n wells have been installed.

Groundwater samples will be analyzed both at an offsite analytical laboratory and in the field using test kits and other onsite analytical methods to reduce subcontractor laboratory costs. Groundwater parameters that will be monitored in the field will be conducted in accordance with Section 2.6 of the Master FSP for MCAS Cherry Point. A low-flow purging technique will be used, in conjunction with a flow through cell with multiple sampling and monitoring points. The parameters that will be measured in the field are listed in Table 4-2, along with the field instruments that will be used. Parameters that will be analyzed at an offsite laboratory also are listed in Table 4-2, along with the associated analytical methods. Sampling will be conducted in accordance with Section 2.9.1 of the Master FSP for MCAS Cherry Point.

Groundwater levels also will be monitored and recorded during sampling events.

Quality Assurance and Quality Control (QA/QC) samples will be collected at the frequency outlined in Table 4-3.

4.3 Data Analysis, Interpretation, and Reporting

CH2M HILL will prepare technical memos for submission to the Navy, EPA, and NCDENR to present the progress and the preliminary results of the HRC treatability study during the course of the test. It is currently envisioned that a brief technical memorandum will be prepared after each sampling round. In addition, a summary technical memorandum will be prepared after the last round of groundwater sampling, that will summarize the contents of the interim memoranda, document all field activities and analytical results from groundwater monitoring, and evaluate the effectiveness of bioremediation by the implemented technology.

4.4 Residuals Management

Three types of potentially contaminated residues are expected to be generated during the field work:

1. Personal protective equipment (PPE).
2. Fluids from the decontamination of the drilling equipment, sampling tools and equipment, and PPE.
3. Purge water from well development and groundwater sampling.

Details on procedures for the handling and disposal of these materials can be found in Section 2.15 of the Master FSP for MCAS Cherry Point.

Table 4-1
Treatability Test Monitoring Well Network

Sampling Point	Total Depth (feet bgs)	Depth of Screened Interval (feet bgs)
Wells Within the Targeted Groundwater Plume		
OU1-47GW07	17	7-17
OU1-47GW08*	48	38-48
OU1-47GW13 (proposed new well)	17	7-17 (planned to be screened such that the top of the screen approximately coincides with the water table)
OU1-47GW14 (proposed new well)	17	7-17 (planned to be screened such that the top of the screen approximately coincides with the water table)
Wells Downgradient of the Targeted Groundwater Plume		
OU1-47GW11*	50	40-50
OU1-51GW02	14.89	4.89-14.89
OU1-47GW12	17	7-17
All wells are screened in the upper Surficial Aquifer, with the exception of wells OU1-47GW08 and OU1-47GW11, which are screened in the lower Surficial Aquifer.		

Table 4-2
Treatability Study Monitoring Parameters

Parameter	Analytical Method
Dissolved Gases	
Dissolved Methane, Ethane, Ethene	EPA R.S. Kerr Laboratory SOP-147 [5]
Dissolved Oxygen	Horiba Combination Meter[1] (Field Test)
Geochemical Parameters	
Alkalinity	EPA 310.1 [4]
Chloride	EPA 325.2 [4]
Nitrate as Nitrogen	EPA 352.1 [4]
Nitrite as Nitrogen	EPA 354.1 [4]
Oxidation Reduction Potential (ORP)	Oxidation-Reduction Meter[1] (Field Test)
pH	Horiba Combination Meter[1] (Field Test)
Sulfate	EPA 375.4 [4]
Sulfide	HACH Test Kit[2] (Field Test)
Temperature	Horiba Combination Meter[1] (Field Test)
Dissolved Metals	
Ferrous Iron	HACH Test Kit[2] (Field Test)
Dissolved Manganese	EPA SW-846/6010B
Organic Metabolic Acids	
Acetic, Butyric, Lactic, Propionic, and Pyruvic Acids	High Performance Liquid Chromatography (HPLC)
Volatile Organics	EPA SW-846/8260B [3]

Notes:

[1] Obtained from Section 2.6.1 of Brown & Root Environmental's April 1998 Master FSP for MCAS Cherry Point.

[2] Obtained from Section 5.3 of the Master QAP for MCAS Cherry Point.

[3] Obtained from VOC List in Table 5-1 Section 5.5.1 of the Master QAP for MCAS Cherry Point.

[4] Obtained from Physical Properties/Non-Metal Inorganic List in Table 5-1 Section 5.5.1 of the Master QAP for MCAS Cherry Point.

[5] Obtained from Natural Attenuation Parameters List in Table 5-1 Section 5.5.1 of the Master QAP for MCAS Cherry Point.

Table 4-3
General Requirements for QC Sample Collection

QC Samples	QC Specified Collection Frequency
Field Duplicates	One duplicate per 10 groundwater samples or one duplicate per day per sampling event, whichever is more frequent
Field Blanks	One per sampling event (i.e. sampling round). The number of field blanks will increase in the event that ambient site conditions vary, or for sampling events that extend beyond a week (5 working days).
Trip Blanks	One set of trip blanks per cooler containing samples collected for VOC analysis
Matrix Spikes	One per 20 samples
Equipment Blanks	One per day
The QC sample collection requirements listed are in accordance with EPA Region IV guidance, specifically "*Environmental Investigations Standard Operating Procedures and Quality Assurance Manual,*" EPA Region IV, May 1996.	

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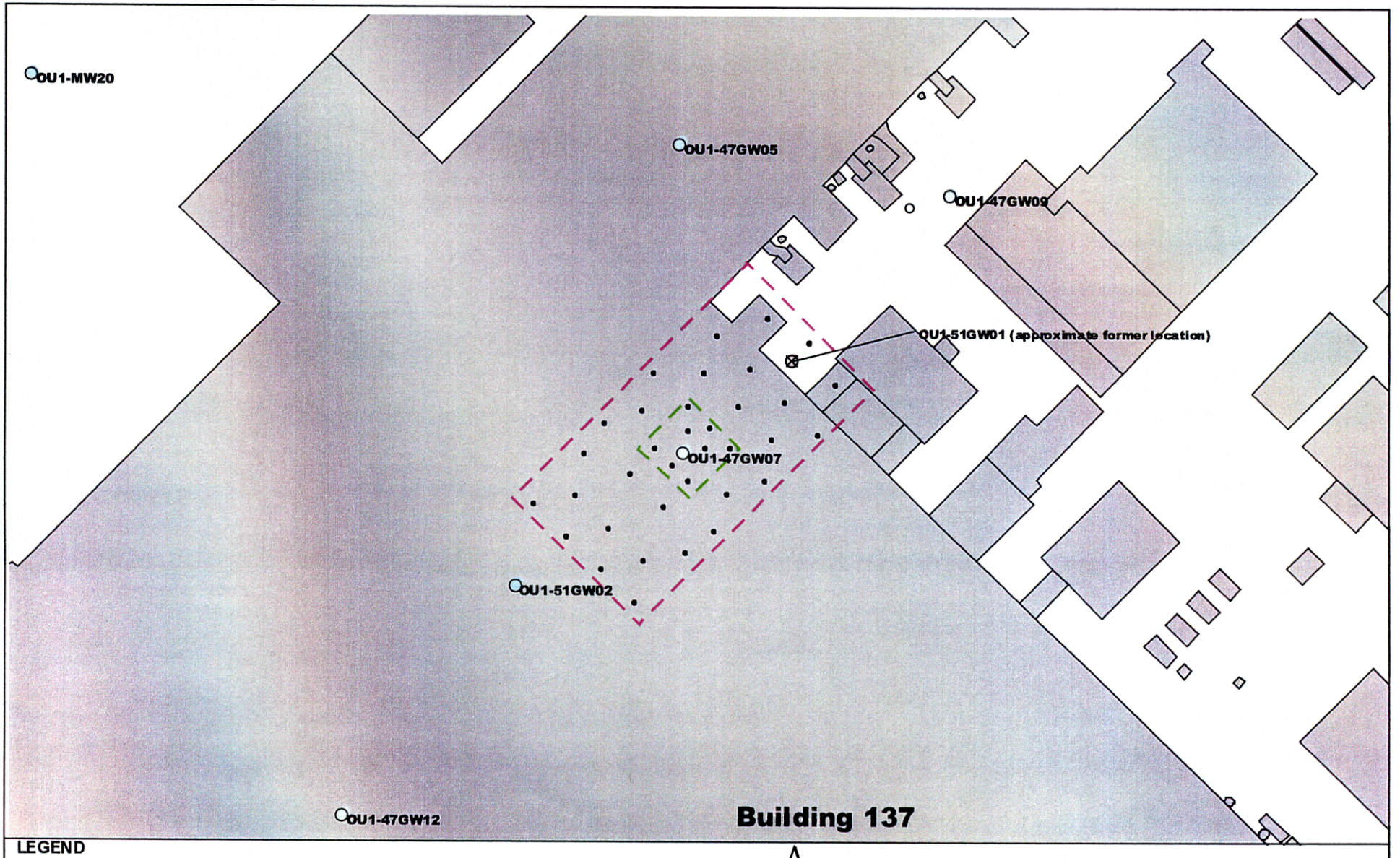

Figure 4-1
HRC® Design Injection Point
Site 47 IRA
MCAS Cherry Point

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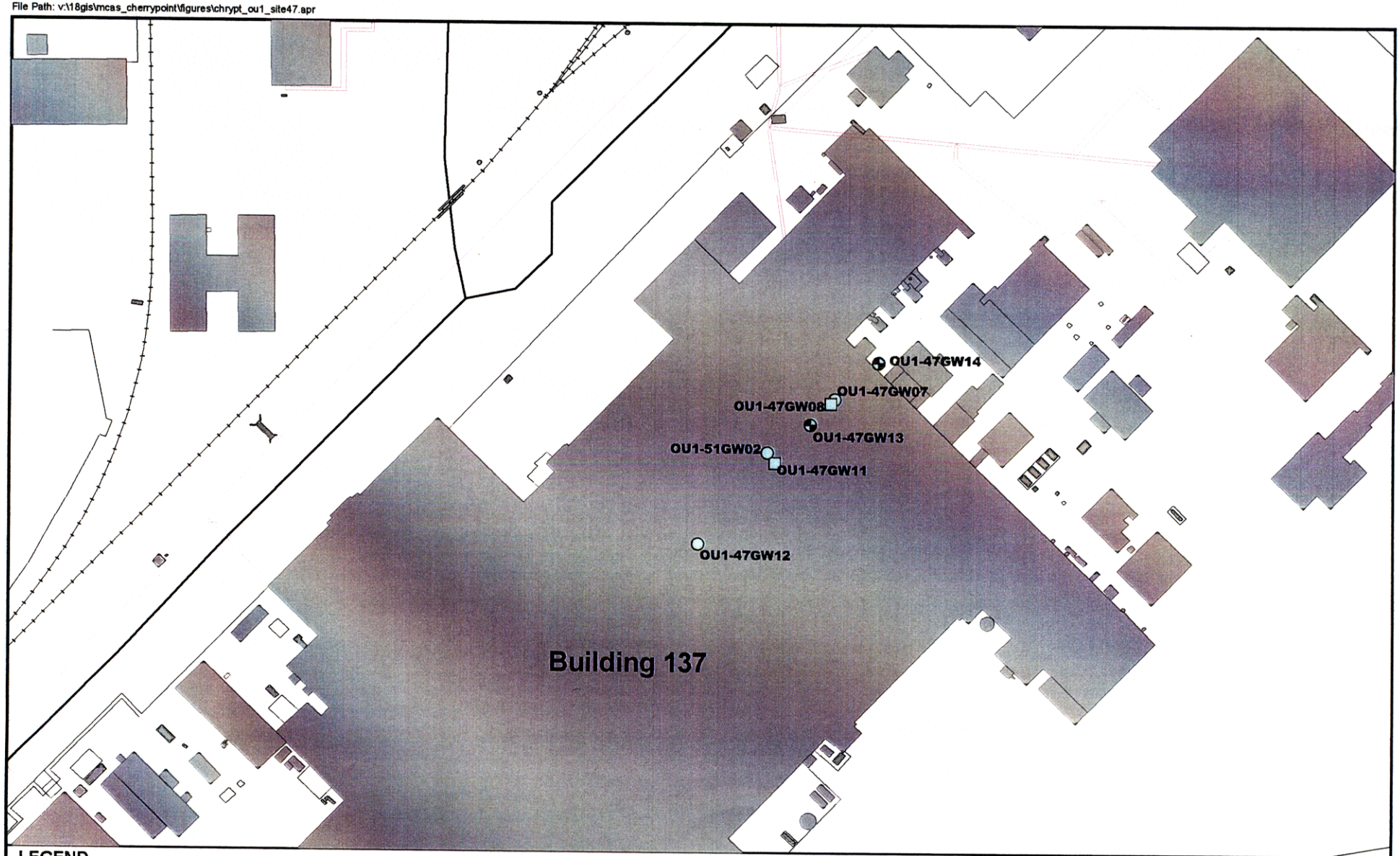


LEGEND

- Proposed Upper Surficial Aquifer Monitoring Wells
- Existing Upper Surficial Aquifer Monitoring Well
- Existing Lower Surficial Aquifer Monitoring Well
- Railroad Track Centerline
- Road Centerline
- Fences
- Steam Pipes
- Buildings & Structures

N

0 80 160 Feet

Figure 4-2
Upper and Lower Surficial Aquifer
Groundwater Monitoring Well Network
Site 47 IRA
MCAS Cherry Point

CH2MHILL

5.0 References

Brown & Root Environmental. April 1988a. *Master Field Sampling Plan for Marine Corps Air Station Cherry Point, North Carolina,* Contract Number N62472-90-D-1298, Contract Task Order 0266.

Brown & Root Environmental. April 1998b. *Master Quality Assurance Plan for Marine Corps Air Station Cherry Point, North Carolina,* Contract Number N62472-90-D-1298, Contract Task Order 0266.

Eimers, J.L., et al., 1994, *Hydrogeology and Simulation of Ground-Water Flow at U.S. Marine Corps Air Station, Cherry Point, North Carolina,* 1987-90, U.S. Geological Survey Water-Resources Investigations Report 94-4186, 75p.

LANTDIV, 3rd Quarter, Fiscal Year 1993. *Installation Restoration Site Management Plan.*

McCarty, P.L. & Semprini, L., 1994, Groundwater Treatment for Chlorinated Solvents. Section 5 in *Handbook of Bioremediation,* Lewis Publishers, Boca Raton, Florida.

U.S. EPA. September 1998. *"Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water,"* Document Number: EPA/600/R-98/128.

Appendix A
Groundwater Sample Analytical Results

Table
Raw Temporary Well Groundwater Data
Site 47 Stripper Barn Plume
Cherry Point, NC

Chemical Name	47TW01	47TW02	47TW03	47TW04	47TW05	47TW06	47TW07	47TW08	47TW09	47TW10	47TW11	47TW12	47TW13
Volatile Organic Compounds (ug/L)													
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.1	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	4.4	1 U	1 U	1 U	5.8
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.6	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	2.1	1.5	1 U	1 U	6.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	22
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Carbon disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloroform	1 U	1 U	1 U	1 U	1 U	22	1 U	1 U	2.4	1 U	1.2	1 U	1 U
Chloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene chloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	1 U	1 U	1 U	4	1 U	1 U	17	1 U	2.3	1 U	1 U	1 U	2.5
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	1.6	1.2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	7.1
Vinyl chloride	2 U	2 U	2 U	2 U	21	2 U	2 U	5.2	2 U	2 U	2 U	2 U	2 U
Xylene, total	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Note: All temporary wells were screened in the upper Surficial Aquifer.

NA - Not analyzed
U - Analyte not detected

Table A2
Detected Temporary Well Groundwater Data
Site 47 Stripper Barn Plume
Cherry Point, NC

Chemical Name	47TW01	47TW02	47TW03	47TW04	47TW05	47TW06	47TW07	47TW08	47TW09	47TW10	47TW11	47TW12	47TW13
Volatile Organic Compounds (ug/L)													
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.1	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	4.4	1 U	1 U	1 U	5.8
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.6	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	2.1	1.5	1 U	1 U	6.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	22
Chloroform	1 U	1 U	1 U	1 U	1 U	22	1 U	1 U	2.4	1 U	1.2	1 U	1 U
Tetrachloroethene	1 U	1 U	1 U	4	1 U	1 U	17	1 U	2.3	1 U	1 U	1 U	2.5
Trichloroethene	1.6	1.2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	7.1
Vinyl chloride	2 U	2 U	2 U	2 U	21	2 U	2 U	5.2	2 U	2 U	2 U	2 U	2 U

Note: All temporary wells were screened in the upper Surficial Aquifer.

Shaded cells indicate detected analytes.

NA - Not analyzed
U - Analyte not detected

Table
Raw Monitoring Well Groundwater Data
Site 47 Stripper Barn Plume
Cherry Point, NC

Well ID	47GW01	47GW02	47GW03	47GW04	47GW05	47GW06	47GW07	47GW08	47GW09	47GW10	47GW11	47GW11-P	47GW12	51GW02	MW-22	MW-23	MW-24	MW-25
Screened Placement	US	LS	US	LS	US	LS	US	LS	US	LS	LS	LS	US	US	US	LS	LS	LS
Chemical Name																		
Volatile Organic Compounds (UG/L)																		
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1.7 U	1 U	49,000	8.2	1 U	1 U	1.1	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	2.6	1 U	5,000 U	1.6	1 U	1 U	1 U	1 U	3	350	1 U	50 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1.7	1 U	5,000 U	1.1	1 U	1 U	1 U	1 U	2.5 U	140	1 U	50 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
1,2-Dichloroethene (total)	1 U	1 U	1 U	1 U	1.7 U	1.5	5,000 U	1 U	1.5	1 U	1 U	1 U	2.5 U	39	1 U	880	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
2-Butanone	10 R	10 R	10 R	10 R	17 U	10 R	50,000 R	10 R	10 R	10 R	10 R	10 R	25 R	120 R	10 R	500 R	10 R	10 R
2-Hexanone	10 U	10 U	10 U	10 U	17 U	10 U	50,000 U	10 U	10 U	10 U	10 U	10 U	25 U	120 U	10 U	500 U	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	17 U	10 U	50,000 U	10 U	10 U	10 U	10 U	10 U	25 U	120 U	10 U	500 U	10 U	10 U
Acetone	10 R	10 R	13 L	10 R	17 R	10 R	50,000 R	10 R	10 R	10 R	10 R	10 R	25 R	120 R	31 L	500 R	10 R	10 R
Benzene	1 U	1 U	1 U	1 U	3.4	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Bromoform	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Bromomethane	2 U	2 U	2 U	2 U	3.3	2 U	10,000 U	2 U	2 U	2 U	2 U	2 U	5 U	25 U	2 U	100 U	2 U	2 U
Carbon disulfide	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Carbon tetrachloride	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Chloroethane	2 U	2 U	2 U	2 U	21	2 U	10,000 U	2 U	2 U	2 U	2 U	2 U	5 U	25 U	2 U	100 U	2 U	2 U
Chloroform	1 U	3 B	1 U	3.2 B	1.7 U	1 U	5,000 U	1.6 B	1 U	1 U	1.9 B	1.8 B	2.5 U	12 U	1 U	50 U	1 U	1 U
Chloromethane	2 U	2 U	2 U	2 U	3.3 U	2 U	10,000 U	2 U	2 U	2 U	2 U	2 U	5 U	25 U	2 U	100 U	2 U	2 U
Dibromochloromethane	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Ethylbenzene	1 U	1 U	1 U	1 U	4.1	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Methylene chloride	1 U	1 U	3.9	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Styrene	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	2.9	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Trichloroethene	1 U	1 U	1 U	1 U	1.7 U	1 U	8,500	2.2	1 U	1 U	1	1 U	2.5 U	21	1 U	1,500	1 U	1 U
Vinyl chloride	2 U	2 U	2 U	2 U	39	2 U	10,000 U	2 U	2 U	2 U	2 U	2 U	5 U	160	2 U	170	2 U	2 U
Xylene, total	1 U	1 U	1 U	1 U	3.8	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
trans-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Geochemistry (MG/L)																		
Alkalinity	60	80	170	160	250	330	72	70	150	95	220	210	20	NS	210	350	340	18
Chemical oxygen demand	5.9	5 U	16.8	7.2	32	8.5	38.6	16.1	12.1	5 U	7.2	8.5	6.2	NS	12.5	13.8	5 U	5 U
Chloride	7	11	7	7	32	8	58	9	11	5	6	6	17	NS	22	11	8	4
Ethane (ug/L)	0.5 U	0.5 U	0.5 U	0.5 U	38	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NS	0.5 U	3.3	0.5 U	0.5 U
Ethene (ug/L)	0.5 U	0.5 U	0.5 U	0.5 U	110	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NS	0.5 U	7.6	0.5 U	0.5 U
Manganese (ug/L)	77	87	370	39	140	69	120	87	710	19	340	340	130	NS	23	120	35	17
Methane (ug/L)	0.51	22	180 D	90 D	5,700 D	100 D	4.9	36	14	92 D	10	11	53	NS	1,000 D	920 D	110 D	41
Nitrate	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	6	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.7	NS	0.2	0.1 U	0.1 U	0.1 U
Nitrite	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1.4	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	NS	0.1 U	0.1 U	0.1 U	0.1 U
Sulfate	52	29	44	13	25	28	56	35	72	21	65	62	29	NS	43	19	24	36
Total organic carbon (TOC)	2	2	6	3	11	4	6	3	5	2	2	NS	1	NS	4	5	2	2

US - upper Surficial Aquifer
LS - lower Surficial Aquifer

NS - Not sampled
B - Analyte not detected above associated blank
D - Result came from a diluted sample
L - Reported value may be biased low
R - Unreliable result

U - Analyte not detected

Table A4
Detected Monitoring Well Groundwater Data
Site 47 Stripper Barn Plume
Cherry Point, NC

Well ID	47GW01	47GW02	47GW03	47GW04	47GW05	47GW06	47GW07	47GW08	47GW09	47GW10	47GW11	47GW11-P	47GW12	51GW02	MW-22	MW-23	MW-24	MW-25
Screened Placement	US	LS	US	LS	US	LS	US	LS	US	LS	LS	LS	US	US	US	LS	LS	LS
Chemical Name																		
Volatile Organic Compounds (UG/L)																		
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1.7 U	1 U	49,000	8.2	1 U	1 U	1.1	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	2.6	1 U	5,000 U	1.6	1 U	1 U	1 U	1 U	3	350	1 U	50 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1.7 U	1 U	5,000 U	1.1	1 U	1 U	1 U	1 U	2.5 U	140	1 U	50 U	1 U	1 U
1,2-Di roethene (total)	1 U	1 U	1 U	1 U	1.7 U	1.5	5,000 U	1 U	1.5	1 U	1 U	1 U	2.5 U	39	1 U	880	1 U	1 U
2-Buta ne	10 R	10 R	10 R	10 R	17 U	10 R	50,000 R	10 R	10 R	10 R	10 R	10 R	25 R	120 R	10 R	500 R	10 R	10 R
Acetone	10 R	10 R	13 L	10 R	17 R	10 R	50,000 R	10 R	10 R	10 R	10 R	10 R	25 R	120 R	31 L	500 R	10 R	10 R
Benzene	1 U	1 U	1 U	1 U	3.4	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Ch roethane	2 U	2 U	2 U	2 U	21	2 U	10,000 U	2 U	2 U	2 U	2 U	2 U	5 U	25 U	2 U	100 U	2 U	2 U
Ethylbenzene	1 U	1 U	1 U	1 U	4.1	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Methylene chloride	1 U	1 U	3.9	1 U	1.7 U	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	2.9	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Trichloroethene	1 U	1 U	1 U	1 U	1.7 U	1 U	5,500	2.2	1 U	1 U	1	1 U	2.5 U	21	1 U	1,500	1 U	1 U
Vinyl chloride	2 U	2 U	2 U	2 U	39	2 U	10,000 U	2 U	2 U	2 U	2 U	2 U	5 U	160	2 U	170	2 U	2 U
Xylene, total	1 U	1 U	1 U	1 U	3.8	1 U	5,000 U	1 U	1 U	1 U	1 U	1 U	2.5 U	12 U	1 U	50 U	1 U	1 U
Geochemistry (MG/L)																		
Alkalinity	60	80	170	160	250	330	72	70	150	95	220	210	20	NS	210	350	340	18
Chemi al oxygen demand	5.9	5 U	16.8	7.2	32	8.5	38.6	16.1	12.1	5 U	7.2	8.5	6.2	NS	12.5	13.8	5 U	5 U
Chloride	7	11	7	7	32	8	58	9	11	5	6	6	17	NS	22	11	8	4
Ethane (ug/L)	0.5 U	0.5 U	0.5 U	0.5 U	38	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NS	0.5 U	3.3	0.5 U	0.5 U
Ethene (ug/L)	0.5 U	0.5 U	0.5 U	0.5 U	110	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NS	0.5 U	7.6	0.5 U	0.5 U
Manganese (ug/L)	77	87	370	39	140	69	120	87	710	19	340	340	130	NS	23	120	35	17
Methane (ug/L)	0.51	22	180 D	90 D	5,700 D	100 D	4.9	36	14	92 D	10	11	53	NS	1,000 D	920 D	110 D	41
Nitrate	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	6	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.7	NS	0.2	0.1 U	0.1 U	0.1 U
Nitrite	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1.4	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	NS	0.1 U	0.1 U	0.1 U	0.1 U
Sulfate	52	29	44	13	25	28	56	35	72	21	65	62	29	NS	43	19	24	36
Total organic carbon (TOC)	2	2	6	3	11	4	6	3	5	2	2	NS	1	NS	4	5	2	2

US - upper Surficial Aquifer
LS - lower Surficial Aquifer

Shaded cells indicate detected analytes.

NS - Not sampled
D - Result came from a diluted sample
L - Reported value be biased low
R - Unreliable re
U - Analyte not d

Table A5
Soil Data
Site 47 Stripper Barn Plume
Cherry Point, NC

	47GW02-SB	47GW04-SB	47GW08-SB	47GW09-SB	47TW08-SB
Chemical Name					
Wet Chemistry (%)					
% Solids	82.7	81.8	88.9	82.1	94.9
Total organic carbon (TOC) - mg/kg	670	120 U	460	120 U	820

NA - Not analyzed
U - Analyte not detected

Table A6
Raw Quality Control Data
Site 47 Stripper Barn Plume
Cherry Point, NC

	47EB0300	47FB0300	47TB0323	47TB0324	OU1-47TB01-0307
Chemical Name					
Volatile Organic Compounds (ug/L)					
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U
2-Butanone	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U
Acetone	10 U	10 U	10 U	10 U	10 U
Benzene	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U
Bromoform	1 U	1 U	1 U	1 U	1 U
Bromomethane	2 U	2 U	2 U	2 U	2 U
Carbon disulfide	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U
Chloroethane	2 U	2 U	2 U	2 U	2 U
Chloroform	4.9	7.2	1 U	1 U	1 U
Chloromethane	2 U	2 U	2 U	2 U	2 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	1 U	1 U	1 U	1 U	1 U
Ethane	0.5 U	0.5 U	NA	NA	NA
Ethene	0.5 U	0.5 U	NA	NA	NA
Ethylbenzene	1 U	1 U	1 U	1 U	1 U
Methane	0.5 U	0.5 U	NA	NA	NA
Methylene chloride	1 U	1 U	1 U	1 U	1 U
Styrene	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U
Trichloroethene	1 U	1 U	1 U	1 U	1 U
Vinyl chloride	2 U	2 U	2 U	2 U	2 U
Xylene, total	1 U	1 U	1 U	1 U	1 U
Wet Chemistry (mg/L)					
Alkalinity	5 U	5 U	NA	NA	NA
Chemical oxygen demand	5 U	5 U	NA	NA	NA
Chloride	1 U	1 U	NA	NA	NA
Manganese	0.0025 U	0.0025 U	NA	NA	NA
Nitrate	0.1 U	0.1 U	NA	NA	NA
Nitrite	0.1 U	0.1 U	NA	NA	NA
Sulfate	5 U	5 U	NA	NA	NA
Total organic carbon (TOC)	1 U	1 U	NA	NA	NA

NA - Not analyzed
U - Analyte not detected

Table A7
Detected Quality Control Data
Site 47 Stripper Barn Plume
Cherry Point, NC

	47EB0300	47FB0300	47TB0323	47TB0324	OU1-47TB01-0307
Chemical Name					
Volatile Organic Compounds (ug/L)					
Chloroform	4.9	7.2	1 U	1 U	1 U
Wet Chemistry (mg/L)					
No Detections					

Shaded cells indicate detected analytes.

NA - Not analyzed
U - Analyte not detected

Non-Validated Temporary Well Data

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C090118 001
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/09/00
Work Order: D9EFP101 Date Extracted:03/09/00
Dilution factor: 1 Date Analyzed: 03/09/00
Moisture %:NA

QC Batch: 0069301

Client Sample Id: 47TW09

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	**1,1-Dichloroethene**	**1.6**	
75-34-3	**1,1-Dichloroethane**	**4.4**	
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	**Chloroform**	**2.4**	
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	**1,1,1-Trichloroethane**	**2.1**	
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	**Tetrachloroethene**	**2.3**	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C090118 001
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/09/00
Work Order: D9EFP101 Date Extracted:03/09/00
Dilution factor: 1 Date Analyzed: 03/09/00
Moisture %:NA

QC Batch: 0069301

Client Sample Id: 47TW09

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C090118 002
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/09/00
Work Order: D9EFQ101 Date Extracted:03/09/00
Dilution factor: 1 Date Analyzed: 03/09/00
Moisture %:NA

QC Batch: 0069301

Client Sample Id: 47TW10

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C090118 002
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/09/00
Work Order: D9EFQ101 Date Extracted:03/09/00
Dilution factor: 1 Date Analyzed: 03/09/00
Moisture %:NA

QC Batch: 0069301

Client Sample Id: 47TW10

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 001

Sample WT/Vol: 25 / mL
Work Order: D9CC3101
Dilution factor: 12.5
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 51GW02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	25	U
74-83-9	Bromomethane	25	U
75-01-4	**Vinyl chloride**	**160**	
75-00-3	Chloroethane	25	U
75-09-2	Methylene chloride	12	U
67-64-1	Acetone	120	U
75-15-0	Carbon disulfide	12	U
75-35-4	**1,1-Dichloroethene**	**140**	
75-34-3	**1,1-Dichloroethane**	**350**	
540-59-0	**1,2-Dichloroethene (total)**	**39**	
67-66-3	Chloroform	12	U
107-06-2	1,2-Dichloroethane	12	U
78-93-3	2-Butanone	120	U
71-55-6	1,1,1-Trichloroethane	12	U
56-23-5	Carbon tetrachloride	12	U
75-27-4	Bromodichloromethane	12	U
78-87-5	1,2-Dichloropropane	12	U
10061-01-5	cis-1,3-Dichloropropene	12	U
79-01-6	**Trichloroethene**	**21**	
124-48-1	Dibromochloromethane	12	U
79-00-5	1,1,2-Trichloroethane	12	U
71-43-2	Benzene	12	U
10061-02-6	trans-1,3-Dichloropropene	12	U
75-25-2	Bromoform	12	U
108-10-1	4-Methyl-2-pentanone	120	U
591-78-6	2-Hexanone	120	U
127-18-4	Tetrachloroethene	12	U
79-34-5	1,1,2,2-Tetrachloroethane	12	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 001

Sample WT/Vol: 25 / mL
Work Order: D9CC3101
Dilution factor: 12.5
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 51GW02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	12	U
108-90-7	Chlorobenzene	12	U
100-41-4	Ethylbenzene	12	U
100-42-5	Styrene	12	U
1330-20-7	Xylenes (total)	12	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 002

Sample WT/Vol: 25 / mL
Work Order: D9CC4101
Dilution factor: 1
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 47TW13

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	**1,1-Dichloroethane**	**5.8**	
540-59-0	**1,2-Dichloroethene (total)**	**22**	
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	**Trichloroethene**	**7.1**	
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	**Tetrachloroethene**	**2.5**	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 002

Sample WT/Vol: 25 / mL
Work Order: D9CC4101
Dilution factor: 1
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 47TW13

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 003

Sample WT/Vol: 25 / mL
Work Order: D9CC7101
Dilution factor: 1
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 47TW11

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.2	
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 003

Sample WT/Vol: 25 / mL
Work Order: D9CC7101
Dilution factor: 1
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 47TW11

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 004

Sample WT/Vol: 25 / mL
Work Order: D9CC8101
Dilution factor: 1
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 47TW08

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	5.2	
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 004

Sample WT/Vol: 25 / mL
Work Order: D9CC8101
Dilution factor: 1
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 47TW08

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C070214 005
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/07/00
Work Order: D9CC9101 Date Extracted:03/08/00
Dilution factor: 1 Date Analyzed: 03/08/00
Moisture %:NA

QC Batch: 0068256

Client Sample Id: 47TW02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	**1,2-Dichloroethene (total)**	**1.5**	
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	**Trichloroethene**	**1.2**	
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C070214 005
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/07/00
Work Order: D9CC9101 Date Extracted:03/08/00
Dilution factor: 1 Date Analyzed: 03/08/00
Moisture %:NA

QC Batch: 0068256

Client Sample Id: 47TW02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 006

Sample WT/Vol: 25 / mL
Work Order: D9CCA101
Dilution factor: 1
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 47TW01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	**1,2-Dichloroethene (total)**	**2.1**	
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	**Trichloroethene**	**1.6**	
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 006

Sample WT/Vol: 25 / mL
Work Order: D9CCA101
Dilution factor: 1
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 47TW01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID: A0C080131 001

Sample WT/Vol: 5 / mL
Work Order: D9D0D101
Dilution factor: 1
Moisture %: NA

Date Received: 03/08/00
Date Extracted: 03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW04

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	**Tetrachloroethene**	**4.0**	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 001

Sample WT/Vol: 5 / mL
Work Order: D9D0D101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW04

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 002

Sample WT/Vol: 5 / mL
Work Order: D9D0E101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW12

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 002

Sample WT/Vol: 5 / mL
Work Order: D9D0E101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW12

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L		Q
108-88-3	Toluene		1.0	U
108-90-7	Chlorobenzene		1.0	U
100-41-4	Ethylbenzene		1.0	U
100-42-5	Styrene		1.0	U
1330-20-7	Xylenes (total)		1.0	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 003

Sample WT/Vol: 5 / mL
Work Order: D9D0F101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: OU1-47TB01-0307

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 003

Sample WT/Vol: 5 / mL
Work Order: D9D0F101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: OU1-47TB01-0307

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 004

Sample WT/Vol: 5 / mL
Work Order: D9D0G101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 004

Sample WT/Vol: 5 / mL
Work Order: D9D0G101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 005

Sample WT/Vol: 5 / mL
Work Order: D9D0J101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW05

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	**Vinyl chloride**	**21**	
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	**1,2-Dichloroethene (total)**	**6.6**	
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID: A0C080131 005

Sample WT/Vol: 5 / mL
Work Order: D9D0J101
Dilution factor: 1
Moisture %: NA

Date Received: 03/08/00
Date Extracted: 03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW05

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 006

Sample WT/Vol: 5 / mL
Work Order: D9D0K101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW06

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	**Chloroform**	**22**	
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 006

Sample WT/Vol: 5 / mL
Work Order: D9D0K101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW06

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 007

Sample WT/Vol: 5 / mL
Work Order: D9D0L101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW07

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	17	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C080131 007

Sample WT/Vol: 5 / mL
Work Order: D9D0L101
Dilution factor: 1
Moisture %:NA

Date Received: 03/08/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0069118

Client Sample Id: 47TW07

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

Appendix B
Data Validation Package

Environmental
Data Quality, Inc.

967 East Swedesford Road, Suite 401, Exton, Pennsylvania 19341
610-725-1770 610-725-1781 fax edqi@voicenet.com

May 20, 2000
Reference: 604.70.01

Jeff Morrison
CH2M Hill
13921 Park Center Road
Suite 600
Herndon, VA 20171

TRANSMITTAL: Data Validation Report - March 2000 Sampling, MCAS Cherry Point, OU-1 Site 47, CTO-136, 20 May 2000

Dear Jeff:

Please find enclosed one copy of the above-referenced report. Files containing the final, validated results were forwarded to you previously via electronic mail.

Jeff, thank you for considering Environmental Data Quality, Inc. for your data validation needs. Please contact me at (610) 725-1770 should you have questions concerning this report.

Sincerely,

Shawne M. Rodgers
President

Enclosures

Analytical Data Validation Report
Samples Collected March 2000
MCAS Cherry Point OU-1 Site 47
(CTO-136)

May 20, 2000

Environmental Data Quality, Inc.
967 East Swedesford Road Suite 401
Exton, Pennsylvania 19341

File No.: 601.70.01

Analytical Data Validation Report
Samples Collected March 2000
MCAS Cherry Point OU-1 Site 47
(CTO-136)

May 20, 2000

Shawne M. Rodgers
President

Environmental Data Quality, Inc.
967 East Swedesford Road Suite 401
Exton, Pennsylvania 19341

File No.: [illegible].70.01

LIST OF TABLES **FOLLOWING PAGE**

EXECUTIVE SUMMARY

This analytical data validation report is based on the review of data generated for ground water samples. The sample locations, laboratory identification numbers, sample collection dates, sample matrix, and analyses performed are presented in Table 1-1. The samples are presented in order of collection date.

The samples were analyzed for volatile organic compounds, as specified in Table 1-1. Severn Trent Laboratories, North Canton, Ohio, performed all analyses.

The sample analyses were performed in accordance with the procedures outlined in the OLC02 USEPA Contract Laboratory Program (CLP) Statement of Work for Organic Analysis. Results have been validated or qualified according to general guidance provided in the Region III modifications to "Laboratory Data Validation Functional Guidelines for Validating Organic Analyses", USEPA 9/94. This document specifies procedures for validating data generated for CLP analyses.

The organic analyses were performed acceptably, but required qualifying statements. The aspects of the data, which required qualification, are identified in this report.

Acetone and 2-butanone results were qualified for the samples because of poor response of calibration standards for these compounds.

Analysis results forms presenting the validated and qualified results for the samples are included in Attachment 1.

1.0 INTRODUCTION

This analytical data validation report is based on the review of data generated for ground water samples. The sample locations, laboratory identification numbers, sample collection dates, sample matrix, and analyses performed are presented in Table 1-1. The samples are presented in order of collection date.

The samples were analyzed for volatile organic compounds, as specified in Table 1-1. Severn Trent Laboratories, North Canton, Ohio, performed all analyses.

The sample analyses were performed in accordance with the procedures outlined in the OLC02 USEPA Contract Laboratory Program (CLP) Statement of Work for Organic Analysis. Results have been validated or qualified according to general guidance provided in the Region III modifications to "Laboratory Data Validation Functional Guidelines for Validating Organic Analyses", USEPA 9/94. This document specifies procedures for validating data generated for CLP analyses.

The organic analyses were performed acceptably, but required qualifying statements. The aspects of the data, which required qualification, are identified in this report.

Completeness of data deliverables for all samples and method compliance is discussed in Section 2.0. Analysis results forms presenting the validated and qualified results for the samples are included in Attachment 1.

2.0 *DATA DELIVERABLE COMPLETENESS AND METHOD COMPLIANCE*

During the course of the quality assurance data validation review, an evaluation of the completeness of the data deliverables provided by the laboratory and conformance to the specified methods was performed. Data deliverables that were determined to be either incomplete or incorrect were required to be resubmitted by the laboratory. Deviations from the protocols in the required analysis methods were evaluated to determine the impact, if any on the analysis results reported by the laboratory. Qualifications to the data resulting from method deviations are discussed fully for the samples receiving the validation review in Section 3.0.

2.1 *DATA DELIVERABLE COMPLETENESS*

The following deliverables issues were identified during the data validation review.

2.1.1 *Organic Analyses*

- The data deliverables were complete.

2.2 *METHOD COMPLIANCE*

The following are considered to be deviations from the specified methods. Qualifications to affected samples are discussed in Section 3.0.

2.2.1 *Organic Analyses*

- Based on the deliverables reviewed, there were no deviations to the organic methodologies used for analysis.

3.0 *ORGANIC DATA*

The findings offered in this report are based on a review of the analytical data reported according to a CLP-equivalent deliverable format.

The data validation included an assessment of the following items: chain of custody documentation, holding times, laboratory method, field, and trip blank results, surrogate recoveries, MS/MSD analysis results, field duplicate results, bromofluorobenzene (BFB) mass tuning results, initial and continuing calibrations, internal standard performance, qualitative identification, and quantitation of results.

The organic analyses were performed acceptably, but require qualifying statements. It is recommended that the data only be used with the qualifying statements presented below. Any data that are not discussed in this report should be considered qualitatively and quantitatively valid, based on the items evaluated. Validated and/or qualified results for the samples are provided in Attachment 1.

3.1 *DATA QUALIFIERS*

- Positive results reported for chloroform for samples 47GW02, 47GW04, 47GW08, 47GW11, and 47GW11P are qualitatively invalid due to the presence of this compound in the associated equipment blank. USEPA protocol requires positive results for uncommon contaminants, such as chloroform, that are less than or equal to five times the associated blank contamination level, to be considered qualitatively invalid. Placing "B" qualifiers next to these quantitative results for these samples has indicated this.
- The positive results and quantitation limits for acetone and 2-butanone for the samples have been rejected and should be considered suspect. The initial calibration average relative response factor (RRF) was less than 0.05 for these compounds. This indicates a lack of instrument stability for these compounds. Positive results have been marked with "L" qualifiers to indicate that they are biased low. Quantitation limits have been marked with "R" qualifiers to indicate that they are suspect.
- The samples presented below were analyzed at dilutions for volatile organic cc pounds. The dilutio analyses were performed because of suspected high concentrations of target compounds and/or interferences. Quantitation limits elevated by the dilution factor have resulted for those compounds that were not detected. This should be noted when assessing the data.

Sample	Dilution Factor
47GW05	1.7
47GW07	5000
47GW12	2.5

- As required by CLP protocol, all compounds that were qualitatively identified at concentrations below their respective Contract Required Quantitation Limits (CRQLs) have been marked with "J" qualifiers to indicate that they are quantitative estimates.

40 SUMMARY

The organic analyses described in this analytical data validation report were performed acceptably, but required qualifying statements. The aspects of the data, which required qualification, are identified in this report.

Attachment 1
Analysis Results Forms Presenting Validated and Qualified Results

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 001

Sample WT/Vol: 25 / mL
Work Order: D9CC3101
Dilution factor: 12.5
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 51GW02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	25	U	
74-83-9	Bromomethane	25	U	
75-01-4	**Vinyl chloride**	**160**		
75-00-3	Chloroethane	25	U	
75-09-2	Methylene chloride	12	U	
67-64-1	Acetone	120	U	R
75-15-0	Carbon disulfide	12	U	
75-35-4	**1,1-Dichloroethene**	**140**		
75-34-3	**1,1-Dichloroethane**	**350**		
540-59-0	**1,2-Dichloroethene (total)**	**39**		
67-66-3	Chloroform	12	U	
107-06-2	1,2-Dichloroethane	12	U	
78-93-3	2-Butanone	120	U	R
71-55-6	1,1,1-Trichloroethane	12	U	
56-23-5	Carbon tetrachloride	12	U	
75-27-4	Bromodichloromethane	12	U	
78-87-5	1,2-Dichloropropane	12	U	
10061-01-5	cis-1,3-Dichloropropene	12	U	
79-01-6	**Trichloroethene**	**21**		
124-48-1	Dibromochloromethane	12	U	
79-00-5	1,1,2-Trichloroethane	12	U	
71-43-2	Benzene	12	U	
10061-02-6	trans-1,3-Dichloropropene	12	U	
75-25-2	Bromoform	12	U	
108-10-1	4-Methyl-2-pentanone	120	U	
591-78-6	2-Hexanone	120	U	
127-18-4	Tetrachloroethene	12	U	
79-34-5	1,1,2,2-Tetrachloroethane	12	U	

5/12/2000

CH2M HILL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) WATER
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Lab Sample ID:A0C070214 001

Sample WT/Vol: 25 / mL
Work Order: D9CC3101
Dilution factor: 12.5
Moisture %:NA

Date Received: 03/07/00
Date Extracted:03/08/00
Date Analyzed: 03/08/00

QC Batch: 0068256

Client Sample Id: 51GW02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	12	U
108-90-7	Chlorobenzene	12	U
100-41-4	Ethylbenzene	12	U
100-42-5	Styrene	12	U
1330-20-7	Xylenes (total)	12	U

SMK 5/12/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C240154 001
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA29G107 Date Extracted:03/30/00
Dilution factor: 1.66 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090287

Client Sample Id: 47GW05

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	3.3	U	
74-83-9	Bromomethane	3.3	U	
75-01-4	**Vinyl chloride**	**39**		
75-00-3	**Chloroethane**	**21**		
75-09-2	Methylene chloride	1.7	U	
67-64-1	Acetone	17	~~U~~	R
75-15-0	Carbon disulfide	1.7	U	
75-35-4	1,1-Dichloroethene	1.7	U	
75-34-3	**1,1-Dichloroethane**	**2.6**		
540-59-0	1,2-Dichloroethene (total)	1.7	U	
67-66-3	Chloroform	1.7	U	
107-06-2	1,2-Dichloroethane	1.7	U	
78-93-3	2-Butanone	17	~~U~~	R
71-55-6	1,1,1-Trichloroethane	1.7	U	
56-23-5	Carbon tetrachloride	1.7	U	
75-27-4	Bromodichloromethane	1.7	U	
78-87-5	1,2-Dichloropropane	1.7	U	
10061-01-5	cis-1,3-Dichloropropene	1.7	U	
79-01-6	Trichloroethene	1.7	U	
124-48-1	Dibromochloromethane	1.7	U	
79-00-5	1,1,2-Trichloroethane	1.7	U	
71-43-2	**Benzene**	**3.4**		
10061-02-6	trans-1,3-Dichloropropene	1.7	U	
75-25-2	Bromoform	1.7	U	
108-10-1	4-Methyl-2-pentanone	17	U	
591-78-6	2-Hexanone	17	U	
127-18-4	Tetrachloroethene	1.7	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.7	U	

SMK

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C240154 001
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA29G107 Date Extracted:03/30/00
Dilution factor: 1.66 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090287

Client Sample Id: 47GW05

CAS NC.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	**Toluene**	**2.9**	
108-90-7	Chlorobenzene	1.7	U
100-41-4	**Ethylbenzene**	**4.1**	
100-42-5	Styrene	1.7	U
1330-20-7	**Xylenes (total)**	**3.8**	

SMT 5/11/2000

CH2M HILL

Lab Name: Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID: A0C240154 002
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA29M107 Date Extracted: 03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %: NA

QC Batch: 0090287

Client Sample Id: MW25

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	~~U~~ R
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	~~U~~ R
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

5/11/00

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C240154 002
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA29M107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090287

Client Sample Id: MW25

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name: Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID: A0C240154 003
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA29N107 Date Extracted: 03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %: NA

QC Batch: 0090287

Client Sample Id: 47GW10

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

SMK 5/12/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C240154 003
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA29N107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090287

Client Sample Id: 47GW10

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

5/11/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C240154 004
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/24/00
Work Order: DA29P107 Date Extracted:03/31/00
Dilution factor: 1 Date Analyzed: 03/31/00
Moisture %:NA

QC Batch: 0091374

Client Sample Id: MW-24

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C240154 004
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/24/00
Work Order: DA29P107 Date Extracted:03/31/00
Dilution factor: 1 Date Analyzed: 03/31/00
Moisture %:NA

QC Batch: 0091374

Client Sample Id: MW-24

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name: Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID: A0C240154 005
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA29Q107 Date Extracted: 03/30/00
Dilution factor: 50 Date Analyzed: 03/30/00
Moisture %: NA

QC Batch: 0090287

Client Sample Id: MW-23

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	100	U
74-83-9	Bromomethane	100 ✓	U
75-01-4	**Vinyl chloride**	**170** ✓	
75-00-3	Chloroethane	100	U
75-09-2	Methylene chloride	50	U
67-64-1	Acetone	500	~~U~~ R
75-15-0	Carbon disulfide	50	U
75-35-4	1,1-Dichloroethene	50	U
75-34-3	1,1-Dichloroethane	50	U
540-59-0	**1,2-Dichloroethene (total)**	**880**	
67-66-3	Chloroform	50	U
107-06-2	1,2-Dichloroethane	50	U
78-93-3	2-Butanone	500	~~U~~ R
71-55-6	1,1,1-Trichloroethane	50	U
56-23-5	Carbon tetrachloride	50	U
75-27-4	Bromodichloromethane	50	U
78-87-5	1,2-Dichloropropane	50	U
10061-01-5	cis-1,3-Dichloropropene	50	U
79-01-6	**Trichloroethene**	**1500**	
124-48-1	Dibromochloromethane	50	U
79-00-5	1,1,2-Trichloroethane	50	U
71-43-2	Benzene	50	U
10061-02-6	trans-1,3-Dichloropropene	50	U
75-25-2	Bromoform	50	U
108-10-1	4-Methyl-2-pentanone	500	U
591-78-6	2-Hexanone	500	U
127-18-4	Tetrachloroethene	50	U
79-34-5	1,1,2,2-Tetrachloroethane	50	U

JMK 5/11/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C240154 005
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL
Work Order: DA29Q107
Dilution factor: 50
Moisture %:NA

Date Received: 03/24/00
Date Extracted:03/30/00
Date Analyzed: 03/30/00

QC Batch: 0090287

Client Sample Id: MW-23

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	50	U
108-90-7	Chlorobenzene	50	U
100-41-4	Ethylbenzene	50	U
100-42-5	Styrene	50	U
1330-20-7	Xylenes (total)	50	U

5/11/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C240154 006
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA29T107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0094233

Client Sample Id: MW-22

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	**Acetone**	31	J
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	~~U~~ R
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon t trachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

5/11/00

CH2M HILL

Lab Name: Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID: A0C240154 006
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA29T107 Date Extracted: 03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %: NA

QC Batch: 0094233

Client Sample Id: MW-22

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C240154 007
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA2A0101 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0094233

Client Sample Id: 47TB0323

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichlorometh	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

5/11 5/11

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C240154 007
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/24/00
Work Order: DA2A0101 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0094233

Client Sample Id: 47TB0323

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

5/11/2001

CH2M HILL

Lab Name: Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID: A0C250120 001
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3HE107 Date Extracted: 03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %: NA

QC Batch: 0090221

Client Sample Id: 47GW11

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	2.0	U	
74-83-9	Bromomethane	2.0	U	
75-01-4	Vinyl chloride	2.0	U	
75-00-3	Chloroethane	2.0	U	
75-09-2	Methylene chloride	1.0	U	
67-64-1	Acetone	10	~~U~~	R
75-15-0	Carbon disulfide	1.0	U	
75-35-4	1,1-Dichloroethene	1.0	U	
75-34-3	1,1-Dichloroethane	1.0	U	
540-59-0	1,2-Dichloroethene (total)	1.0	U	
67-66-3	**Chloroform**	**1.9**		B
107-06-2	1,2-Dichloroethane	1.0	U	
78-93-3	2-Butanone	10	~~U~~	R
71-55-6	**1,1,1-Trichloroethane**	**1.1**		
56-23-5	Carbon tetrachloride	1.0	U	
75-27-4	Bromodichloromethane	1.0	U	
78-87-5	1,2-Dichloropropane	1.0	U	
10061-01-5	cis-1,3-Dichloropropene	1.0	U	
79-01-6	**Trichloroethene**	**1.0**		
124-48-1	Dibromochloromethane	1.0	U	
79-00-5	1,1,2-Trichloroethane	1.0	U	
71-43-2	Benzene	1.0	U	
10061-02-6	trans-1,3-Dichloropropene	1.0	U	
75-25-2	Bromoform	1.0	U	
108-10-1	4-Methyl-2-pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	1.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U	

5/11/00

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 001
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3HE107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW11

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

SMK 5/8/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 002
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3HF107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW11-P

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	2.0	U	
74-83-9	Bromomethane	2.0	U	
75-01-4	Vinyl chloride	2.0	U	
75-00-3	Chloroethane	2.0	U	
75-09-2	Methylene chloride	1.0	U	
67-64-1	Acetone	10	~~U~~	R
75-15-0	Carbon disulfide	1.0	U	
75-35-4	1,1-Dichloroethene	1.0	U	
75-34-3	1,1-Dichloroethane	1.0	U	
540-59-0	1,2-Dichloroethene (total)	1.0	U	
67-66-3	**Chloroform**	1.8		B
107-06-2	1,2-Dichloroethane	1.0	U	
78-93-3	2-Butanone	10	~~U~~	R
71-55-6	1,1,1-Trichloroethane	1.0	U	
56-23-5	Carbon tetrachloride	1.0	U	
75-27-4	Bromodichloromethane	1.0	U	
78-87-5	1,2-Dichloropropane	1.0	U	
10061-01-5	cis-1,3-Dichloropropene	1.0	U	
79-01-6	Trichloroethene	1.0	U	
124-48-1	Dibromochloromethane	1.0	U	
79-00-5	1,1,2-Trichloroethane	1.0	U	
71-43-2	Benzene	1.0	U	
10061-02-6	trans-1,3-Dichloropropene	1.0	U	
75-25-2	Bromoform	1.0	U	
108-10-1	4-Methyl-2-pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	1.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U	

5/11/2000

CH2M HILL

Lab Name: Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID: A0C250120 002
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL
Work Order: DA3HF107
Dilution factor: 1
Moisture %: NA

Date Received: 03/25/00
Date Extracted: 03/30/00
Date Analyzed: 03/30/00

QC Batch: 0090221

Client Sample Id: 47GW11-P

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 003
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3HG10L Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW06

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	~~U~~ JC
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0 ✓	U
540-59-0	**1,2-Dichloroethene (total)**	**1.5**	
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	~~U~~ R
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

SMK 5/11/2000

CH2M HILL

Lab Name: Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID: A0C250120 003
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL
Work Order: DA3HG10L
Dilution factor: 1
Moisture %: NA

Date Received: 03/25/00
Date Extracted: 03/30/00
Date Analyzed: 03/30/00

QC Batch: 0090221

Client Sample Id: 47GW06

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

smt 5/10/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 004
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3HV107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	2.0	U	
74-83-9	Bromomethane	2.0	U	
75-01-4	Vinyl chloride	2.0	U	
75-00-3	Chloroethane	2.0	U	
75-09-2	Methylene chloride	1.0	U	
67-64-1	Acetone	10	~~U~~	R
75-15-0	Carbon disulfide	1.0	U	
75-35-4	1,1-Dichloroethene	1.0	U	
75-34-3	1,1-Dichloroethane	1.0	U	
540-59-0	1,2-Dichloroethene (total)	1.0	U	
67-66-3	Chloroform	1.0	U	
107-06-2	1,2-Dichloroethane	1.0	U	
78-93-3	2-Butanone	10	~~U~~	R
71-55-6	1,1,1-Trichloroethane	1.0	U	
56-23-5	Carbon tetrachloride	1.0	U	
75-27-4	Bromodichloromethane	1.0	U	
78-87-5	1,2-Dichloropropane	1.0	U	
10061-01-5	cis-1,3-Dichloropropene	1.0	U	
79-01-6	Trichloroethene	1.0	U	
124-48-1	Dibromochloromethane	1.0	U	
79-00-5	1,1,2-Trichloroethane	1.0	U	
71-43-2	Benzene	1.0	U	
10061-02-6	trans-1,3-Dichloropropene	1.0	U	
75-25-2	Bromoform	1.0	U	
108-10-1	4-Methyl-2-pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	1.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U	

smk 5/11/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 004
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3HV107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

SMK 5/1/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 005
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3HW107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	2.0	U	
74-83-9	Bromomethane	2.0	U	
75-01-4	Vinyl chloride	2.0	U	
75-00-3	Chloroethane	2.0	U	
75-09-2	**Methylene chloride**	**3.9**		
67-64-1	**Acetone**	**13**		L
75-15-0	Carbon disulfide	1.0	U	
75-35-4	1,1-Dichloroethene	1.0	U	
75-34-3	1,1-Dichloroethane	1.0	U	
540-59-0	1,2-Dichloroethene (total)	1.0	U	
67-66-3	Chloroform	1.0	U	
107-06-2	1,2-Dichloroethane	1.0	U	
78-93-3	2-Butanone	10	~~U~~	R
71-55-6	1,1,1-Trichloroethane	1.0	U	
56-23-5	Carbon tetrachloride	1.0	U	
75-27-4	Bromodichloromethane	1.0	U	
78-87-5	1,2-Dichloropropane	1.0	U	
10061-01-5	cis-1,3-Dichloropropene	1.0	U	
79-01-6	Trichloroethene	1.0	U	
124-48-1	Dibromochloromethane	1.0	U	
79-00-5	1,1,2-Trichloroethane	1.0	U	
71-43-2	Benzene	1.0	U	
10061-02-6	trans-1,3-Dichloropropene	1.0	U	
75-25-2	Bromoform	1.0	U	
108-10-1	4-Methyl-2-pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	1.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U	

5/11/00

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 005
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3HW107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name: Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID: A0C250120 006
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3HX107 Date Extracted: 03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %: NA

QC Batch: 0090221

Client Sample Id: 47GW04

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	2.0	U	
74-83-9	Bromomethane	2.0	U	
75-01-4	Vinyl chloride	2.0	U	
75-00-3	Chloroethane	2.0	U	
75-09-2	Methylene chloride	1.0	U	
67-64-1	Acetone	10	~~U~~	R
75-15-0	Carbon disulfide	1.0	U	
75-35-4	1,1-Dichloroethene	1.0	U	
75-34-3	1,1-Dichloroethane	1.0	U	
540-59-0	1,2-Dichloroethene (total)	1.0	U	
67-66-3	**Chloroform**	3.2		B
107-06-2	1,2-Dichloroethane	1.0	U	
78-93-3	2-Butanone	10	~~U~~	R
71-55-6	1,1,1-Trichloroethane	1.0	U	
56-23-5	Carbon tetrachloride	1.0	U	
75-27-4	Bromodichloromethane	1.0	U	
78-87-5	1,2-Dichloropropane	1.0	U	
10061-01-5	cis-1,3-Dichloropropene	1.0	U	
79-01-6	Trichloroethene	1.0	U	
124-48-1	Dibromochloromethane	1.0	U	
79-00-5	1,1,2-Trichloroethane	1.0	U	
71-43-2	Benzene	1.0	U	
10061-02-6	trans-1,3-Dichloropropene	1.0	U	
75-25-2	Bromoform	1.0	U	
108-10-1	4-Methyl-2-pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	1.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U	

5/11/2000

CH2M HILL

Lab Name: Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID: A0C250120 006
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL
Work Order: DA3HX107
Dilution factor: 1
Moisture %: NA

Date Received: 03/25/00
Date Extracted: 03/30/00
Date Analyzed: 03/30/00

QC Batch: 0090221

Client Sample Id: 47GW04

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 007
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3J0107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW09

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	2.0	U	
74-83-9	Bromomethane	2.0	U	
75-01-4	Vinyl chloride	2.0	U	
75-00-3	Chloroethane	2.0	U	
75-09-2	Methylene chloride	1.0	U	
67-64-1	Acetone	10	~~U~~	R
75-15-0	Carbon disulfide	1.0	U	
75-35-4	1,1-Dichloroethene	1.0	U	
75-34-3	1,1-Dichloroethane	1.0	U	
540-59-0	**1,2-Dichloroethene (total)**	**1.5**		
67-66-3	Chloroform	1.0	U	
107-06-2	1,2-Dichloroethane	1.0	U	
78-93-3	2-Butanone	10	~~U~~	R
71-55-6	1,1,1-Trichloroethane	1.0	U	
56-23-5	Carbon tetrachloride	1.0	U	
75-27-4	Bromodichloromethane	1.0	U	
78-87-5	1,2-Dichloropropane	1.0	U	
10061-01-5	cis-1,3-Dichloropropene	1.0	U	
79-01-6	Trichloroethene	1.0	U	
124-48-1	Dibromochloromethane	1.0	U	
79-00-5	1,1,2-Trichloroethane	1.0	U	
71-43-2	Benzene	1.0	U	
10061-02-6	trans-1,3-Dichloropropene	1.0	U	
75-25-2	Bromoform	1.0	U	
108-10-1	4-Methyl-2-pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	1.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U	

5/11/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 007
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL
Work Order: DA3J0107
Dilution factor: 1
Moisture %:NA

Date Received: 03/25/00
Date Extracted:03/30/00
Date Analyzed: 03/30/00

QC Batch: 0090221

Client Sample Id: 47GW09

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 008
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3J1107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	2.0	U	
74-83-9	Bromomethane	2.0	U	
75-01-4	Vinyl chloride	2.0	U	
75-00-3	Chloroethane	2.0	U	
75-09-2	Methylene chloride	1.0	U	
67-64-1	Acetone	10	~~U~~	R
75-15-0	Carbon disulfide	1.0	U	
75-35-4	1,1-Dichloroethene	1.0	U	
75-34-3	1,1-Dichloroethane	1.0	U	
540-59-0	1,2-Dichloroethene (total)	1.0	U	
67-66-3	**Chloroform**	**3.0**		B
107-06-2	1,2-Dichloroethane	1.0	U	
78-93-3	2-Butanone	10	~~U~~	R
71-55-6	1,1,1-Trichloroethane	1.0	U	
56-23-5	Carbon tetrachloride	1.0	U	
75-27-4	Bromodichloromethane	1.0	U	
78-87-5	1,2-Dichloropropane	1.0	U	
10061-01-5	cis-1,3-Dichloropropene	1.0	U	
79-01-6	Trichloroethene	1.0	U	
124-48-1	Dibromochloromethane	1.0	U	
79-00-5	1,1,2-Trichloroethane	1.0	U	
71-43-2	Benzene	1.0	U	
10061-02-6	trans-1,3-Dichloropropene	1.0	U	
75-25-2	Bromoform	1.0	U	
108-10-1	4-Methyl-2-pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	1.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U	

5/11/00

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 008
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3J1107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 009
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/25/00
Work Order: DA3J2107 Date Extracted:03/31/00
Dilution factor: 1 Date Analyzed: 03/31/00
Moisture %:NA

QC Batch: 0091374

Client Sample Id: 47FB0300

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	**Chloroform**	**7.2**	
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

RL

FORM I

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 009
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/25/00
Work Order: DA3J2107 Date Extracted:03/31/00
Dilution factor: 1 Date Analyzed: 03/31/00
Moisture %:NA

QC Batch: 0091374

Client Sample Id: 47FB0300

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 010
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3J4107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW08

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	2.0	U	
74-83-9	Bromomethane	2.0	U	
75-01-4	Vinyl chloride	2.0	U	
75-00-3	Chloroethane	2.0	U	
75-09-2	Methylene chloride	1.0	U	
67-64-1	Acetone	10	~~U~~	R
75-15-0	Carbon disulfide	1.0	U	
75-35-4	**1,1-Dichloroethene**	**1.1** ✓		
75-34-3	**1,1-Dichloroethane**	**1.6**		
540-59-0	1,2-Dichloroethene (total)	1.0	U	
67-66-3	**Chloroform**	**1.6**		B
107-06-2	1,2-Dichloroethane	1.0	U	
78-93-3	2-Butanone	10	~~U~~	R
71-55-6	**1,1,1-Trichloroethane**	**8.2**		
56-23-5	Carbon tetrachloride	1.0	U	
75-27-4	Bromodichloromethane	1.0	U	
78-87-5	1,2-Dichloropropane	1.0	U	
10061-01-5	cis-1,3-Dichloropropene	1.0	U	
79-01-6	**Trichloroethene**	**2.2**		
124-48-1	Dibromochloromethane	1.0	U	
79-00-5	1,1,2-Trichloroethane	1.0	U	
71-43-2	Benzene	1.0	U	
10061-02-6	trans-1,3-Dichloropropene	1.0	U	
75-25-2	Bromoform	1.0	U	
108-10-1	4-Methyl-2-pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	1.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U	

5/11/00

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 010
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 25 / mL Date Received: 03/25/00
Work Order: DA3J4107 Date Extracted:03/30/00
Dilution factor: 1 Date Analyzed: 03/30/00
Moisture %:NA

QC Batch: 0090221

Client Sample Id: 47GW08

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

smt 5/11/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 011
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/25/00
Work Order: DA3J5107 Date Extracted:03/31/00
Dilution factor: 5000 Date Analyzed: 03/31/00
Moisture %:NA

QC Batch: 0091374

Client Sample Id: 47GW07

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q	
74-87-3	Chloromethane	10000	U	
74-83-9	Bromomethane	10000	U	
75-01-4	Vinyl chloride	10000	U	
75-00-3	Chloroethane	10000	U	
75-09-2	Methylene chloride	5000	U	
67-64-1	Acetone	50000	~~U~~	R
75-15-0	Carbon disulfide	5000	U	
75-35-4	1,1-Dichloroethene	5000	U	
75-34-3	1,1-Dichloroethane	5000	U	
540-59-0	1,2-Dichloroethene (total)	5000	U	
67-66-3	Chloroform	5000	U	
107-06-2	1,2-Dichloroethane	5000	U	
78-93-3	2-Butanone	50000	~~U~~	R
71-55-6	**1,1,1-Trichloroethane**	**49000**		
56-23-5	Carbon tetrachloride	5000	U	
75-27-4	Bromodichloromethane	5000	U	
78-87-5	1,2-Dichloropropane	5000	U	
10061-01-5	cis-1,3-Dichloropropene	5000	U	
79-01-6	**Trichloroethene**	**8500**		
124-48-1	Dibromochloromethane	5000	U	
79-00-5	1,1,2-Trichloroethane	5000	U	
71-43-2	Benzene	5000	U	
10061-02-6	trans-1,3-Dichloropropene	5000	U	
75-25-2	Bromoform	5000	U	
108-10-1	4-Methyl-2-pentanone	50000	U	
591-78-6	2-Hexanone	50000	U	
127-18-4	Tetrachloroethene	5000	U	
79-34-5	1,1,2,2-Tetrachloroethane	5000	U	

smt 5/11/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 011
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL
Work Order: DA3J5107
Dilution factor: 5000
Moisture %:NA

Date Received: 03/25/00
Date Extracted:03/31/00
Date Analyzed: 03/31/00

QC Batch: 0091374

Client Sample Id: 47GW07

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	5000	U
108-90-7	Chlorobenzene	5000	U
100-41-4	Ethylbenzene	5000	U
100-42-5	Styrene	5000	U
1330-20-7	Xylenes (total)	5000	U

smh 5/17/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 013
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/25/00
Work Order: DA3JL107 Date Extracted:03/31/00
Dilution factor: 1 Date Analyzed: 03/31/00
Moisture %:NA

QC Batch: 0091374

Client Sample Id: 47EB0300

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	**Chloroform**	**4.9**	
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

SMK 5/11/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 013
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/25/00
Work Order: DA3JL107 Date Extracted:03/31/00
Dilution factor: 1 Date Analyzed: 03/31/00
Moisture %:NA

QC Batch: 0091374

Client Sample Id: 47EB0300

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

5/11/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 014
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/25/00
Work Order: DA3JN101 Date Extracted:03/31/00
Dilution factor: 1 Date Analyzed: 03/31/00
Moisture %:NA

QC Batch: 0091374

Client Sample Id: 47TB0324

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	2.0	U
74-83-9	Bromomethane	2.0	U
75-01-4	Vinyl chloride	2.0	U
75-00-3	Chloroethane	2.0	U
75-09-2	Methylene chloride	1.0	U
67-64-1	Acetone	10	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

5/1/2000

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 014
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/25/00
Work Order: DA3JN101 Date Extracted:03/31/00
Dilution factor: 1 Date Analyzed: 03/31/00
Moisture %:NA

QC Batch: 0091374

Client Sample Id: 47TB0324

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

SMK 5/11/2000

Lab Name: Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID: A0C250120 012
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/25/00
Work Order: DA3JA107 Date Extracted: 03/31/00
Dilution factor: 2.5 Date Analyzed: 03/31/00
Moisture %: NA

QC Batch: 0091374

Client Sample Id: 47GW12

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	5.0	U
74-83-9	Bromomethane	5.0	U
75-01-4	Vinyl chloride	5.0	U
75-00-3	Chloroethane	5.0	U
75-09-2	Methylene chloride	2.5	U
67-64-1	Acetone	25	U
75-15-0	Carbon disulfide	2.5	U
75-35-4	1,1-Dichloroethene	2.5	U
75-34-3	**1,1-Dichloroethane**	**3.0**	
540-59-0	1,2-Dichloroethene (total)	2.5	U
67-66-3	Chloroform	2.5	U
107-06-2	1,2-Dichloroethane	2.5	U
78-93-3	2-Butanone	25	U
71-55-6	1,1,1-Trichloroethane	2.5	U
56-23-5	Carbon tetrachloride	2.5	U
75-27-4	Bromodichloromethane	2.5	U
78-87-5	1,2-Dichloropropane	2.5	U
10061-01-5	cis-1,3-Dichloropropene	2.5	U
79-01-6	Trichloroethene	2.5	U
124-48-1	Dibromochloromethane	2.5	U
79-00-5	1,1,2-Trichloroethane	2.5	U
71-43-2	Benzene	2.5	U
10061-02-6	trans-1,3-Dichloropropene	2.5	U
75-25-2	Bromoform	2.5	U
108-10-1	4-Methyl-2-pentanone	25	U
591-78-6	2-Hexanone	25	U
127-18-4	Tetrachloroethene	2.5	U
79-34-5	1,1,2,2-Tetrachloroethane	2.5	U

CH2M HILL

Lab Name:Severn Trent Laboratories, Inc. SDG Number:

Matrix: (soil/water) WATER Lab Sample ID:A0C250120 012
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 5 / mL Date Received: 03/25/00
Work Order: DA3JA107 Date Extracted:03/31/00
Dilution factor: 2.5 Date Analyzed: 03/31/00
Moisture %:NA

QC Batch: 0091374

Client Sample Id: 47GW12

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	2.5	U
108-90-7	Chlorobenzene	2.5	U
100-41-4	Ethylbenzene	2.5	U
100-42-5	Styrene	2.5	U
1330-20-7	Xylenes (total)	2.5	U

Attachment 2
Methodology References

METHODOLOGY REFERENCES

Analysis	Reference
Volatile Organic Compounds	USEPA Contract Laboratory Program, Statement of Work for Organics Analysis, Multi-media, Multi-concentration, OLC02.

Attachment 3
Chain of Custody Documentation

Chain of Custody Record

Quanterra

QUA 4124

Client: CH2M HILL	Project Manager: Jeff Morrison	Date: 3-24-00	Chain Of Custody Number: 12734
Address: 13921 Park Center Rd Ste 600	Telephone Number (Area Code) Fax Number: (703) 471 6405 / (703) 471 9134	Lab Number:	Page 1 of 1
City: Herndon / State: VA / Zip Code:	Site Contact:		
Project Name: MCAS - Cherry Point OU1 - Site 47	Carrier/Waybill Number:		
Contract Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: Total Alk	Cl Sulfate Nitrate Alkalite	Diss Metals	COD		MS/MSD						
47GW11	3-24-00	1427	GQ		Plastic	4	H_2SO_4 / None		X	X	X	X								
47GW11-D	3-24-00	1427	GQ		Plastic	4	H_2SO_4 / None		X	X	X	X								
47GW06	3-24-00	1844	GQ		Plastic	4	H_2SO_4 / Iron		X	X	X	X		X						
47GW01	3-23-00	2031	GQ		Plastic	4	H_2SO_4 / None		X	X	X	X								

Special Instructions: METALS ARE UNPRESERVED

Possible Hazard Identification: [ ] Non-Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [X] Unknown

Sample Disposal: [ ] Return To Client [ ] Disposal By Lab [ ] Archive For ____ Months

Turn Around Time Required: [X] Normal [ ] Rush

QC Level: [ ] I. [ ] II. [ ] III.

Project Specific (Specify):

	Date	Time		Date	Time
1 Relinquished By: [signature] S. Lehmann	3-24-00	1800	1 Received By: [signature]	3-25-00	945AM
2 Relinquished By			2 Received By		
3 Relinquished By			3 Received By		

Comments:

DISTRIBUTION: WHITE - Stays with Sample CANARY - Returned to Client with Report, PINK - Field Copy

Chain of Custody Record

02, 03, 04, 09 & FB

Quanterra

GUA 4124

Client: CH2M HILL

Address: 13921 PARK CTR RD STE 600

City: HERNDON | State: VA | Zip Code:

Project Manager: JEFF MORRISON

Telephone Number (Area Code) Fax Number: (703) 471-6405 / (703) 471 9134

Site Contact:

Lab Number:

Date: 3.24.00

Chain Of Custody Number: 12732

Page 1 of 1

Project Name: MCAS - CHERRY POINT OU1 - SITE 41

Contract/Purchase Order/Quote No:

Carrier/Waybill Number:

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: TOTAL ALK	CL, SULFATE, NITRATE/NITRITE	DISS. METALS	COD
47GN03	3.23.00	1218				4	H_2SO_4 / none		X	X	Y	X
47GN04	3.23.00	13320				4			X	X	Y	X
47GN09	3.23.00	1709				4			X	X	Y	X
47GN02 47FB0300 (2)	3.23.00	1459				4			X	X	Y	X
47FB 0300	3.23.00	1821				4			X	X	Y	X

Special Instructions: METALS ARE UN PRESERVED

Possible Hazard Identification: ☐ Non Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ___ Months

Turn Around Time Required: ☒ Normal ☐ Rush

QC Level: ☐ I. ☐ II. ☐ III.

Project Specific (Specify):

Relinquished By: S. LEHMANN — Date: 3.24.00 — Time: 1800

1. Received By: Terry Burns — Date: 3-25-00 — Time: 945/14

Relinquished By — Date — Time

2. Received By — Date — Time

Relinquished By — Date — Time

3. Received By — Date — Time

Comments:

DISTRIBUTION: WHITE - Returned to Client with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA 4124

Client: CH2M HILL	Project Manager: JEFF MORRISON	Date: 3-24-00	Chain Of Custody Number: 12733
Address: 13921 PARK CENTER RD STE 600	Telephone Number (Area Code)/Fax Number: (703) 471 6405 / FAX (703) 471 9139	Lab Number:	Page: 1 of 1
City: HERNDON	State: VA	Zip Code:	Site Contact:
Project Name: MCAS- CHERRY POINT OU1-SITE 47	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: TOTAL ALK	CHLORIDE/NITRATE/NITRITE	DISS METALS	COD
47GW08	3-24-00	1001	AQ		PLASTIC	4	H_2SO_4/ice		X	X	X	X
47GW07	3-24-00	1103	AQ		PLASTIC	4	H_2SO_4/ice		X	X	X	X
47GW12	3-24-00	1247	AQ		PLASTIC	4	H_2SO_4/ice		X	X	X	X
~~47EB032400~~ 47GW12D	3-24-00	1545	AQ		PLASTIC	4	H_2SO_4/ice		X	X	X	X
47EB032400 03:0	3-24-00											

Special Instructions: METALS ARE UNPRESSERVED

Possible Hazard Identification: [ ] Non Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [X] Unknown

Sample Disposal: [ ] Return To Client [ ] Disposal By Lab [ ] Archive For ____ Months

Turn Around Time Required: [X] Normal [ ] Rush

QC Level: [ ] I. [ ] II. [ ] III.

Project Specific (Specify):

	Date	Time		Date	Time
1 Relinquished By: S. LEHMAN	3-24-00	1800	1 Received By: Terry Burns	3-25-00	945/19
2 Relinquished By:			2 Received By:		
3 Relinquished By:			3 Received By:		

Comments:

DISTRIBUTION: WHITE - Stays with Sample, CANARY - Returned to Client with Report, Pink - Field Copy

Chain of Custody Record

Quanterra

QHA 4121

Client: CH2M HILL, INC	Project Manager: JEFF MORRISON	Date: 3/23/00	Chain Of Custody Number: 61501
Address: 13921 PARK CENTER RD SUITE 600	Telephone Number (Area Code)/Fax Number: (703) 471-6405 FAX (703) 471-9434	Lab Number:	Page 1 of 1
City: HERNDON / State: VA / Zip Code:	Site Contact:		
Project Name: MCAS - CHERRY POINT OU1 SITE 47	Carrier/Waybill Number: FedEx / ECF 7950 7169		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No	Preservative	Condition on Receipt	Analysis
47GW05	3/22/00	1720	AQ			10	HCl, ICE		X X X X X X X
MW25	3/22/00	1916	AQ			12	↓ ↓		X X X X X X X
47GW10	3/22/00	2213	AQ			12	↓ ↓		X X X X X X X
MW 24	3/22/00	1551	AQ			8	HCl, ICE		X X X
MW 23	3/22/00	0956	AQ			8	HCl, ICE		X X X
MW 22	3/21/00	2010	AQ			8	HCl, ICE		X X X
47TB0323	—	—	AQ			1			X

Special Instructions: METALS ARE DISSOLVED.

Possible Hazard Identification: [ ] Non Hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [X] Unknown

Sample Disposal: [ ] Return To Client [ ] Disposal By Lab [ ] Archive For ____ Months

Turn Around Time Required: [X] Normal [ ] Rush

QC Level: [ ] I. [ ] II. [ ] III.

Project Specific (Specify):

	Date	Time		Date	Time
1. Relinquished By: [signature] STEVE LEHMANN	3/23/00	1630	1. Received By:		
2. Relinquished By:			2. Received By: [signature]	3/24/00	950
3. Relinquished By:			3. Received By:		

Comments:

Chain of Custody Record

Quanterra

QUA 4124

Client: CH2M Hill Inc	Project Manager: Jeff [illegible]	Date: 3/23/00	Chain Of Custody Number: 51205
Address: 13921 Park Center Rd Suite 600	Telephone Number (Area Code)/Fax Number: (703) 471 6405 / FAX (703) 471 1[illegible]	Lab Number	Page 1 of 1
City: Herndon · State: VA · Zip Code	Site Contact		
Project Name: NCAS - Cherry Point CO1 S[illegible] 17	Carrier/Waybill Number: FedEx [illegible]		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: [illegible]	Analysis: [illegible]	Analysis: [illegible]	Analysis: COD
MW-23	3-22-00	1158	AQ			1	H2SO4, NaH		X	X	X	X
MW-22	3-21-00	2016	AQ			1	H2SO4, [illegible]		X	X	X	X
MW-21	3-22-00	1551	AQ			1	H2SO4, [illegible]		X	X	X	X

Special Instructions: METALS ARE UNFILTERED

Possible Hazard Identification: ☐ Non Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ___ Months

Turn Around Time Required: ☒ Normal ☐ Rush

QC Level: ☐ I. ☐ II. ☐ III.

Project Specific (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature] Steven [illegible]	3-23-00	1100	1. Received By: Penny Burns	3-24-00	9:50A
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

Appendix C
Temporary Well Boring Logs

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
154661.DR.FT	OU1-47TW01	SHEET 1 OF 2

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT NC

ELEVATION _____ DRILLING CONTRACTOR PARRATT WOLFF, INC.

DRILLING METHOD AND EQUIPMENT INGERSOLL RAND E200 DPT

WATER LEVEL AND DATE _____ START 3/4/00 FINISH 3/4/00 LOGGER U. FRIEDMAN

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT) (IN)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					ASPHALT		
	1-3'	1	12"		TOP 10" 2.5Y 7/1 SILTY FINE SAND, DRY, LOOSE BOTTOM 2" 10YR6/6 FINE SANDY SILT, MOIST, COHESIVE		PID 259 ~~0.0~~ PPM
	3-5	2	16"		10YR6/6 SILTY FINE SAND, SLIGHTLY COHESIVE, MOIST		PID 301 ~~0.0~~ PPM
	5-7	3	12"		SAME AS ABOVE. 1/2" SHELL LAYER		PID 26E ~~0.0~~ PPM
	7-9	4	12"		10YR 8/1 FINE SAND, WITH SILT STRINGERS, LOOSE, MOIST PETROLEUM ODOR, BLACK STAINING AT TIP OF SCREEN		PID 5221 PPM
	9-11	5	12"		SAME AS ABOVE, WET SOME MORE BLACK STAINING, PETROLEUM ODOR		PID 4932 PPM WATER TABLE AT APPROX. ~~25~~ 10' BGS
	11-13	6	16"		10YR 6/8 TO 10YR 7/1 SILTY FINE SAND, LOOSE, MOIST TO SATURATED, 2" BLACK STAINED LAYER, PETROLEUM ODOR.		PID 4117 PPM
	13-15	7	2"		SAME AS ABOVE, NO STAINING OR PETROLEUM ODOR		PID 232 PPM
	15-17	8	14"		10YR 7/6 SILTY FINE SAND, SOME MEDIUM SAND, LOOSE, SATURATED, NO NOTICEABLE ODOR		PID 3802 PPM
	17-19	9	24"		10YR 7/6 SILTY FINE SAND, SATURATED, LOOSE, NO NOTICEABLE STAINING OR ODOR		PID 6678 PPM
	19-21	10	24"		SAME AS ABOVE		PID 3986

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	OU1-47TW01	SHEET 2 OF 2

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT, NC

ELEVATION _____ DRILLING CONTRACTOR PARRATT WOLFF INC

DRILLING METHOD AND EQUIPMENT INGERSOLL RAND 8200 DPT

WATER LEVEL AND DATE _____ START 3/4/00 FINISH 3/4/00 LOGGER W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	21-23	11			10YR 7/1 SILTY FINE SAND TO FINE SAND, SATURATED, LOOSE WELL SORTED.		PID 1938
	25-25				5Y6/1 FINE SAND TO SILTY FINE SAND, TRACE OF MEDIUM SAND, LOOSE, SATURATED, OCCASSIONAL SILTY CLAY STRINGER		PID 2140

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	OU1-47TW02	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT, NC

ELEVATION _____ DRILLING CONTRACTOR PARRATT WOLFF, INC.

DRILLING METHOD AND EQUIPMENT INGERSOLL RAND E200 DPT

WATER LEVEL AND DATE _____ START 3/5/00 FINISH 3/5/00 LOGGER W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	1-3	1	12"		2.5Y 7/6 FINE SAND, SILT AND GRAVEL, MOIST, LOOSE		
	3-5	2	9"		2.5Y 5/2 SILTY FINE SAND, COHESIVE, MOIST		
	5-7	3	12"		SAME AS ABOVE, 3" ORGANIC ZONE WHICH CONTAINS SILTY FINE SAND, PLANT ROOTS, 2.5Y 3/1, NO INDICATION OF CONTAMINATION		
	7-9	4	12"		5Y 7/6 SILTY FINE SAND AND SHELL HASH, POSSIBLE FILL MATERIAL, SLIGHTLY COHESIVE, MOIST		
	9-11	5	12"		5Y 6/1 SILTY FINE SAND, SLIGHTLY COHESIVE, MOIST TO WET.		
	11-13	6	13		SAME AS ABOVE, WET.		WATER TABLE AT ~10-11' BGS.
	13-15	7	12"		SAME AS ABOVE, NO SIGN OF CONTAMINATION.		
	15-17	8	20"		2.5Y 7/1 FINE SAND TO SILTY FINE SAND, WET, LOOSE		
	17-19	9	14"		SAME AS ABOVE.		
	19-21	10	24"		SAME AS ABOVE		
	21-23	11	24"		5Y 7/6 FINE SAND TO SILTY FINE SAND, LOOSE, WET. SAME AS ABOVE		
	23-25	12	20"		SAME AS ABOVE.		

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	OU1-47TW03	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT NC

ELEVATION _____ DRILLING CONTRACTOR PARRATT WOLFF, INC

DRILLING METHOD AND EQUIPMENT INGERSOL RAND 8200 DPT

WATER LEVEL AND DATE MARCH 4 2000 START 3/4/00 FINISH 3/4/00 LOGGER W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					8" CONCRETE		
	1-3	1	18"		5Y6/3 SILTY FINE SAND, MOIST, SLIGHTLY COHESIVE.		PID 220 ppm
	3-5	2	22"		5Y6/1 TO 5Y8/1 SILTY FINE SAND, TO FINE SANDY SILT, COHESIVE MOIST,		PID 142 ppm
	5-7	3	20"		TOP 17" SAME AS ABOVE BOTTOM 3" - 5Y 2.5/1 FINE SANDY SILT, ORGANIC, ROOTS, MOIST		PID 69.3 ppm PID 15.8 ppm
	7-9"	4	22"		5Y7/2 SILTY FINE SAND TO FINE SAND, LOOSE, MOIST, INCREASING MOISTURE.		PID 381 ppm
	9-11	5	24"		5Y 8/1 FINE SAND TO SILTY FINE SAND, SATURATED, LOOSE		PID 368 ppm WATER TABLE AT ~9' BGS
	11-13	6	24"		SAME AS ABOVE.		PID 796 ppm
	13-15	7	10"		5Y7/4 SILTY FINE SAND TO FINE SAND, WET, SLIGHTLY TO NON-COHESIVE.		PID 46.5
	15-17'	8	14"		SAME AS ABOVE.		PID 13.9
	17-19	9	8"		SAME AS ABOVE.		PID 21.0
	19-21	10	24"		5Y7/2 SILTY FINE SAND TO FINE SAND, NON COHESIVE, WET		PID 11.7
	21-23	11	24"		SAME AS ABOVE, 5Y8/1		PID 32.0
	23-25	12	18"		SAME AS ABOVE		PID 18.3

CH2M HILL

PROJECT NUMBER	BORING NUMBER
154661.DF.FI	OU1-47TW04 SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU 1 SITE 47 LOCATION CHERRY POINT, NC

ELEVATION _____ DRILLING CONTRACTOR PITTRATT WOLFF, INC.

DRILLING METHOD AND EQUIPMENT INGER SOLL RAN 2CC DPT

WATER LEVEL AND DATE _____ START 5/6/00 FINISH 5/6/00 LOGGER W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-1				CONCRETE		
	1-3	1	24		5Y 5/4 TO 2.5Y 7/4 SILTY FINE SAND, SOME FINE MATERIAL, MOIST TO DRY, LOOSE.		
	3-5	2	22"		2.5Y 7/2 SILTY FINE SAND, MOIST SLIGHTLY COHESIVE.		
	5-7	3	24"		SAME AS ABOVE MOIST BECOMING SLIGHTLY WET.		
	7-9	4	24"		SAME AS ABOVE, WET TO MOIST		
	9-11	~~5~~ 5	24"		2.5Y 8/3 SILTY FINE SAND, WET, LOOSE		WATER TABLE AT ~9' BGS
	11-13	6	0"		NO RECOVERY		
	13-15	7	24"		2.5Y 6/3 SILTY FINE SAND, WET LOOSE TO SLIGHTLY COHESIVE.		
	15-17	8	24"		SAME AS ABOVE.		
	17-19	9	20"		SAME AS ABOVE		
	19-21	10	24"		SAME AS ABOVE, 2.5Y 7/6		
	21-23	11	24"		SAME AS ABOVE.		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	47TW05	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS Cherry Point OU2 Site 47 LOCATION Cherry Point, NC

ELEVATION _____ DRILLING CONTRACTOR Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand 8200 DPT

WATER LEVEL AND DATE _____ START 03/06/98 FINISH 03/06/98 LOGGER W. Freedmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-1				CONCRETE		
	1-3	1	24"		2.5Y 7/3 SILTY FINE SAND, DRY TO MOIST, LOOSE TO SLIGHTLY COHESIVE		
	3-5	2	20"		SAME AS ABOVE		
	5-7	3	18"		SAME AS ABOVE		
	7-9	4	22"		SAME AS ABOVE, NO SIGN OF CONTAMINATION, 2.5Y 8/2		
	9-11	5	24		2.5Y 8/1 WITH 2.5Y 6/8 MOTTLES, SILTY FINE SAND WET, SLIGHTLY COHESIVE NO SIGN OF CONTAMINATION		WATER TABLE AT ~ 10' BGS
	11-13	6	20		2.5Y 8/1 SILTY FINE SAND, WET, SLIGHTLY COHESIVE.		
	13-15	7	0		NO RECOVERY		
	15-17	8	4"		5Y 8/4 SILTY FINE SAND, SLIGHTLY COHESIVE, WET.		
	17-19	9	14"		SAME AS ABOVE, 2.5Y 7/8		
	19-21	10	20"		SAME AS ABOVE		
	21-23	11	18"		SAME AS ABOVE		
	23-25	12	18"		SAME AS ABOVE.		

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	OU1-47TW06	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT, NC

ELEVATION _____ DRILLING CONTRACTOR PARRATT WOLFF, INC

DRILLING METHOD AND EQUIPMENT INGERSOLL RAN 8200 DPT

WATER LEVEL AND DATE _____ START 3/6/00 FINISH 3/6/00 LOGGER W FRIEDMANN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-5		N/A		10YR 7/6 SILTY FINE SAND, MOIST, SLIGHTLY COHESIVE.		
	5-6		N/A		SAME AS ABOVE, 2.5YR/1		
	6-8	1	20"		2.5YR/1 TO 10YR6/8 SILTY FINE SAND, MOIST BECOMING WET, SLIGHTLY COHESIVE, NO APPARENT ODOR OR STAINING		WATER TABLE AT ~8' BGS
	8-10	2	20"		SAME AS ABOVE, 2.5Y 7/6		
	10-12	3	18"		SAME AS ABOVE		
	12-14	4	20"		SAME AS ABOVE		
	14-16	5	18"		2.5Y 7/7 TO 2.5Y 7/6 SILTY FINE SAND, SLIGHTLY COHESIVE, WET, NO APPARENT ODOR OR STAINING		
	16-18	6	18"		SAME AS ABOVE		
	18-20	7	12"		SAME AS ABOVE		
	20-22	8	20"		SAME AS ABOVE		
	22-24	9	22"		SAME AS ABOVE		

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	OU1-47TW07	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT, NC

ELEVATION _____ DRILLING CONTRACTOR PRATT WOLFF, INC.

DRILLING METHOD AND EQUIPMENT INGERSOLL RAN 8200 DPT

WATER LEVEL AND DATE _____ START 3/6/00 FINISH 3/6/00 LOGGER N. FRIEDMANN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					CONCRETE		
	1-3	1			2.5Y 7/6 SILTY FINE SAND, LOOSE TO SLIGHTLY COHESIVE, MOIST.		
	3-5	2			2.5Y 7/6 TO 2.5Y 8/1 SILTY FINE SAND TO FINE SAND, LOOSE TO SLIGHTLY COHESIVE, DRY TO MOIST		
	5-7	3	10"		SAME AS ABOVE, MOIST, NO VISUAL OR ODOR OF CONTAMINATION		
	7-9	~~4~~ 4	20"		2.5Y 7/3 SILTY FINE SAND, BECOMING WET, NO SIGN OF CONTAMINATION		WATER TABLE AT ~ 9'BGS
	~~9-11~~	~~5~~ 5	8"		10YR 7/8 SILTY FINE SAND WET		
	11-13	~~6~~ 6"	4"		SAME AS ABOVE		
	13-15	~~7~~ 7	8"		SAME AS ABOVE		
	15-17	8	6"		SAME AS ABOVE, 2.5Y 8/6, NO INDICATION OF CONTAMINATION		
	17-19	9	12"		SAME AS ABOVE		
	19-21	10	10"		SAME AS ABOVE		
	21-23	11	16"		SAME AS ABOVE		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	001-47TW08	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT, ~~OU1 SITE 4~~

ELEVATION _____ DRILLING CONTRACTOR PARRATT WOLFF, INC.

DRILLING METHOD AND EQUIPMENT INGERSOLL RAN 8200 DPT

WATER LEVEL AND DATE _____ START 3/9/00 FINISH 3/9/00 LOGGER W. FRIEDMAN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-1				CONCRETE		
	1-3	1	8"		5Y 7/3 SILTY FINE SAND, MOIST, COHESIVE		
	3-5	2	12"		SAME AS ABOVE		
	5-7	3	8"		2.5Y 6/4 SILTY FINE SAND, MOIST, COHESIVE		
	7-9	4	12"		SAME AS ABOVE, NO INDICATION OF CONTAMINATION, MOIST		
	9-11	5	12"		2.5Y 7/1 SILTY FINE SAND, WET, COHESIVE		WATER TABLE AT ~9' BGS
	11-13	6	4"		SAME AS ABOVE		
	13-15	7	6"		SAME AS ABOVE		
	15-17	8	8"		2.5Y 6/3 SILTY FINE SAND, SLIGHTLY TO NON-COHESIVE, WET		
	17-19	9	8"		SAME AS ABOVE, NO INDICATION OF CONTAMINATION		
	19-21	10	20"		2.5Y 7/1 FINE SAND TO SILTY FINE SAND, SLIGHTLY COHESIVE, WET		
	21-23	11	12"		SAME AS ABOVE, NO SIGN OF CONTAMINATION		
	23-25	12	12"		SAME AS ABOVE		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
154661.DF.FI	47TW09	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT, NC

ELEVATION _____ DRILLING CONTRACTOR PARRATT WOLFF INC.

DRILLING METHOD AND EQUIPMENT INGER SOLL RAN 2200 DPT

WATER LEVEL AND DATE _____ START 3/7/00 FINISH 3/7/00 LOGGER W. FRIEDMAN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					CONCRETE		
	2-4	1			2.5Y 7/6 SILTY FINE SAND, SLIGHTLY COHESIVE, MOIST		PID 1.2 PPM
	4-6	2	12"		2.5Y 7/8 SILTY FINE SAND, LOOSE TO SLIGHTLY COHESIVE, MOIST		PID 1.4 PPM
	6-8	3	2"		SAME AS ABOVE		PID 17.8
	8-10	4	12"		SAME AS ABOVE, WET		PID 5.1 PPM WATER TABLE AT ~9' BGS
	10-12	5	12"		2.5Y 7/8 SILTY FINE SAND, SLIGHTLY COHESIVE, WET		PID 1.6 PPM
	12-14	6	12"		SAME AS ABOVE.		PID 0.7 PPM
	14-16	7	20"		SAME AS ABOVE 2.5Y 8/6		
	16-18	8	18"		2.5Y 8/6 SILTY FINE SAND, LOOSE TO SLIGHTLY COHESIVE, WET		PID 0.8 PPM
	18-20	9	18"		SAME AS ABOVE.		PID 0.7 PPM
	20-22	10	14"		SAME AS ABOVE.		PID 0.6 PPM
	22-24	11	16"		SAME AS ABOVE.		

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	47TW10	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT, NC

ELEVATION _____ DRILLING CONTRACTOR PARRATT WOLFF, INC.

DRILLING METHOD AND EQUIPMENT INGERSOLL RAND 2340 DPT

WATER LEVEL AND DATE _____ START 3/7/00 FINISH 3/7/00 LOGGER W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	1-4	1	36"		5Y6/4 SILTY FINE SAND, COHESIVE, MOIST.		PID 3.7
	4-6	2	20		SAME AS ABOVE, CHANGING TO 5Y8/1.		PID 3.6
	6-8	3	18"		5Y8/4 SILTY FINE SAND, MOIST BECOMING WET, COHESIVE.		PID 3.5 WATER TABLE AT ~8' BGS
	8-10	4	12"		SAME AS ABOVE		PID 2.7
	10-12	5	14"		SAME AS ABOVE, 2.5Y7/8		
	12-14	6	12"		SAME AS ABOVE.		PID 2.8
	14-16	7	18"		2.5Y 7/8 SILTY FINE SAND, LOOSE TO SLIGHTLY COHESIVE, WET.		PID 2.4
	16-18	8	20"		SAME AS ABOVE		PID 1.7
	18-20	9	16"		SAME AS ABOVE.		PID 1.9
	20-22	10	18"		SAME AS ABOVE.		PID 1.3
	22-24	11	12"		SAME AS ABOVE.		PID .9

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	OU1-47TW11	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT, NC

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT TRUCK MOUNTED CME 75 DPT

WATER LEVEL AND DATE _____ START 3/5/00 FINISH 3/5/00 LOGGER W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-2				CONCRETE, RUBBLE		NO PID READINGS
	2-4	1	12"		2.5Y 7/3 SILTY FINE SAND TO FINE SANDY SILT, MOIST, COHESIVE		
	4-6	2	12"		SAME AS ABOVE		
	6-8	3	3"		2.5Y 5/3 SILTY FINE SAND TO FINE SANDY SILT, MOIST COHESIVE		ROCK IN HOLE
	8-10	4	0"				
	10-12	5	1"		WET, SILTY FINE SAND, LOOSE		
	12-14	6	20"		2.5Y 7/2 SILTY FINE SAND TO FINE SAND, WET, LOOSE, NO INDICATION OF CONTAMINATION.		WATER TABLE AT ~ 10' BGS
	14-16	7	24"		SAME AS ABOVE.		
	16-18	8	20"		SAME AS ABOVE		
	18-20	9	0"				
	20-22	10	24"		2.5Y 7/2 FINE SAND WITH SOME SILT, WET, RUNNY, NO INDICATION OF CONTAMINATION		
	22-24	11			SAME AS ABOVE.		

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	OU1-47TW12	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT, NC

ELEVATION _____ DRILLING CONTRACTOR PARRATT WOLFF INC.

DRILLING METHOD AND EQUIPMENT INGERSOLL RAN 8200 DPT

WATER LEVEL AND DATE _____ START 3/4/00 FINISH 3/4/00 LOGGER W. FRIEDMAN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	1-3	1	12"		~~1-3~~ 10YR 7/6 SILTY FINE SAND, TRACE MEDIUM SAND, MOIST, SLIGHTLY COHESIVE		PID 5.3PPM
	3-5				CONCRETE		
	5-7	2	12		10YR 7/6 SILTY FINE SAND, GRAVEL FILL.		
	7-9	3	16"		10YR 8/8 SILTY FINE SAND TO FINE SAND, MOIST, SLIGHTLY COHESIVE		
	9-11	4	20"		SAME AS ABOVE, BECOMING WET, NO APPARENT ODOR		PID 150ppm WATER TABLE AT ~ 10'BGS
	11-13	5	18"		SAME AS ABOVE.		PID 216 PPP
	13-15	6	20"		SAME AS ABOVE		PID 343 ppm
	15-17	7	22		10YR7/8 - FINE SAND TO SILTY FINE SAND, LOOSE, WET		PID 449 ppm
	17-19	8	18"		SAME AS ABOVE.		PID 459 ppm
	19-21	9	20"		2.5Y 6/1 TO 2.5Y 8/6 - FINE SAND TO SILTY FINE SAND		PID 216 ppm
	21-23	10	18		SAME AS ABOVE		PID 185
	23-25	11	24"		SAME AS ABOVE. 2.5Y6/1		

REV 7/86 FORM D1586

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	OU1-47TW13	SHEET 1 OF 1

SOIL BORING LOG

PROJECT MCAS CHERRY POINT OU1 SITE 47 LOCATION CHERRY POINT, NC

ELEVATION _____ DRILLING CONTRACTOR PARRATT WOLFF INC.

DRILLING METHOD AND EQUIPMENT INGERSOLL RAN 8200 DPT

WATER LEVEL AND DATE _____ START 3/4/00 FINISH 3/4/00 LOGGER W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	3-5	1	12*		2.5Y 6/4 - SILTY FINE SAND, SLIGHTLY COHESIVE, MOIST		PID 1.6 ppm
	5-7	2	12"		2.5Y 2.5/1 ORGANIC FINE SAND AND SILT, ROOTS AND PIECES OF WOOD, MOIST		PID 6.6 ppm
	7-9	3	16"		2.5Y 5/2 SILTY FINE SAND COHESIVE MOIST TO SLIGHTLY WET, PLANT ROOT.		PID 10.1 ppm
	9-11	4	14"		2.5Y 6/1 WITH 2.5Y 4/1 MOTTLES SILTY FINE SAND TO FINE SAND, WET NO APPARENT ODOR OR STAINING		PID 6.3 ppm WATER TABLE AT ~9' BGS.
	11-13	5	20"		5Y 7/1 SILTY FINE SAND, ~~TO~~ WET, SLIGHTLY TO NON COHESIVE, SLIGHT H_2SO_4 ODOR.		PID 30.3 ppm
	13-15	6	14"		SAME AS ABOVE.		PID 41.2 ppm
	15-17	7	14"		SAME AS ABOVE		PID 44.7 ppm
	17-19	8	6"		TIP WAS FINE SAND		NO READING
	19-21	9	12"		2.5Y 8/1 - FINE SAND TO SILTY FINE SAND, LOOSE, ~~CC~~ WET.		PID 88.7 ppm
	21-23	10	18"		2.5Y 8/4 SAME AS ABOVE.		PID 16.3
	23-25	11	24"		2.5 7/8 SAME AS ABOVE		PID 31.4

Appendix D
Temporary Well Field Geochemical Parameters

Table D1
Temporary Well Field Geochemical Parameter Data
Site 47 Stripper Barn Plume
Cherry Point, NC

Parameter	Units	Well ID / Measurement Date	47TW01 03/06/2000	47TW02 03/06/2000	47TW03 03/07/2000	47TW04 03/07/2000	47TW05 03/07/2000	47TW06 03/07/2000	47TW07 03/07/2000	47TW08 03/06/2000
Temperature	°C		22.2	23.9	20.5	18.9	23.2	20.7	19.4	25.0
pH	--		5.84	6.29	6.52	6.18	6.24	6.88	5.13	6.79
Turbidity	NTU		7	4	3	36	-5	35	7	820
Conductivity	mS/cm		0.375	0.503	0.356	0.317	0.489	0.383	0.261	0.059
Total Dissolved Solids	g/L		0.24	0.32	0.23	0.21	0.32	0.25	0.17	0.04
Dissolved Oxygen	mg/L		0.00	0.08	0.85	0	1.76	0.98	0.66	0.11
Oxidation-Reduction Potential	mV		-137	-261	-102	-324	-74	-282	-201	-125
Iron II (dissolved)	mg/L		5	50	10	3	6.5	2	5.5	5
Sulfide	mg/L		0	0	0	0	0	0	0	0

Note: All temporary wells were screened in the upper Surficial Aquifer.

Table D1
Temporary Well Field Geochemical Parameter Data
Site 47 Stripper Barn Plume
Cherry Point, NC

Well ID		47TW09	47TW10	47TW11	47TW12	47TW13
Measurement Date		03/08/2000	03/08/2000	03/05/2000	03/07/2000	03/05/2000
Parameter	**Units**					
Temperature	°C	20.2	20.6	22.0	21.4	16.5
pH	--	5.59	5.01	5.25	6.22	6.32
Turbidity	NTU	-9	1	280	8	320
Conductivity	mS/cm	0.264	0.443	0.263	0.337	0.306
Total Dissolved Solids	g/L	0.17	0.29	0.17	0.22	0.20
Dissolved Oxygen	mg/L	3.14	0.11	3.18	0	1.93
Oxidation-Reduction Potential	mV	-98	-234	191	-268	-56
Iron II (dissolved)	mg/L	3.2	6	0.4	7	15
Sulfide	mg/L	0	0	0	0	0

Note: All temporary wells were screened in the upper Surficial Aquifer.

Appendix E
Chain of Custody Forms

[redacted]

Chain of Custody Record

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
CH2M HILL, INC	JEFF MORRISON	3/23/00	61500

Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page
13921 PARK CENTER RD SUITE 600	(703) 471-6405 FAX (703) 471-9134		Page 1 of 1

City	State	Zip Code	Site Contact
HERNDON	VA		

Project Name: MCAS-CHERRY POINT OU1 SITE 47

Carrier/Waybill Number: FEDEX / 8187 4450 7169

Contract/Purchase Order/Quote No.:

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	VOC	TOC	Methane, Ethene, Ethane	Total Alk.	Cl, Sulfate, Nitrate, Nitrite	Diss Metals	COD
47GW05	3·22·00	1730	AQ			12	HCl, H_2SO_4		X	X	X	X	X	X	X
MW25	3·22·00	1910	AQ			12	↓ ↓		X	X	X	X	X	X	X
47GW10	3·22·00	2213	AQ			12	↓ ↓		X	X	X	X	X	X	X
MW-21	3·22·00	1551	A			8	HCl, H_2SO_4		X	X	X				
MW-23	3·22·00	0158	AQ			8	HCl, H_2SO_4		X	X	X				
MW-22	3·21·00	2046	AQ			8	HCl, H_2SO_4		X	X	X				
47TB0323	—	—	AQ			1			X						

Special Instructions: METALS ARE UNPRESS.

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months

Turn Around Time Required: ☒ Normal ☐ Rush

QC Level: ☐ I. ☐ II. ☐ III.

Project Specific (Specify):

Relinquished By	Date	Time	Received By	Date	Time
1. [signature] Steven Lehmann	3·23·00	1040	1.		
2.			2.		
3.			3.		

Comments:

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; . NK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
OHM Remediation Services Corp	JEFF MORRISON	3/23/00	61205
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
9211 Prince William Center Rd Suite 600	(703) 471 6405 / FAX (703) 471 9134		
City / **State** / **Zip Code**	**Site Contact**		
Herndon / VA			
Project Name	**Carrier/Waybill Number**		
MCAS - Cherry Point OU1 Site 47	FedEx / 818744507158		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: Total Alk	Diss Metals (Unfiltered)	Cl, Sulfate, Nitrate	Nitrate	COD
MW-23	3-22-00	0158	AQ			4	H_2SO_4, None		X	X	X	X	
MW-22	3-21-00	2046	AQ			4	H_2SO_4, None		X	X	X	X	
MW-29	3-22-00	1551	AQ			4	H_2SO_4 None		X	X	X	X	

Special Instructions

METALS ARE UNFILTERED.

Possible Hazard Identification

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal

☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required

☑ Normal ☐ Rush

QC Level

☐ I. ☐ II. ☐ III.

Project Specific (Specify)

	Date	Time		Date	Time
1. Relinquished By (Signature) (Printed) LEHMANN	3-23-00	1010	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124

Client: CH2M HILL	Project Manager: JEFF MORRISON	Date: 3·24·00	Chain Of Custody Number: 12733
Address: 13921 PARK CENTER RD STE 600	Telephone Number (Area Code)/Fax Number: (703) 471 6405 / FAX (703) 471 9134	Lab Number:	Page 1 of 1
City: HERNDON; State: VA; Zip Code:	Site Contact: X		
Project Name: MCAS- CHERRY POINT OU1-SITE 47	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: TOTAL ALK	CL, SULFATE, NITRATE/NITRITE, AMMONIA	DISS METALS	COD
47GW08	3·24·00	1101	AQ		PLASTIC	4	H_2SO_4 / NONE		X	X	X	X
47GW07	3·24·00	1103	AQ		PLASTIC	4	H_2SO_4 / NONE		X	X	X	X
47GW12	3·24·00	1247	AQ		PLASTIC	4	H_2SO_4 / NONE		X	X	X	X
~~47EB032400~~ 47EB0300	3·24·00	1545	AQ		PLASTIC	4	H_2SO_4 / NONE		X	X	X	X

Special Instructions: METALS ARE UNFILTERED

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required: ☒ Normal ☐ Rush

QC Level: ☐ I. ☐ II. ☐ III.

Project Specific (Specify):

	Date	Time		Date	Time
1. Relinquished By: S. LEHMANN	3·24·00	1800	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

02, 03, 04, 09 & FB

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
CH2M HILL	JEFF MORRISON	3.24.00	12732
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
13921 PARK CTR RD STE 600	(703) 471-6405 FAX (703) 471 9134		
City / **State** / **Zip Code**	**Site Contact**		
HERNDON / VA			
Project Name	**Carrier/Waybill Number**		
MCAS - CHERRY POINT OU1 SI-1.47			
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: TOTAL ALK	TOTAL SULFATE/ALKALINITY	DISS. METALS	COD
47GW03	3.23.00	1218				4	H_2SO_4 / NONE		X	X	X	X
47GW04	3.23.00	1339				4			X	X	X	X
47GW09	3.23.00	~~1454~~ 1709				4			X	X	X	X
47GW02 ~~47FB0300~~ (3)	3.23.00	~~1709~~ 1459				4			X	X	X	X
47FB 0300	3.23.00	1821				4			X	X	X	X

Special Instructions

METALS ARE UNPRESERVED

Possible Hazard Identification

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal

☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required

☑ Normal ☐ Rush

QC Level

☐ I. ☐ II. ☐ III.

Project Specific (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
S. LEHMANN	3.24.00	1800			
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: W - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
CH2M HILL	JEFF MORRISON	3.24.00	12734
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
13921 PARK CENTER RD STE 600	(703) 471 6405 / (703) 471 9134		
City / **State** / **Zip Code**	**Site Contact**		
HERNDON / VA			
Project Name	**Carrier/Waybill Number**		
MCAS CHERRY POINT OU1 SITE 47			
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: Total Alk	Cl, Sulfate, Nitrate, Nitrite	Diss Metals	COD	MS/MSD
47GW11	3.24.00	1927	AQ		PLASTIC	4	H_2SO_4/NONE		X	X	X	X	
47GW11-P	3.24.00	1427	AQ		PLASTIC	4	H_2SO_4/NONE		X	X	X	X	
47GW06	3.24.00	1899	AQ		PLASTIC	4	H_2SO_4/NONE		X	X	X	X	X
47GW01	3.23.00	2031	AQ		PLASTIC	4	H_2SO_4/NONE		X	X	X	X	

Special Instructions

METALS ARE UNPRESERVED

Possible Hazard Identification

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal

☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required

☒ Normal ☐ Rush

QC Level

☐ I. ☐ II. ☐ III.

Project Specific (Specify)

	Relinquished By	Date	Time	Received By	Date	Time
1.	S. LEHMANN	3.24.00	1800			
2.						
3.						

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
CH2M HILL, INC.	JEFF MORRISON	03/06/00	61499
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of**
13921 PARK CENTER RD. SUITE 600	(703) 471-1441 FAX (703) 471-9134		
City / **State** / **Zip Code**	**Site Contact**		
HERNDON / VA / 20171			
Project Name	**Carrier/Waybill Number**		
NCAS CHERRY POINT OU1 SITE 47			
Contract/Purchase Order/Quote No.			
154661.DE.FI			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: VOCs	Methane, Ethane, Ethene	TOC	Total Alkalinity	Chloride, Sulfate, Alkalinity, Nitrate	Diss. Metals	COD
51GW02	03/04/00	1155	AQ			12			3	3	2	-	-	1	1
47TW13	03/05/00	0723	AQ			3			3	1	1	-	-	-	-
47TW11	03/05/00	0839	AQ			3			3	1	1	-	-	-	-
47TW08-SB	03/05/00	0220	SOIL			1			1	-	1	-	-	-	-
47TW08	03/06/00	1911	AQ			3			3	-	-	-	-	-	-
47TW03 (47TW02)	03/06/00	1625	AQ			3			3	-	-	-	-	-	-
47TW01	03/06/00	[illegible]	AQ			3			3	-	-	-	-	-	-

Special Instructions

24 HOUR TAT FOR AQUEOUS VOCS NORMAL TAT FOR REMAINING.

Possible Hazard Identification

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal

☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required 24 HOUR TAT FOR AQUEOUS VOCS ONLY

☐ Normal ☒ Rush

QC Level ☐ I. ☐ II. ☐ III.

Project Specific (Specify)

	Date	Time		Date	Time
1. Relinquished By	03/06/00	1815	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
CH2M HILL INC.	JEFF MORRISON	03/07/00	60592
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page** 1 of 1
13921 PARK CENTER RD. STE 600	(703) 471-1441 (703) 471-9134		
City / **State** / **Zip Code**	**Site Contact**		
HERNDON / VA /			
Project Name	**Carrier/Waybill Number**		
MCAS CHERRY POINT			
Contract/Purchase Order/Quote No.			
154661.DF.FT			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: VOC
47TW04	03/07/00	0834	AQ	120ml	VOA	3	HCl		3
47TW12	03/07/00	1011	AQ	120ml	VOA	3	HCl		3
OU1-47TB01-0307	03/07/00	1147	AQ	120mL	VOA	3	HCl		3
47TW03	03/07/00	1117	AQ	120mL	VOA	3	HCl		3
47TW05	03/07/00	1410	AQ	120mL	VOA	3	HCl		3
47TW06	03/07/00	1511	AQ	120mL	VOA	3	HCl		3
47TW07	03/07/00	1618	AQ	120mL	VOA	3	HCl		3

Special Instructions

24 HOUR RUSH TAT FOR VOCs EXCEPT TRIP BLANK

Possible Hazard Identification

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal

☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required

☐ Normal ☒ Rush 24 HOUR TAT

QC Level

☐ I. ☐ II. ☐ III.

Project Specific (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
[signature]	03/07/00	1800			
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
CH2M HILL, INC	JEFF MORRISON	03/13/00	61202

Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page ____ of ____
13921 PARK CENTER ROAD SUITE 600	(703) 471-1441 FAX (703) 471-9134		

City	State	Zip Code	Site Contact
HERNDON	VA	20171	

Project Name	Carrier/Waybill Number
NEAS CHERRY POINT OU1 SITE 47	

Contract/Purchase Order/Quote No.
154661. DE. FI

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: VOCs	Analysis: TOC
47GW05	03/12/00	2130	GW	120 ml	VOA	3	HCl		3	-
47GW07	03/13/00	0901	GW	120 ml	VOA	3	HCl		3	-
47GW08	03/13/00	0843	GW	120 ml	VOA	3	HCl		3	-
~~TOC~~ 47GW07-SA	03/10/00	2200	Soil	2 oz					-	1
47GW08-SB	03/13/00	0925							-	1

Special Instructions
24 HOUR RUSH TAT ON ALL VOC SAMPLES

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months

Turn Around Time Required
☐ Normal ☒ Rush 24 HOURS ON VOCs

QC Level
☐ I. ☐ II. ☐ III.

Project Specific (Specify)

	Date	Time		Date	Time
1. Relinquished By			1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: W - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
CH2M HILL, INC.	~~PROJECT~~ JEFF MORRISON	03/09/00	60591
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
13921 PARK CENTER ROAD SUITE 600	(703) 471-1441 FAX (703) 471-9134		
City / **State** / **Zip Code**	**Site Contact**		
HERNDON / VA / 20171			
Project Name	**Carrier/Waybill Number**		
MCAS CHERRY POINT OU1 SITE 47			
Contract/Purchase Order/Quote No.			
154661.DE.FI			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: TOC
47GW04-SB	03/08/00	1910	SOIL	2oz.		1	—		1
47GW09-SB	03/09/00	0120	SOIL	2 oz		1	—		1

Special Instructions

Possible Hazard Identification

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal

☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required

☒ Normal ☐ Rush

QC Level

☐ I. ☐ II. ☐ III.

Project Specific (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
William J Fruetmorn Jr.	03/10/00	1600			
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
CH2M HILL INC.	JEI F MORRISON	03/08/00	61207

Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page 1 of 1
13921 PARK CENTER RD STE.600S	(703) 471-1441 (703) 471-9134		

City	State	Zip Code	Site Contact
HERNDON	VA	20171	

Project Name	Carrier/Waybill Number
MCAS CHERRY POINT OU1 - SITE 47	

Contract/Purchase Order/Quote No.
154661. DE. FI

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: VOC
47TW09	03/08/00	0837	AQ	120ml			HCl		3
47TW10	03/08/00	1125	AQ	120ml			HCl		3

Special Instructions
24 HOUR RUSH TAT FOR VOCs

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required
☐ Normal ☒ Rush 24 HOUR TAT

QC Level
☐ I. ☐ II. ☐ III.

Project Specific (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
STEVEN LEHMANN/CH2M HILL	3.8.00	1300			
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: TE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

VOC

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
CH2M HILL, INC	JEFF MORRISON	3·24·00	61204
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page**
13921 PARK CENTER RD STE 600	(703) 471 6405 / FAX (703) 471 9134		1 of 1

City	State	Zip Code	Site Contact
HERNDON	VA		

Project Name	Carrier/Waybill Number
MCAS – CHERRY POINT OU1 SITE 47	

Contract/Purchase Order/Quote No.

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: VOC (HCl)	TOC (H_2SO_4)	METHANE, ETHANE, ETHENE (HCl)		MS/MSD
47GW03	3·23·00	1218	AQ		VOA	8	HCl H_2SO_4		X	X	X		
47GW04	3·23·00	1332	AQ		VOA	8	HCl H_2SO_4		X	X	X		
47GW02	3·23·00	1454	AQ		VOA	8	HCl H_2SO_4		X	X	X		
47GW09	3·23·00	1709	AQ		VOA	8	HCl H_2SO_4		X	X	X		
47FB0300	3·23·00	1821	AQ		VOA	8	HCl H_2SO_4		X	X	X		
47GW06	3/23/00	1849	AQ		VOA	24	HCl H_2SO_4		X	X	X		X
47GW01	3·23·00	2031	AQ		VOA	8	HCl/H_2SO_4		X	X	X		
47GW08	3·24·00	1001	AQ		VOA	8	HCl/H_2SO_4		X	X	X		
47GW07	3·24·00	1103	AQ		VOA	8	HCl/H_2SO_4		X	X	X		
47GW12	3·24·00	1247	AQ		VOA	8	HCl/H_2SO_4		X	X	X		
47GW ~~12P~~ 11P	3·24·00	1427	AQ		VOA	8	HCl/H_2SO_4		X	X	X		
47GW11	3·24·00	1427	AQ		VOA	8	HCl/H_2SO_4		X	X	X		
47EB ~~0324~~ 0300	3·24·00	1545	AQ		VOA	8	HCl/H_2SO_4		X	X	X		
47TB0324	~~3·24~~	—	AQ		VOA	3			X				

Special Instructions

Possible Hazard Identification	Sample Disposal
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown	☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months

Turn Around Time Required	QC Level	Project Specific (Specify)
☒ Normal ☐ Rush	☐ I. ☐ II. ☐ III.	

Relinquished By	Date	Time	Received By	Date	Time
1. [signature] STEVEN LEHMANN	3·24·00	1800	1.		
2.			2.		
3.			3.		

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra, Inc. - Pittsburgh PA Lab
450 William Pitt Way
Pittsburgh PA 15238

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
TETRA TECH NUS	GREG ZIMMERMAN	03/06/00	64868
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page 1 of 1
City / State / Zip Code	Site Contact		
Project Name: MCAS CHERRY POINT -	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: VOC	Analysis: 3NB + P/P OXY 42	Analysis: TAL METALS CN
47TW07-SB	03/06/00	0820	SOIL	160z+			—		3	1	1
47TW054-SB	03/06/00	1150	SOIL	160z+			—		3	1	1
47TW06-SB	03/06/00	1350	SOIL	160z+			—		3	1	1

Special Instructions

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required
☒ Normal ☐ Rush

QC Level
☐ I. ☐ II. ☐ III.

Project Specific (Specify)

	Date	Time		Date	Time
1. Relinquished By: Nelson Swedenborg	03/06/00	1700	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra, Inc. - Pittsburgh PA Lab
450 William Pitt Way
Pittsburgh PA 15238

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
TETRA TECH NUS	GREG ZIMMERMAN	03/07/00	34867
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page 1 of 1
City / State / Zip Code	Site Contact		
Project Name: NAVAL CHEMICAL POINT OU1 SITE 47	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: VOC	Analysis: TAL METALS + F/P	Analysis: TAL METALS + CN	Analysis: TCL PEST/PCB
47TW10-SB	03/07/00	1240	SOIL						3	1	1	1
~~OU1 FR~~												
OU1-47FR-01-030700	03/07/00	1200	AQ						2	2	1	1
47TW09-SB	03/07/00	1410	SOIL						3	1	1	1

Special Instructions

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required
☒ Normal ☐ Rush

QC Level
☐ I. ☐ II. ☐ III.

Project Specific (Specify)

	Date	Time		Date	Time
1. Relinquished By (William Fountain)	03/07/00	1800	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra, Inc. - Pittsburgh PA Lab
450 William Pitt Way
Pittsburgh PA 15238

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
TETRA TECH NUS	GREG ZIMMERMAN	03/10/00	64869
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page 1 of 1
City / State / Zip Code	Site Contact		
Project Name: NCAS CHERRY POINT OU1 SITE 47	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: 3 VOC	1 TAL METALS	1 BNAs P/PCBs
47GW05-SB	03/10/00	0200	Soil								

Special Instructions

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required
☒ Normal ☐ Rush

QC Level
☐ I. ☐ II. ☐ III.

Project Specific (Specify)

	Date	Time
1. Relinquished By: William J. Zimmerman Jr.	03/10/00	1600
2. Relinquished By		
3. Relinquished By		

	Date	Time
1. Received By		
2. Received By		
3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124

Client	Project Manager	Date	Chain Of Custody Number
TETRA TECH	GREG ZIMMERMAN	03/13/00	61201
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page ____ of ____
City / State / Zip Code	Site Contact		
Project Name: NAS Charleston Point OU1 Site 47	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: VOC	Analysis: Total Metals
47GW008-SB	03/12/00	0300	Soil			3			3	1

Special Instructions

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Turn Around Time Required
☒ Normal ☐ Rush

QC Level
☐ I. ☐ II. ☐ III.

Project Specific (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
William J Zimmerman	03/13/00	1200			
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Appendix F
Permanent Monitoring Well Boring Logs

PROJECT NUMBER	BORING NUMBER OU1-47GW02(US)
154661.DE.FT	OU1-47GW01(US) SHEET 1 OF 1

SOIL BORING LOG

PROJECT: MCAS CHERRY POINT OU1 SITE 47 LOCATION: CHERRY POINT, NC
ELEVATION: DRILLING CONTRACTOR: PARRATT WOLFF, INC
DRILLING METHOD AND EQUIPMENT USED: INGERSOLL RAND 8200 4¼" HSA
WATER LEVELS: START: 3/16/00 END: 3/17/00 LOGGER: W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
	~~1-3~~ 3-5	16"	1		2.5Y 7/6 SILTY FINE SAND, MOIST TO DRY, LOOSE TO SLIGHTLY COHESIVE	PID 0.0 ppm (SAMPLE)
5						
	8-10	18"	2		2.5Y 6/8 SILTY FINE SAND TO SANDY FINE SILT, SOME CLAY, WET, COHESIVE	PID 0.0 ppm (SAMPLE) ▽ WATER AT ~8' BGS
10						
	13-15	12"	3		2.5Y 6/8 SILTY FINE SAND, WET, SLIGHTLY COHESIVE,	PID 0.0 ppm (SAMPLE)
15						
	18-20	~~18~~ 18	4		SAME AS ABOVE, OCCASSIONAL 2.5Y 7/3 CLAY PIECES, WET.	PID 0.0 ppm (SAMPLE)
20						
	23-25	18	5		SAME AS ABOVE, NO CLAY	PID 0.0 ppm (SAMPLE)
25						
	28-30	24"	6		2.5Y 7/6 SILTY FINE SAND, SLIGHTLY COHESIVE, WET	PID 0.0 (ppm)

PROJECT NUMBER	BORING NUMBER
154661.DE.FI	GU1-47GW02 SHEET 2 OF 2

SOIL BORING LOG

PROJECT: MCAS CHERRY POINT OU1 SITE 47 LOCATION: CHERRY POINT, NC
ELEVATION: DRILLING CONTRACTOR: PARRATT WOLFF, INC.
DRILLING METHOD AND EQUIPMENT USED: INGER SOLL RAND 8200 4¼" HSA
WATER LEVELS: START: 3/11/00 END: 3/11/00 LOGGER: W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
35	33-35	20"	7		2.5Y 7/6 SILTY MEDIUM SAND, SOME FINE SAND AND CLAY STRINGERS, WET.	PID 0.0 PPM
40	38-40	16"	8		SAME AS ABOVE, NO CLAY	PID 0.0 PPM
45	43-45	20	9		2.5Y 6/2 MEDIUM TO COARSE SAND, TRACE OF FINE SAND, WET LOOSE.	PID 0.0 PPM
	48-50	8"	10		GLEY 3/ MEDIUM TO COARSE SAND, WET, LOOSE	PID 0.0 PPM
50	50-52	24"	11		GLEY 4/ SILT, COHESIVE, NON PLASTIC, DRY	PID 0.0 PPM

PROJECT NUMBER	BORING NUMBER OU1-47GW024 wj1
154661.DE.FI	OU1-47GW03 SHEET 1 OF 1

SOIL BORING LOG

PROJECT: MCAS CHERRY POINT OU1 SITE 47 LOCATION: CHERRY POINT, NC
ELEVATION: DRILLING CONTRACTOR: PARRATT WOLFF, INC
DRILLING METHOD AND EQUIPMENT USED: 4¼ HSA INGER SOLL RAND 8200
WATER LEVELS: START: 03/07/00 1600 END: 03/08/00 LOGGER: W FRIEDMANN

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
0	0-1.5				CONCRETE	
5						
	6-8	10"	1	N/A	2.5Y 6/1 FINE SANDY SILT, SOME CLAY, COHESIVE MOIST TO WET.	0.2 ppm (BREATHING) ▽ ~9' BGS
10						
	11-13	24"	2		2.5Y 6/1 SILTY FINE SAND WET; LOOSE TO SLIGHTLY COHESIVE, NO APPARENT SIGNS OF CONTAMINATION	
15						
	16-18	24"	3		SAME AS ABOVE.	0.0 (BREATHING)
20						
	21-23	18"	4		SAME AS ABOVE.	
25						
	26-28		5		2.5Y 6/1 SILTY FINE SAND, WET, LOOSE TO SLIGHTLY COHESIVE, NO APPARENT SIGN OF CONTAMINATION	0.0 (SAMPLE)

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	OU1-47GW04	SHEET 2 OF 2

SOIL BORING LOG

PROJECT: MCAS CHERRY POINT OU1 SITE 47 LOCATION: CHERRY POINT, NC
ELEVATION: DRILLING CONTRACTOR: PARRATT WOLFF, INC.
DRILLING METHOD AND EQUIPMENT USED: INGER SOIL RAN 8200 4¼" HSA
WATER LEVELS: START: 03/08/00 1700 END: 3/8/00 LOGGER: W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
30	31-33	24	6		5Y 4/2 SILTY FINE SAND, WITH CLAY. CLAY IS SOFT, NON PLASTIC, WET. NO APPARENT SIGN OF CONTAMINATION	0.0 (SAMPLE) 0.0 (BREATHING)
35	36-38	20"	7		2.5Y 4/1 MEDIUM SAND AND SHELL HASH (~15%) WET, LOOSE, SOME FINE SAND AND SILT	0.0 ppm (SAMPLE)
40	41-43	18"	8		2.5Y 4/1 MEDIUM SAND, TRACE OF SHELL FRAGMENTS AND TRACE COARSE SAND, WET, LOOSE. SAND IS SUBANGULAR TO SUBROUNDED	0.0 ppm (SAMPLE) 0.0 (BREATHING)
45	46-48		9		5G 5/1 SILTY CLAY, CONFINING LAYER, SOFT, STICKY, NON PLASTIC SOME SHELL FRAGMENTS (<5%), DRY.	0.0 ppm (SAMPLE)
50						
55						

PROJECT NUMBER	BORING NUMBER 476W06(LS)
154661.DE.FI	476W05(US) SHEET 1 OF 1

SOIL BORING LOG

PROJECT: MCAS CHERRY POINT OUL SITE 47 LOCATION: CHERRY POINT, NC
ELEVATION: DRILLING CONTRACTOR: ~~INGER~~ PARRATT WOLFF, INC
DRILLING METHOD AND EQUIPMENT USED: INGER SOLL RAN 8200 HSA 4¼"
WATER LEVELS: START: 5/20/00 END: 5/21/00 LOGGER: W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
	1-3	24"	HA-1		2.5Y 5/4 SILTY FINE SAND COHESIVE, MOIST, PETROLEUM ODOR, SOME BLACK STAINING	PID 60.5 ppm (SAMPLE)
5	5-7	16"	1		2.5Y 7/3 SILTY FINE SAND COHESIVE, MOIST, PETROLEUM ODOR.	PID 16.9 ppm
	7-9	18"	2		TOP 4" SAME AS ABOVE, BECOMING WET.	PID 7.6 ppm
10					BOTTOM 14" WOOD (ONE PIECE) BLACK STAINING, SLIGHT ORGANIC ODOR.	PID 3.3 ppm
	12-14	24	3		2.5Y 3/1 ORGANIC CLAY AND PLANT AND ROOT DEBRIS, FIBROUS. CLAY IS SOFT, NON-PLASTIC, MOIST	PID 1.8 ppm
15	17-19	14"	4		2.5Y 7/1 SILTY FINE SAND, LOOSE TO SLIGHTLY COHESIVE, WET.	PID 0.4 ppm
20	22-24	18"	5		2.5YR/1 SILTY FINE SAND TO FINE SAND, LOOSE TO SLIGHTLY COHESIVE, WET	PID 0.0 ppm
25	27-29	12"	6		SAME AS ABOVE, 2.5Y 7/1, OCCASSIONAL CLAY STRINGER	

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	47GW016	SHEET 2 OF 2

SOIL BORING LOG

PROJECT: MCAS CHERRY POINT OU1 SITE 47 LOCATION: CHERRY POINT, NC
ELEVATION: DRILLING CONTRACTOR: PARRATT WOLFF, INC
DRILLING METHOD AND EQUIPMENT USED: INGER SOLL RAN 8200 4¼" HSA
WATER LEVELS: START: 3/20/00 END: 3/21/00 LOGGER: W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
30						
	32-34	20"	7		2.5Y 6/1 SILTY FINE SAND, WITH CLAY STRINGERS, TRACE MEDIUM SAND.	PID 0.0ppm
35 ~~30~~						
	37-39	12"	8		2.5Y 3/1 FINE TO MEDIUM SAND, SOME SILT, WET, LOOSE, SUBANGULAR TO SUB-ROUNDED.	PID 0.0ppm
40 ~~35~~						
	42-44	24"	9		SAME AS ABOVE, SOME COARSE SAND	PID 0.0 ppm
45 ~~40~~						
	47-49	24"	10		5GY 5/1 SILTY CLAY WITH SHELL HASH (~10%) DRY, STICKY, SLIGHTLY PLASTIC.	
50 ~~45~~						

PROJECT NUMBER	BORING NUMBER
154661.DE.FT	OU1-47GW08(US)
	OU1-47GW07(US) SHEET 1 OF 1

SOIL BORING LOG

PROJECT: MCAS CHERRY POINT OU1 SITE 47 LOCATION: CHERRY POINT, NC
ELEVATION: DRILLING CONTRACTOR: PARRATT WOLFF, INC.
DRILLING METHOD AND EQUIPMENT USED: INGERSOLL RAND D200 4¼" HSA
WATER LEVELS: START: 3/11/00 END: 3/12/00 LOGGER: W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
	0-4.5				CONCRETE AND FILL, TWO FLOORS	
5	5-7	10"	1		10YR 6/4 TO 2.5Y 8/2 SILTY FINE SAND, SLIGHTLY COHESIVE, MOIST	PID 0.6 ppm (SAMPLE)
10	10-12	10"	2		5Y 7/2 SILT SAND, FINE TO MEDIUM WITH CLAY STINGERS, WET, LOOSE TO COHESIVE, ODOR.	PID 77.3 ppm PID 0.6 ppm (BREATHING)
15	15-17	12"	3		2.5Y 7/3 SILTY FINE SAND, WET, SLIGHTLY COHESIVE	PID 6.9 ppm
20	20-22	16"	4		SAME AS ABOVE, 2.5Y 6/6	PID 0.0
25	25-27	20"	5		SAME AS ABOVE, 2.5Y 7/3	PID 0.0

PROJECT NUMBER	BORING NUMBER
154661.DT.FI	OU1-47GW08(LS)
	OU1-47GW07(US) SHEET 2 OF 2

SOIL BORING LOG

PROJECT: MCAS CHERRY POINT OU1 SITE 47 LOCATION: CHERRY POINT, NC

ELEVATION: DRILLING CONTRACTOR: PARRATT WOLFF, INC

DRILLING METHOD AND EQUIPMENT USED: INGER SOLL RAN 8200 4¼" HSA

WATER LEVELS: START: 3/11/00 END: 3/12/00 LOGGER: W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
30	30-32	20"	6		5Y 6/1 SILTY FINE SAND, TRACE OF MEDIUM, WET, LOOSE	PID 0.0
~~35~~ 30	35-37	16"	7		2.5Y 3/1 - MEDIUM SAND SOME COARSE SAND, TRACE GRAVEL AND SILT, WET, LOOSE.	PID 0.0
~~40~~ 35	40-42	18	8		SAME AS ABOVE, INCREASING COARSE SAND.	PID 0.0 ppm
~~40~~ 45	45-47	22"	9		SAME AS ABOVE, WET	PID 0.0 ppm
~~45~~ 50	50-52	4"	10		SILT AND SHELL HASH (10-20%) COHESIVE, MOIST,	
~~50~~ 55						

PROJECT NUMBER	BORING NUMBER	
154661.DR.FI	OU1-47GW09(LS) OU1-47GW10(LS)	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: MCAS CHERRY POINT OU1 SITE 47 LOCATION: CHERRY POINT, NC
ELEVATION: DRILLING CONTRACTOR: PARRATT WOLFF, INC.
DRILLING METHOD AND EQUIPMENT USED: INGER SOLL RAN 8200 4¼" HSA
WATER LEVELS: START: 3/8/00 END: 3/9/00 LOGGER: W. FRIEDMANN

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
					ASPHALT	
	1-4	36"			5Y 8/1 SILTY FINE SAND, COHESIVE, SLIGHT ODOR, MOIST	PID 0.4ppm (SAMPLE)
5	4-6	12"	1		5Y 2.5/1 ORGANIC SILTY SAND, COHESIVE, MOIST, PLANT ROOTS	PID 0.1 ppm (SAMPLE) 0.3ppm (BREATHING)
10	9-11	16"	2		2.5Y 7/1 SILTY FINE SAND, MOIST TO WET AT TIP, LOOSE TO SLIGHTLY COHESIVE.	PID 3.0 ppm (SAMPLE) WATERTABLE AT ~10
15	14-16	20"	3		SAME AS ABOVE, 2.5Y 7/3	PID 0.0 ppm
20	21-23	24"	4		2.5Y 7/4 SILTY FINE SAND, WET, LOOSE, NO APPARENT STAINING OR ODOR	PID 0.0 ppm
25	26-28	24"	5		5Y6/1 SILTY FINE SAND, LOOSE, WET.	PID 0.0 ppm

PROJECT NUMBER	BORING NUMBER
154661.DE.FI	OU1-47GW10 SHEET 2 OF 2

SOIL BORING LOG

PROJECT: MCAS Cherry Point OU1 Site 47 LOCATION: Cherry Point, NC
ELEVATION: DRILLING CONTRACTOR: Parratt Wolff, Inc
DRILLING METHOD AND EQUIPMENT USED: Ingersoll Ran 8200 4¼" HSA
WATER LEVELS: START: 3/9/00 END: 3/9/00 LOGGER: W. Friedmann

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
30	31-33		6		5BG 4/1 SILTY CLAY TO CLAYEY SILT, SHELL FRAGMENTS (<10%), MOIST, SOFT, NON PLASTIC	PID(0.0) ppm (SAMPLE)
35 ~~30~~						
40 ~~35~~						
	38-40	16"	7		5Y 3/1 MEDIUM SAND, SOME FINE SAND AND TRACE OF SILT AND SHELLS, WET, LOOSE	PID 0.0 ppm (SAMPLE)
45 ~~40~~	43-45	24	8		GLEY 4/ MEDIUM SAND, SOME FINE SAND, LOOSE WET. NO INDICATION OF CONTAMINATION	PID 0.0 ppm (SAMPLE)
50 ~~45~~	45-47	24	9		TOP 16" SAME AS ABOVE, SOME COARSE SAND. BOTTOM 8" GLEY 3 CLAYEY SILT TO SILTY CLAY, SLIGHTLY PLASTIC	PID 8.3 ppm (SAMPLE)
55 ~~50~~						

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	47GW11	SHEET 1 OF 2

SOIL BORING LOG

PROJECT MCAS Cherry Point OU1 Site 47 LOCATION Cherry Point, NC

ELEVATION _____ DRILLING CONTRACTOR Parratt Wolff, Inc

DRILLING METHOD AND EQUIPMENT Ingersoll Rand 8200 4¼" HSA

WATER LEVEL AND DATE _____ START 3/21/00 FINISH 3/22/00 LOGGER W. Friedmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	1-3	1	6"		5Y7/3 SILTY FINE SAND, LOOSE, DRY.		PID 0.0 ppm
	3-5	2	14"		5Y7/2 FINE SANDY SILT, COHESIVE, MOIST		PID 1.1 ppm
	5-7	3	6"		SAME AS ABOVE		PID 0.4 ppm
	7-9	4	8"		2.5Y 7/3 SILTY FINE SAND, LOOSE TO SLIGHTLY COHESIVE, MOIST		PID 0.0 ppm
	9-11	5	10"		2.5Y 6/2 TO 2.5Y 3/2 SILTY FINE SAND, ORGANIC HORIZON WITH PLANT ROOTS, SLIGHTLY COHESIVE, WET, NO APPARENT SIGN OF CONTAMINATION		PID 0.0 ppm
	14-16'	6	20"		2.5Y 7/4 TO 2.5Y 6/3 SILTY FINE SAND, WOOD PIECE, LOOSE TO SLIGHTLY COHESIVE, WET		PID 0.0 ppm
	19-21'	7	24"		2.5Y 8/2 SILTY FINE SAND, LOOSE, WET, NO APPARENT SIGN OF CONTAMINATION		PID 0.0 ppm
	24-26'	8	20"		2.5 7/1 SILTY FINE SAND, LOOSE, WET		PID 0.0 ppm
	29-31	9	20"		2.5Y 7/1 SILTY FINE SAND, LOOSE, WET, NO APPARENT SIGN OF CONTAMINATION		PID 0.0 ppm

PROJECT NUMBER	BORING NUMBER	
154661.DE.FI	47GW11	SHEET 2 OF 2

SOIL BORING LOG

PROJECT MCAS Cherry Point OU2 Site 47 LOCATION Cherry Point, NC

ELEVATION _____ DRILLING CONTRACTOR Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Sow Rand ECM 4 1/4" HSA

WATER LEVEL AND DATE _____ START 5/21/02 FINISH 5/22/02 LOGGER W Friedmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	31-36	10	24"		5Y 6/2 MEDIUM SAND, SOME FINE SAND, LOOSE, WET.		PID 0.0 ppm
	36-41	11	24"		SAME AS ABOVE, SOME COARSE SAND.		PID 0.0 ppm
	41-46	12	24"		5Y 6/2 MEDIUM TO COARSE SAND, LOOSE, WET		PID 0.0 ppm
	46-51				TOP 6" SAME AS ABOVE BOTTOM 18" 5Y 2.5/1 CLAY, TRACE SHELL FRAGMENTS, STIFF, PLASTIC, DRY		PID 0.0 ppm

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
154661.DB.FI	476W12	SHEET 1 OF 1

SOIL BORING LOG

PROJECT NCBS Cheatham Point OU1 Site 47 LOCATION Cheatham Point OU1

ELEVATION _____ DRILLING CONTRACTOR Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT Ingersoll Rand 8200 4 1/4" HSA

WATER LEVEL AND DATE _____ START 3/21/00 FINISH 3/21/00 LOGGER W. Friedmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-1				CONCRETE/SOIL		
	1-3	1	8"		2.5Y 4/3 FINE SANDY SILT, COHESIVE, DRY		PID 0.0 ppm
	3-5	2	10"		2.5Y 7/2 TO 2.5Y 4/2 SILTY FINE SAND, SLIGHTLY COHESIVE, DRY, NO APPARENT ODOR OR STAINING		PID 0.0 ppm
	5-7	3	6"		SAME AS ABOVE, 2.5Y 7/2, DRY		PID 0.0 ppm
	7-9	4	14"		2.5Y 7/1 SILTY FINE SANDY, SLIGHTLY COHESIVE, MOIST TO SLIGHTLY WET, NO APPARENT ODOR OR STAINING.		PID 0.0 ppm
	12-14	5	18"		2.5Y 7/8 SILTY FINE SAND WITH 2.5Y 6/1 CLAY STRINGERS, WET, SILTY FINE SAND IS COHESIVE WET		PID 0.0 ppm
	17-19	6	20"		SAME AS ABOVE, CLAY STRINGERS ARE 2.5Y 7/8. STICKY, SOFT.		PID 0.0 ppm

Appendix G
Permanent Monitoring Well Construction Logs

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW01	SHEET 1	OF 1

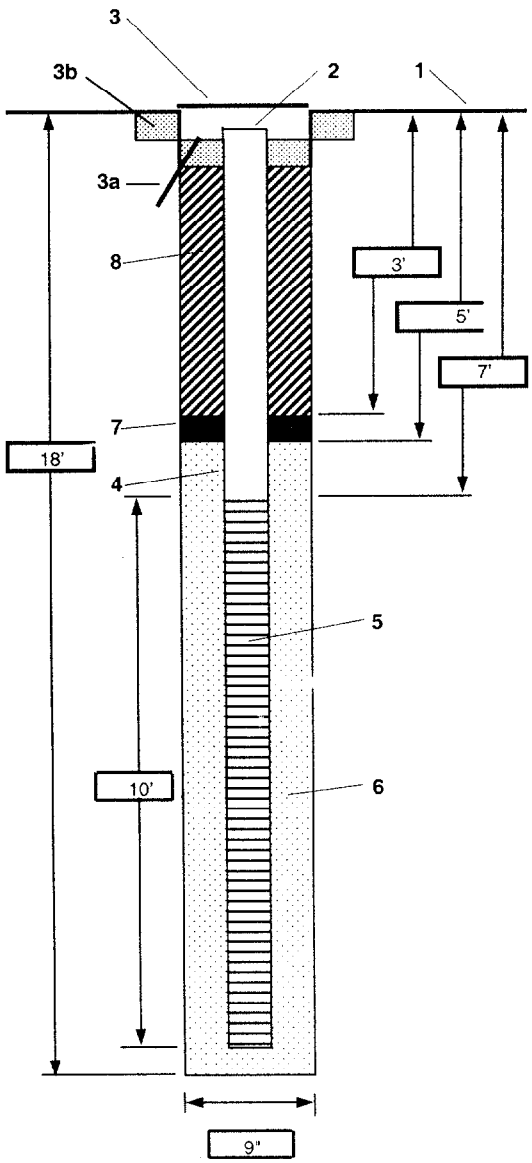
WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers

WATER LEVELS : 14.40' MSL START : March 10, 2000 @ 1800 END : March 10, 2000 @ 2000 LOGGER : William Friedmann



1- Ground elevation at ground	
2- Top of casing elevation	22.7760' MSL
3- Wellhead protection cover type	Steel flush mount
a) drain tube?	No
b) concrete pad dimensions	18" Diamter
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	2" Schedule 40 PVC - 10 slot
6- Type screen filter	#1 DSI Sand
a) Quantity used	250 lbs.
7- Type of seal	3/8" bentonite hole plug
a) Quantity used	50 lbs.
8- Grout	
a) Grout mix used	Portland Cement
b) Method of placement	Tremmied
c) Vol. of well casing grout	
Development method	Submersible pump with surging
Development time	45 minutes
Estimated purge volume	30 gallons

Comments

PROJECT NUMBER	WELL NUMBER
154661.DE.FI	OU1-47GW02 SHEET 1 OF 1

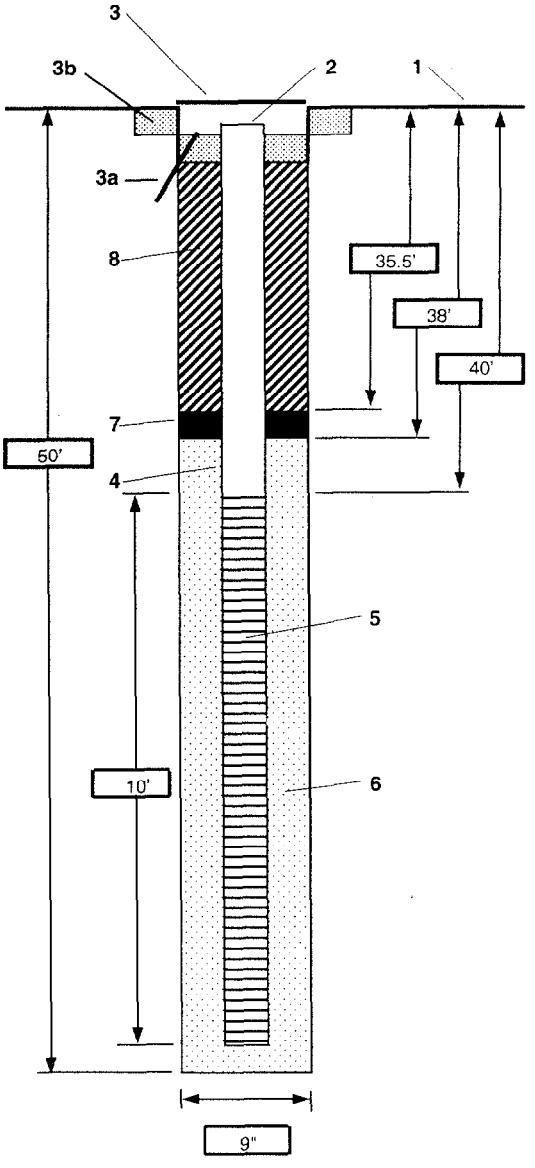
WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers

WATER LEVELS : 14.47' MSL START : March 10, 2000 @ 2100 END : March 11, 2000 @ 0500 LOGGER : William Friedmann



1- Ground elevation at ground

2- Top of casing elevation 22.7680' MSL

3- Wellhead protection cover type Steel flush mount
a) drain tube? No
b) concrete pad dimensions 18" Diamter

4- Dia./type of well casing 2" Schedule 40 PVC

5- Type/slot size of screen 2" Schedule 40 PVC - 10 slot

6- Type screen filter #1 DSI Sand
a) Quantity used 250 lbs.

7- Type of seal 3/8" bentonite hole plug
a) Quantity used 50 lbs.

8- Grout
a) Grout mix used Portland Cement
b) Method of placement Tremmied
c) Vol. of well casing grout

Development method Submersible pump with surging

Development time 45 minutes

Estimated purge volume 110 gallons

Comments

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW03	SHEET 1	OF 1

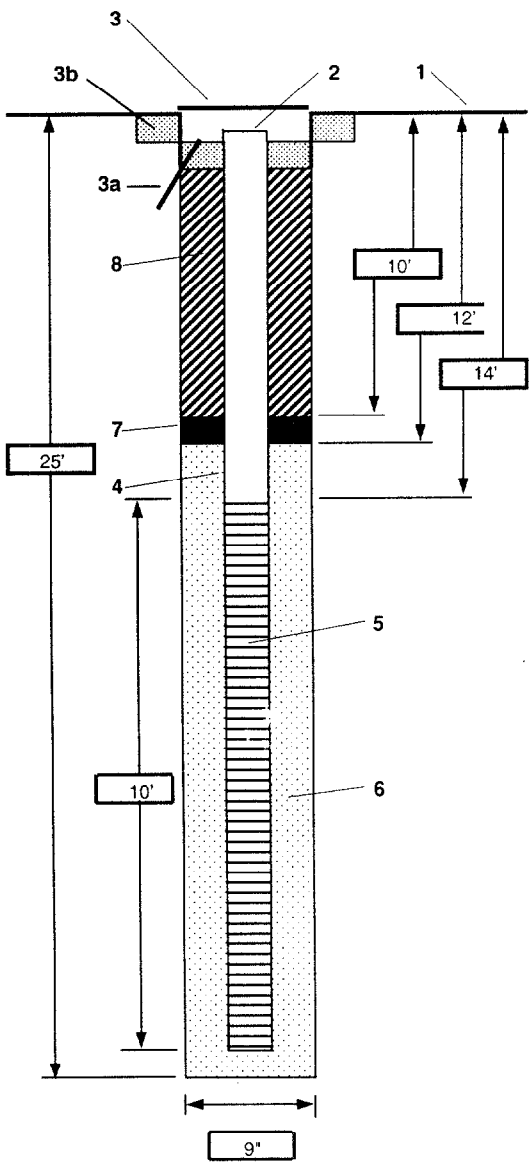
WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers

WATER LEVELS : 14.85' MSL START : March 7, 2000 @ 1600 END : March 7, 2000 @ 1835 LOGGER : William Friedmann



1- Ground elevation at ground	
2- Top of casing elevation	21.8800' MSL
3- Wellhead protection cover type	Steel flush mount
a) drain tube?	No
b) concrete pad dimensions	18" Diamter
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	2" Schedule 40 PVC - 10 slot
6- Type screen filter	#1 DSI Sand
a) Quantity used	250 lbs.
7- Type of seal	3/8" bentonite hole plug
a) Quantity used	50 lbs.
8- Grout	
a) Grout mix used	Portland Cement
b) Method of placement	Tremmied
c) Vol. of well casing grout	
Development method	Submersible pump with surging
Development time	2.5 hours
Estimated purge volume	30 gallons

Comments

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW04	SHEET 1	OF 1

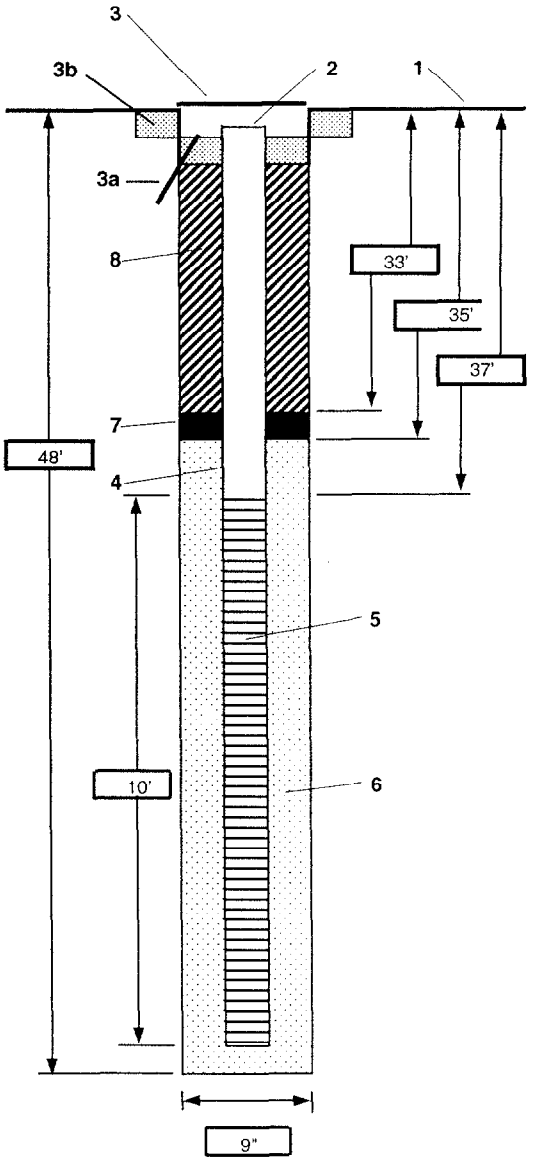
WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers

WATER LEVELS : 14.43' MSL START : March 8, 2000 @ 1700 END : March 8, 2000 @ 2300 LOGGER : William Friedmann



1- Ground elevation at ground	
2- Top of casing elevation	21.9910' MSL
3- Wellhead protection cover type	Steel flush mount
a) drain tube?	No
b) concrete pad dimensions	18" Diamter
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	2" Schedule 40 PVC - 10 slot
6- Type screen filter	#1 DSI Sand
a) Quantity used	250 lbs.
7- Type of seal	3/8" bentonite hole plug
a) Quantity used	50 lbs.
8- Grout	
a) Grout mix used	Portland Cement
b) Method of placement	Tremmied
c) Vol. of well casing grout	
Development method	Submersible pump with surging
Development time	1.5 hours
Estimated purge volume	105 gallons

Comments

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW05	SHEET 1	OF 1

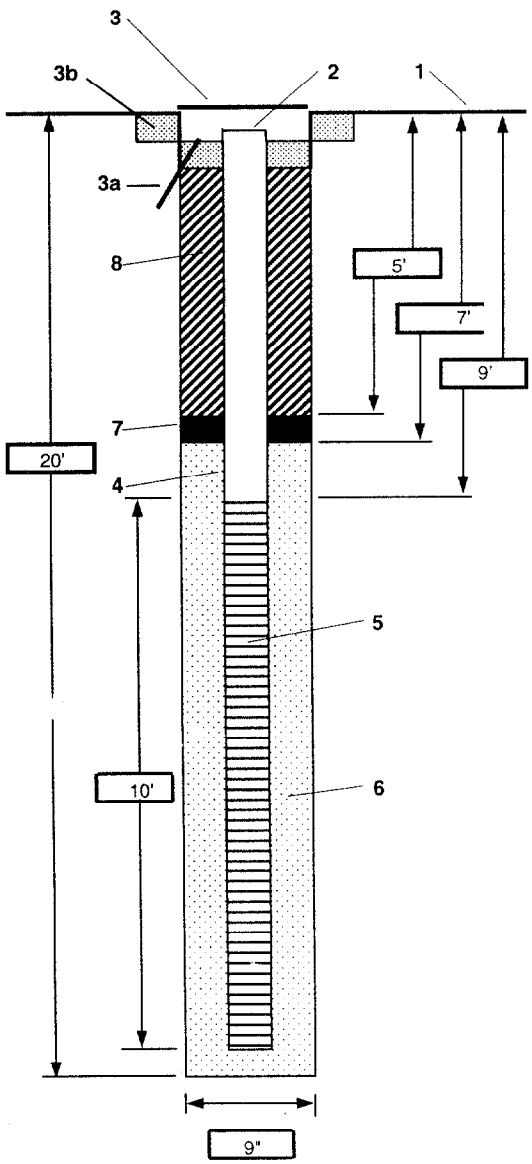
WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers

WATER LEVELS : 14.19' MSL START : March 10, 2000 @ 0000 END : March 10, 2000 @ 0530 LOGGER : William Friedmann



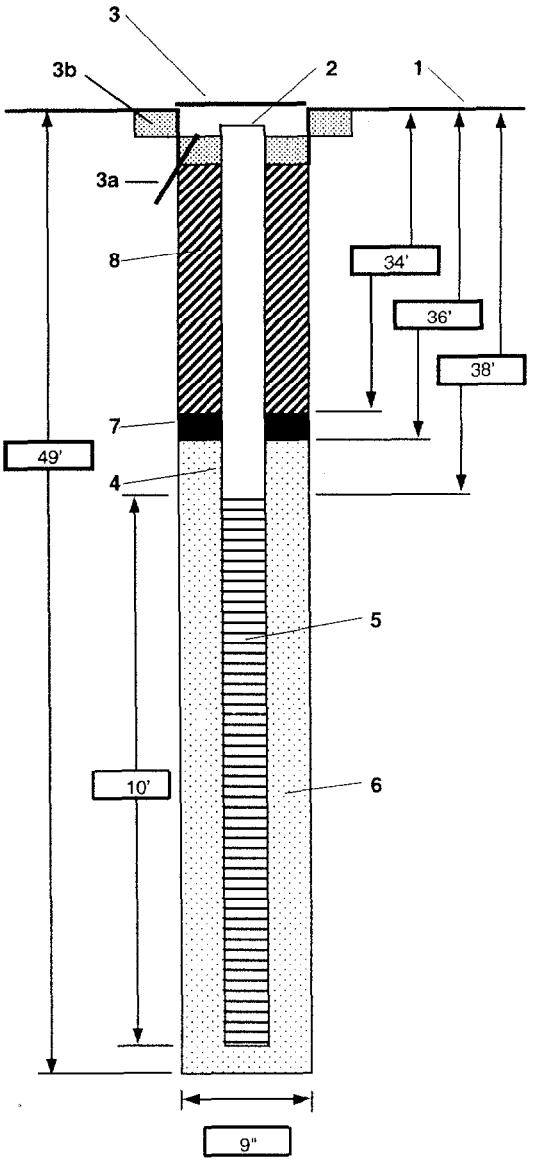
1- Ground elevation at ground	
2- Top of casing elevation	23.4020' MSL
3- Wellhead protection cover type	Steel flush mount
a) drain tube?	No
b) concrete pad dimensions	18" Diamter
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	2" Schedule 40 PVC - 10 slot
6- Type screen filter	#1 DSI Sand
a) Quantity used	250 lbs.
7- Type of seal	3/8" bentonite hole plug
a) Quantity used	50 lbs.
8- Grout	
a) Grout mix used	Portland Cement
b) Method of placement	Tremmied
c) Vol. of well casing grout	
Development method	Submersible pump with surging
Development time	45 minutes
Estimated purge volume	50 gallons

Comments

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW06	SHEET 1	OF 1

WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina
DRILLING CONTRACTOR : Parratt Wolff, Inc.
DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers
WATER LEVELS : 13.96' MSL START : March 20, 2000 @ 0110 END : March 20, 2000 @ 0700 LOGGER : William Friedmann



1- Ground elevation at ground

2- Top of casing elevation 23.4470' MSL

3- Wellhead protection cover type Steel flush mount
a) drain tube? No
b) concrete pad dimensions 18" Diamter

4- Dia./type of well casing 2" Schedule 40 PVC

5- Type/slot size of screen 2" Schedule 40 PVC - 10 slot

6- Type screen filter #1 DSI Sand
a) Quantity used 250 lbs.

7- Type of seal 3/8" bentonite hole plug
a) Quantity used 50 lbs.

8- Grout
a) Grout mix used Portland Cement
b) Method of placement Tremmied
c) Vol. well casing grout

Development method Submersible pump with surging

Development time

Estimated purge volume

Comments

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW07	SHEET 1	OF 1

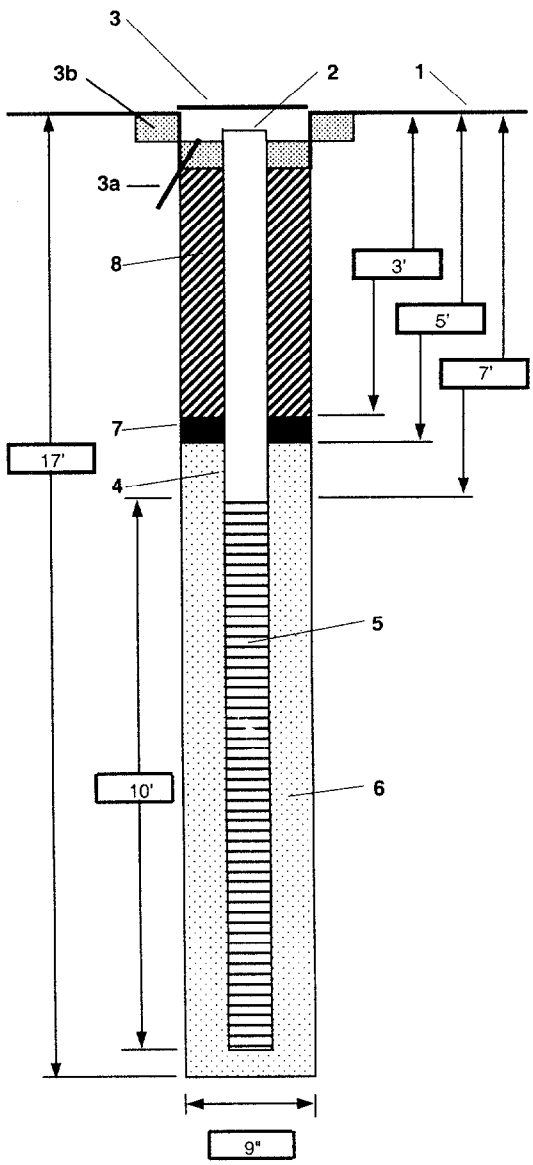
WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers

WATER LEVELS : 14.13' MSL START : March 12, 2000 @ 1000 END : March 12, 2000 @ 1230 LOGGER : William Friedmann



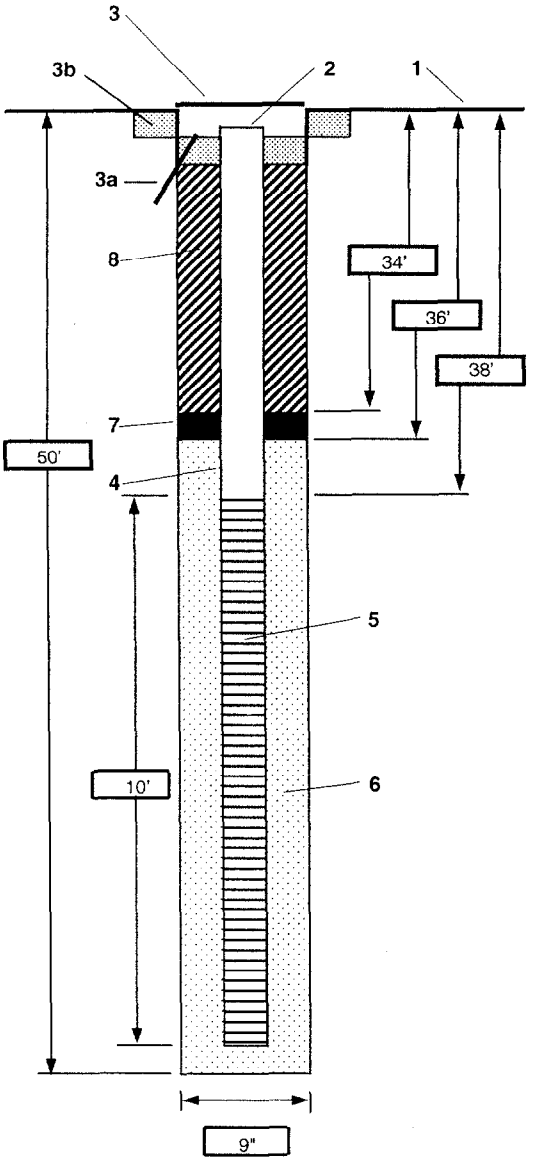
1- Ground elevation at ground	
2- Top of casing elevation	23.3360' MSL
3- Wellhead protection cover type	Steel flush mount
a) drain tube?	No
b) concrete pad dimensions	18" Diamter
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	2" Schedule 40 PVC - 10 slot
6- Type screen filter	#1 DSI Sand
a) Quantity used	250 lbs.
7- Type of seal	3/8" bentonite hole plug
a) Quantity used	50 lbs.
8- Grout	
a) Grout mix used	Portland Cement
b) Method of placement	Tremmied
c) Vol. of well casing grout	
Development method	Submersible pump with surging
Development time	1 hour 50 minutes
Estimated purge volume	50 gallons

Comments

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW08	SHEET 1	OF 1

WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina
DRILLING CONTRACTOR : Parratt Wolff, Inc.
DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers
WATER LEVELS : 13.97' MSL START : March 11, 2000 @ 0100 END : March 11, 2000 @ 0800 LOGGER : William Friedmann



1- Ground elevation at ground	
2- Top of casing elevation	23.2600' MSL
3- Wellhead protection cover type	Steel flush mount
a) drain tube?	No
b) concrete pad dimensions	18" Diamter
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	2" Schedule 40 PVC - 10 slot
6- Type screen filter	#1 DSI Sand
a) Quantity used	250 lbs.
7- Type of seal	3/8" bentonite hole plug
a) Quantity used	50 lbs.
8- Grout	
a) Grout mix used	Portland Cement
b) Method of placement	Tremmied
c) Vol. of well casing grout	
Development method	Submersible pump with surging
Development time	1 hour 22 minutes
Estimated purge volume	100 gallons

Comments

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW09	SHEET 1	OF 1

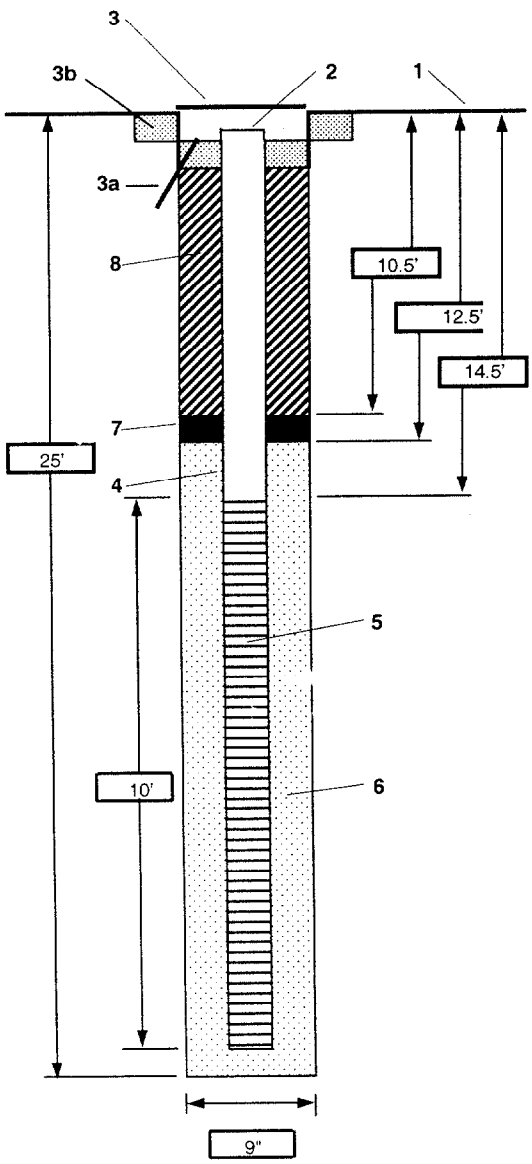
WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers

WATER LEVELS : 14.44' MSL START : March 9, 2000 @ 0030 END : March 9, 2000 @ 0300 LOGGER : William Friedmann



1- Ground elevation at ground

2- Top of casing elevation: 22.4650' MSL

3- Wellhead protection cover type: Steel flush mount
- a) drain tube?: No
- b) concrete pad dimensions: 18" Diamter

4- Dia./type of well casing: 2" Schedule 40 PVC

5- Type/slot size of screen: 2" Schedule 40 PVC - 10 slot

6- Type screen filter: #1 DSI Sand
- a) Quantity used: 250 lbs.

7- Type of seal: 3/8" bentonite hole plug
- a) Quantity used: 50 lbs.

8- Grout
- a) Grout mix used: Portland Cement
- b) Method of placement: Tremmied
- c) Vol. of well casing grout

Development method: Submersible pump with surging

Development time: 1 hour 10 minutes

Estimated purge volume: 75 gallons

Comments

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW10	SHEET 1	OF 1

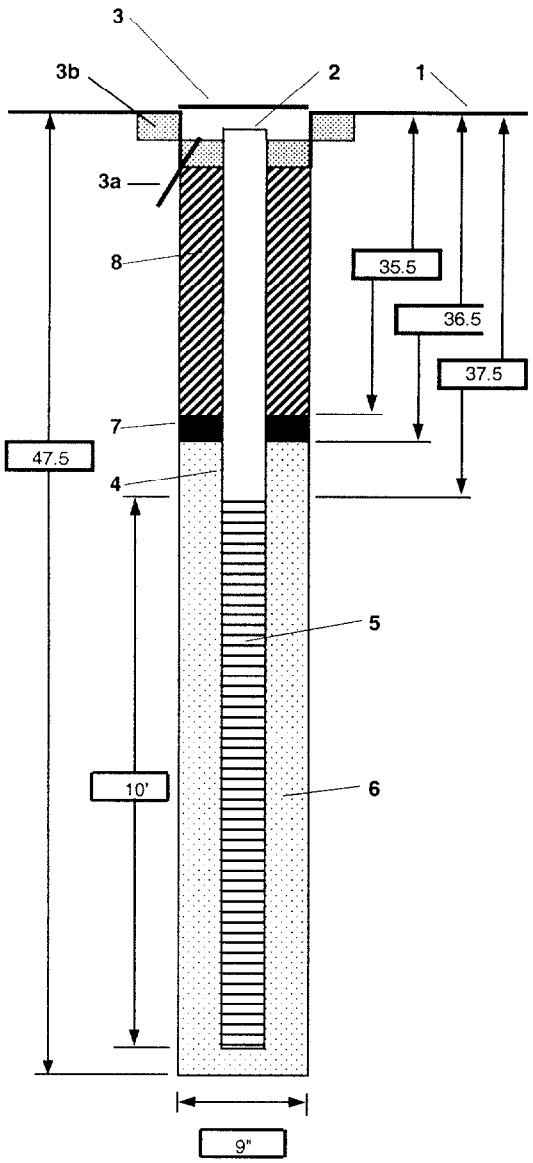
WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers

WATER LEVELS : 14.14' MSL START : March 9, 2000 @ 1800 END : March 9, 2000 @ 2300 LOGGER : William Friedmann



1- Ground elevation at ground	
2- Top of casing elevation	22.4150' MSL
3- Wellhead protection cover type	Steel flush mount
a) drain tube?	No
b) concrete pad dimensions	18" Diamter
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	2" Schedule 40 PVC - 10 slot
6- Type screen filter	#1 DSI Sand
a) Quantity used	250 lbs.
7- Type of seal	3/8" bentonite hole plug
a) Quantity used	50 lbs.
8- Grout	
a) Grout mix used	Portland Cement
b) Method of placement	Tremmied
c) Vol. of well casing grout	
Development method	Submersible pump with surging
Development time	1 hour
Estimated purge volume	50 gallons

Comments

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW11	SHEET 1	OF 1

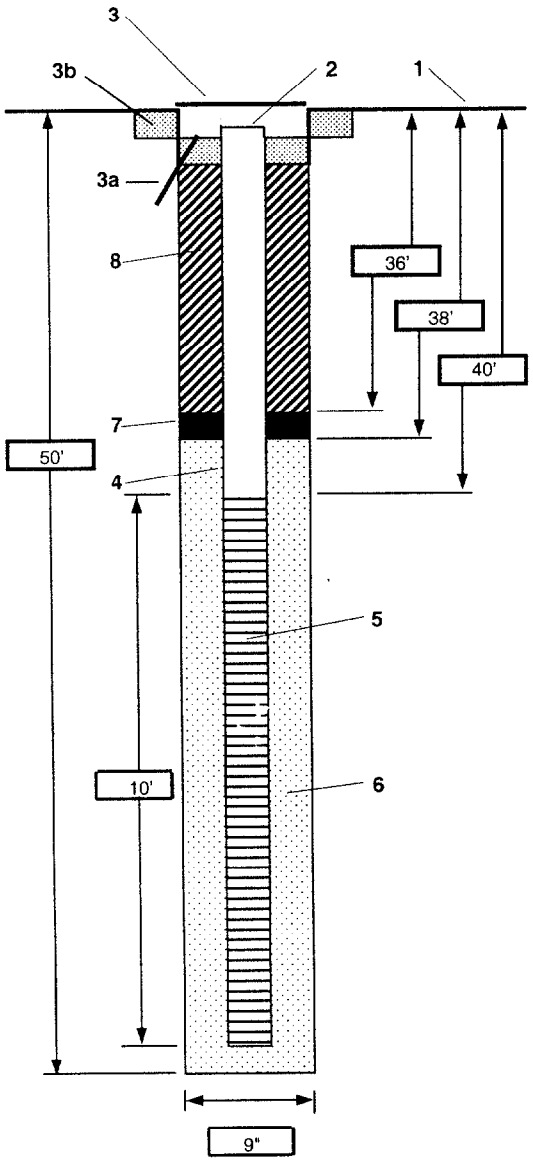
WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers

WATER LEVELS : 13.91' MSL START : March 21, 2000 @ 0345 END : March 20, 2000 @ 0630 LOGGER : William Friedmann



1- Ground elevation at ground

2- Top of casing elevation: 23.2070' MSL

3- Wellhead protection cover type: Steel flush mount
- a) drain tube?: No
- b) concrete pad dimensions: 18" Diamter

4- Dia./type of well casing: 2" Schedule 40 PVC

5- Type/slot size of screen: 2" Schedule 40 PVC - 10 slot

6- Type screen filter: #1 DSI Sand
- a) Quantity used: 250 lbs.

7- Type of seal: 3/8" bentonite hole plug
- a) Quantity used: 50 lbs.

8- Grout
- a) Grout mix used: Portland Cement
- b) Method of placement: Tremmied
- c) Vol. of well casing grout

Development method: Submersible pump with surging

Development time

Estimated purge volume

Comments

PROJECT NUMBER	WELL NUMBER		
154661.DE.FI	OU1-47GW12	SHEET 1	OF 1

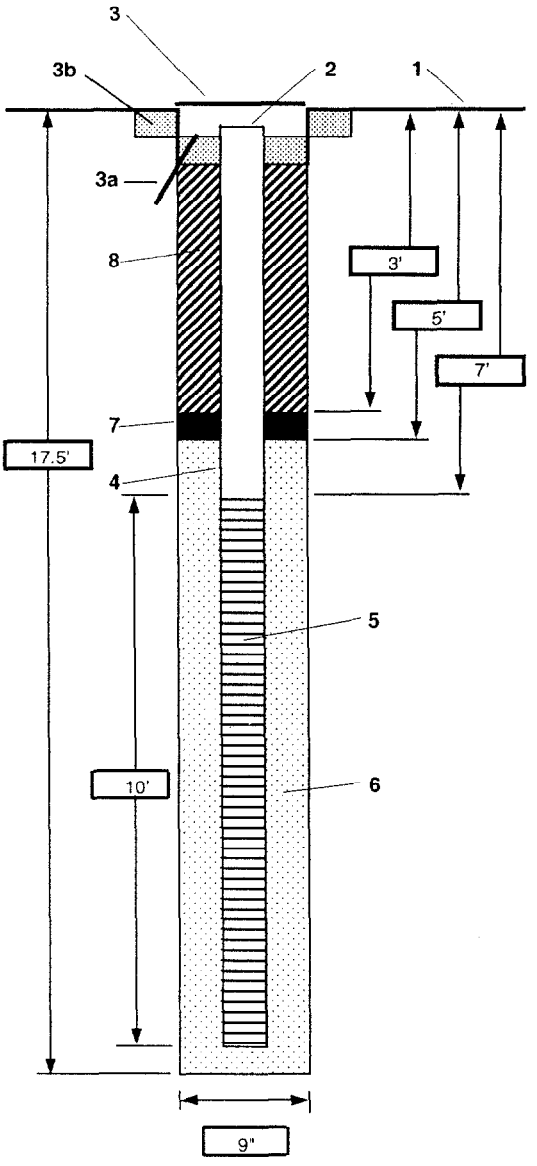
WELL COMPLETION DIAGRAM

PROJECT : MCAS-Cherry Point OU1 LOCATION : Cherry Point, North Carolina

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT USED : 4-1/4" ID Hollow Stem Augers

WATER LEVELS : 13.94' MSL START : March 21, 2000 @ 0010 END : March 20, 2000 @ 0300 LOGGER : William Friedmann



1- Ground elevation at ground	
2- Top of casing elevation	23.5140' MSL
3- Wellhead protection cover type	Steel flush mount
a) drain tube?	No
b) concrete pad dimensions	18" Diamter
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	2" Schedule 40 PVC - 10 slot
6- Type screen filter	#1 DSI Sand
a) Quantity used	250 lbs.
7- Type of seal	3/8" bentonite hole plug
a) Quantity used	50 lbs.
8- Grout	
a) Grout mix used	Portland Cement
b) Method of placement	Tremmied
c) Vol. of well casing grout	
Development method	Submersible pump with surging
Development time	1 hour 10 minutes
Estimated purge volume	50 gallons

Comments

Appendix H
Permanent Monitoring Well Field Geochemical Parameters

Table H1
Permanent Monitoring Well Field Geochemical Parameter Data
Site 47 Stripper Barn Plume
Cherry Point, NC

Well ID		47GW01	47GW02	47GW03	47GW04	47GW05	47GW06	47GW07	47GW08	47GW09	47GW10	47GW11	47GW12	51GW02	MW22	MW23	MW24	MW25
Screen Placement		US	LS	US	LS	US	LS	US	LS	US	LS	LS	US	US	US	LS	LS	LS
Measurement Date		03/23/2000	02/23/2000	03/09/2000	03/23/2000	03/22/2000	03/23/2000	03/24/2000	03/24/2000	03/23/2000	03/22/2000	03/24/2000	03/24/2000	03/04/2000	03/21/2000	03/22/2000	03/22/2000	03/22/2000
Parameter	**Units**																	
Temperature	°C	17.54	20.06	18.59	19.20	20.20	21.54	20.56	21.16	17.93	18.28	22.49	22.35	22.6	16.58	18.41	21.30	19.08
pH	--	5.56	5.72	5.87	6.01	6.23	6.48	5.89	5.54	6.01	5.90	6.73	5.25	5.99	6.93	6.64	6.69	5.13
Turbidity	NTU	-2.3	147	232	7.3	-1.1	4.9	118.0	1.3	32.5	17.5	130.0	7.5	120	1.4	6.3	1.5	79.3
Conductivity	mS/cm	289	0.272	0.495	0.364	0.632	0.680	.589	.277	0.528	0.258	.632	0.199	0.338	0.680	0.671	0.637	0.154
Total Dissolved Solids	g/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.22	NM	NM	NM	NM
Dissolved Oxygen	mg/L	7.26	7.47	10.98	4.60	10.08	6.16	2.74	8.76	7.04	2.60	1.37	4.48	2.75	0	1.6	2.50	4.93
Oxidation-Reduction Potential	mV	104	94	32	71	-24	-15	90	94	42	65	-77	153	-65	-123	-74	-17	117
Iron II (dissolved)	mg/L	1	3.8	6	2	9	4	2	6	5	2.6	2	3.2	10	1.5	5	2.2	5
Sulfide	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

US - upper Surficial Aquifer
LS - lower Surficial Aquifer

NM - Not Measured

Appendix I
HRC® Grid Design Worksheets

HRC Grid Design

REGENESIS
Version 1
Technical Support (949) 366-8000

Site Name: Site 47,Stripper Barn,Core Area
Location: Cherry Point, North Carolina
Consultant: CH2M HILL

Microbial Demand Factor 3 Recommend 3-4x
Additional Demand Factor 3 Recommend 2-3x

Basic Site Characteristics

Width of plume (intersecting flow)	25	ft
Length of plume	25	ft
Depth to contaminated zone	10	ft
Thickness of contaminated saturated zone	25	ft
Nominal aquifer soil (gravel, sand, silty sand, silt, clay)	silty sand	
Porosity	0.25	
Hydraulic conductivity, Kh	10	ft/day
Hydraulic gradient	0.0013	ft/ft
Seepage velocity (0.052 ft/day =)	19.0	ft/yr
Treatment Zone Pore Volume (cu. ft.)	3,906	ft^3

Injection Point Spacing

	Rec.	Min.	Max.
Nominal injection spacing (ft)	10.0	5	15
# points in row(w/desired spacing)	3	5	2
Actual spacing between columns (ft)	8.3	5.0	12.5
# rows (w/desired spacing)	3	5	2
Actual spacing between rows (ft)	8.3	5.0	12.5
Advective travel time bet. rows (days)	160	96	240
Number of points in grid	9	25	4

HRC Injection Amount

Minimum req. HRC per foot (lbs/ft)	13.7	4.9	30.9
Feasibility of above HRC per foot:	(high)	(ok)	(high)

Dissolved Phase Groundwater VOC Concentrations: Cgw in mg/L

PCE		0.00
TCE		8.50
DCE		2.50
VC		10.00
Carbon tetrachloride		0.00
Chloroform		0.00
TCA	DNAPL??-consider inc. add. dem. factor	49.00
DCA		2.50

Sorbed Phase VOC Mass:

Soil bulk density	2	kg/L
Fraction of organic carbon: foc	0.001	

(Values are estimated using Soil Conc=foc*Koc*Cgw)
(Adjust Koc as nec. to provide realistic estimates)

	Koc (L/kg)	Soil Conc. (mg/kg)
PCE	263	0.00
TCE	107	1.82
DCE	80	0.40
VC	2.5	0.05
Carbon tetrachloride	110	0.00
Chloroform	34	0.00
TCA	183	17.93
DCA	40	0.20

Competing Electron Acceptor (CEA) Concentrations:

	(mg/L)
Oxygen	2.70
Nitrate	6.00
Manganese reduction potential	1.00
Iron reduction (potential amount of Fe2+ that can be formed)	5.00
Sulfate reduction	50.00

Call Regenesis to discuss potential methods for HRC injection

Proposed HRC Grid Specifications			
Proposed number of HRC delivery points (adjust as nec. for site)			8
Proposed HRC applic. rate lbs/foot (adjust as nec. for site)			13.7
Corresponding amount of HRC per point (lbs)			343
Buckets per injection point			11.4
Total Buckets			92
Total Amt of HRC (lbs)			2,744
Unit cost of HRC		$	6.00
Total Material Cost		**$**	**16,464**
Shipping and/or Tax Estimate			
HRC ($0.1 to $0.4/lb, call for exact rate)	cost per lb: 0.2	$	549
Sales tax (call for exact rate)	rate: 0%	$	-
Total Regenesis Material Cost		**$**	**17,013**

HRC Grid Design

REGENESIS
Version 1
Technical Support (949) 366-8000

Site Name: Site 47, Stripper Barn, Non-core Area
Location: Cherry Point, North Carolina
Consultant: CH2M HILL

Basic Site Characteristics

Width of plume (intersecting flow)	65	ft
Length of plume	130	ft
Depth to contaminated zone	10	ft
Thickness of contaminated saturated zone	25	ft
Nominal aquifer soil (gravel, sand, silty sand, silt, clay)	silty sand	
Porosity	0.25	
Hydraulic conductivity, Kh	10	ft/day
Hydraulic gradient	0.0013	ft/ft
Seepage velocity (0.052 ft/day =)	19.0	ft/yr
Treatment Zone Pore Volume (cu. ft.)	52,813	ft^3

Dissolved Phase Groundwater VOC Concentrations: Cgw in mg/L

PCE	0.00
TCE	1.85
DCE	0.18
VC	0.00
Carbon tetrachloride	0.00
Chloroform	0.00
TCA	4.00
DCA	0.00

Sorbed Phase VOC Mass:

Soil bulk density	2	kg/L
Fraction of organic carbon: foc	0.001	

(Values are estimated using Soil Conc=foc*Koc*Cgw)
(Adjust Koc as nec. to provide realistic estimates)

	Koc (L/kg)	Soil Conc. (mg/kg)
PCE	263	0.00
TCE	107	0.40
DCE	80	0.03
VC	2.5	0.00
Carbon tetrachloride	110	0.00
Chloroform	34	0.00
TCA	183	1.46
DCA	40	0.00

Competing Electron Acceptor (CEA) Concentrations:

	(mg/L)
Oxygen	2.80
Nitrate	6.00
Manganese reduction potential	1.00
Iron reduction (potential amount of Fe2+ that can be formed)	5.00
Sulfate reduction	50.00

Microbial Demand Factor	2	Recommend 3-4x
Additional Demand Factor	2	Recommend 2-3x

Injection Point Spacing	**Rec.**	Min.	Max.
Nominal injection spacing (ft)	17.5	5	15
# points in row(w/desired spacing)	4	13	4
Actual spacing between columns (ft)	16.3	5.0	16.3
# rows (w/desired spacing)	7	26	9
Actual spacing between rows (ft)	18.6	5.0	14.4
Advective travel time bet. rows (days)	357	96	278
Number of points in grid	28	338	36

HRC Injection Amount

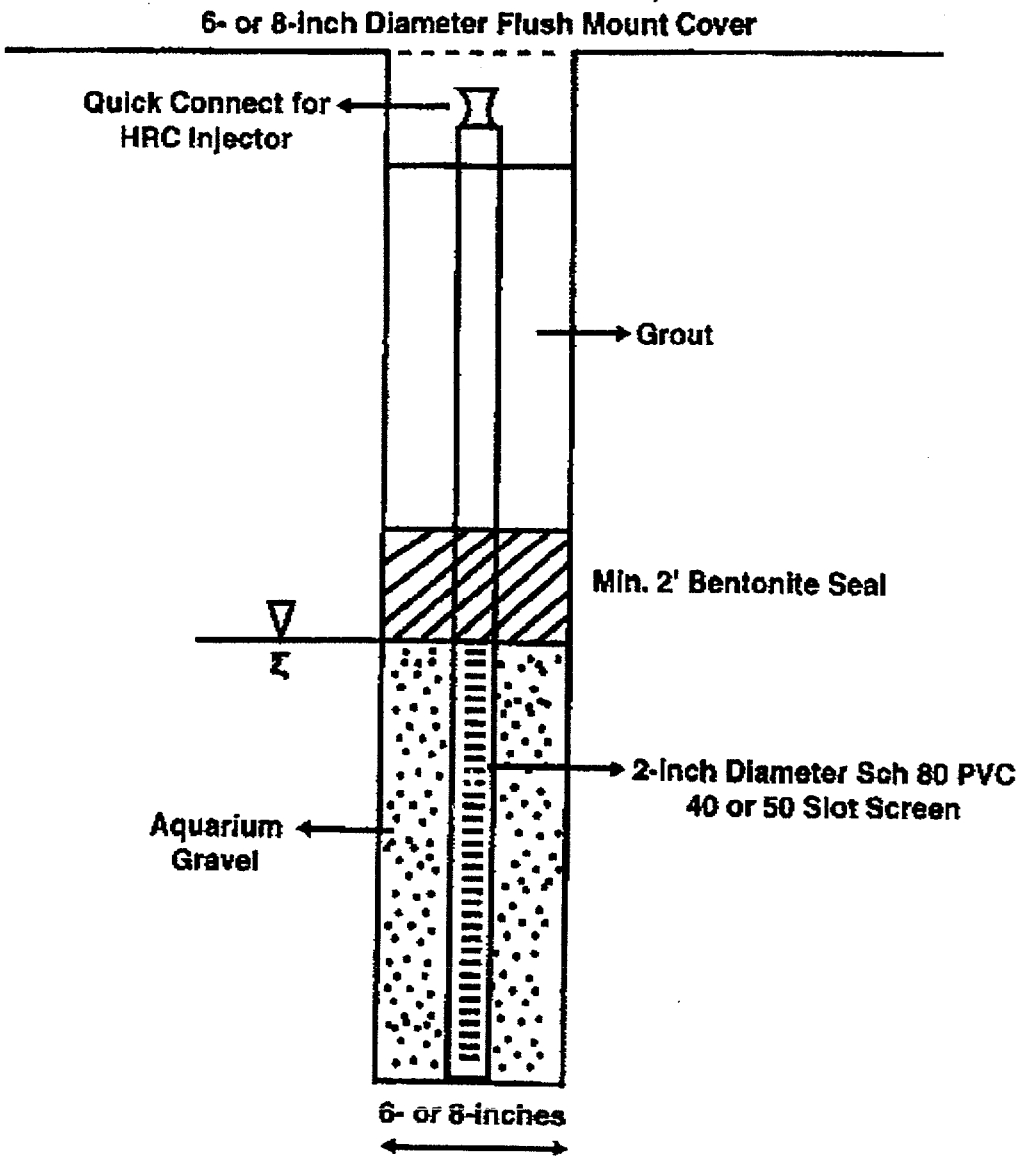
Minimum req. HRC per foot (lbs/ft)	6.8	2.0	5.3
Feasibility of above HRC per foot:	(ok)	(ok)	(ok)

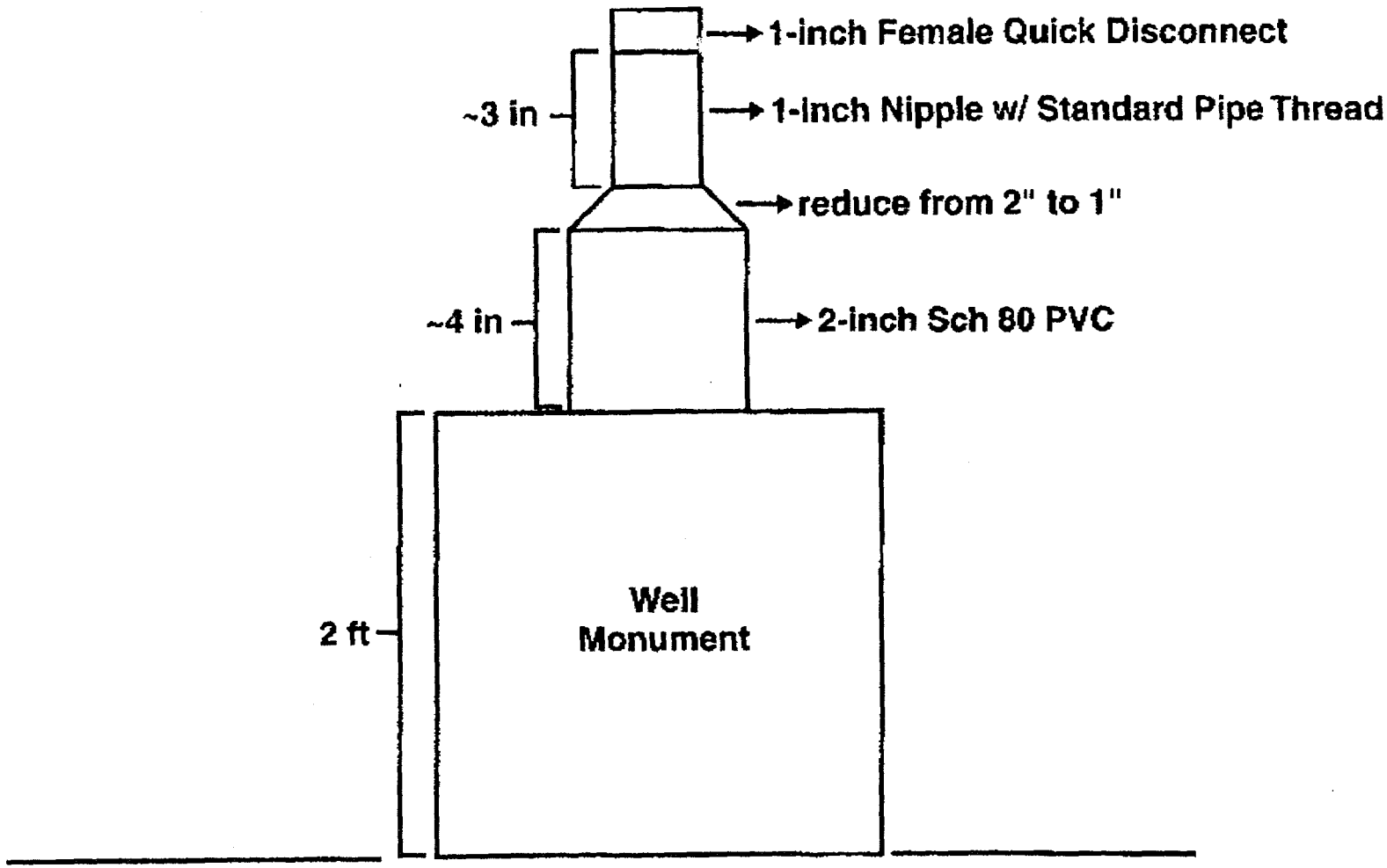
Proposed HRC Grid Specifications			
Proposed number of HRC delivery points (adjust as nec. for site)			27
Proposed HRC applic. rate lbs/foot (adjust as nec. for site)			6.8
Corresponding amount of HRC per point (lbs)			169
Buckets per injection point			5.6
Total Buckets			153
Total Amt of HRC (lbs)			4,568
Unit cost of HRC		$	6.00
Total Material Cost		**$**	**27,407**
Shipping and/or Tax Estimate			
HRC ($0.1 to $0.4/lb, call for exact rate)	cost per lb: 0.2	$	914
Sales tax (call for exact rate)	rate: 0%	$	-
Total Regenesis Material Cost		**$**	**28,320**

WC 0334 ZIP

Appendix J
HRC® Injection Well Design

OVERBURDEN WELL FOR RE-APPLICATION OF HRC




1-inch Female Quick Disconnect
~3 in
1-inch Nipple w/ Standard Pipe Thread
reduce from 2" to 1"
~4 in
2-inch Sch 80 PVC
2 ft
Well
Monument

*NOT TO SCALE