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SEMIANNUAL MONITORING REPORT
OPERABLE UNIT NO. 7 – SITES 1 AND 28

FIRST HALF 1997 (JAN – JUN 97)

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0367

JUNE 20, 1997

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PREFACE

The semiannual monitoring reports that are presented herein describe the procedures, analytical findings, and subsequent recommendations of the monitoring program at Operable Unit (OU) No. 7, Marine Corps Base (MCB) Camp Lejeune, North Carolina. Figure P-1 depicts the location of OU No 7. The monitoring reports have been prepared by Baker Environmental, Inc. and submitted to the Naval Facilities Engineering Command, Atlantic Division; MCB Camp Lejeune, Environmental Management Department; the United States Environmental Protection Agency - Region IV; and the North Carolina Department of Environment, Health and Natural Resources.

Monitoring program activities at OU No. 7 (Sites 1, 28, and 30) were implemented in response to the Record of Decision (ROD) document signed by MCB Camp Lejeune on March 6, 1996. The ROD for OU No. 7 stipulates that environmental samples from Sites 1 and 28 be collected semiannually and submitted for specified laboratory analyses. The ROD also indicates that documentation in support of the selected remedy, institutional controls with monitoring, be maintained for periodic regulatory review. No further remedial actions will be implemented at the third site included in OU No. 7, Site 30.

The principal objective of the monitoring program at OU No. 7 is to monitor the potential for human or ecological exposure due to off-site migration of contaminants. The semiannual monitoring reports document the findings and provide interested parties with information required to authorize future decisions regarding OU No. 7. Information presented in the monitoring reports will be used to either extend, modify, or discontinue the monitoring program as necessary.

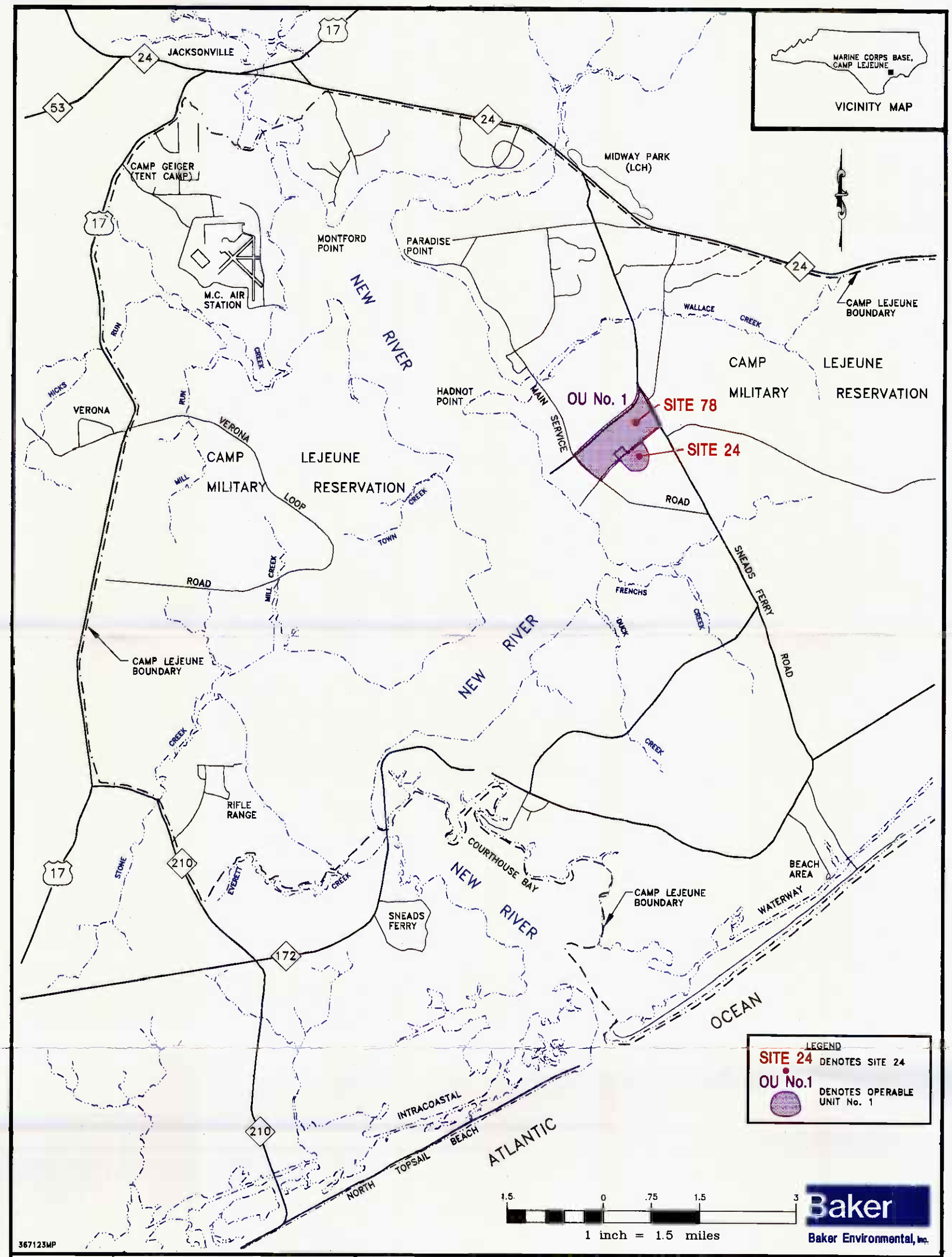

FIGURE P-1
LOCATION MAP
OPERABLE UNIT No. 1 – SITES 24 AND 78
MONITORING AND O&M SUPPORT, CTO – 0367

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

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LIST OF ACRONYMS

CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
DQOs	Data Quality Objective
gpm	gallons per minute
MCB	Marine Corps Base
MCL	Federal Maximum Contaminant Levels
NCWQS	North Carolina Water Quality Standards
NFESC	Naval Facilities Engineering Service Center
NTU	Nephelometric Turbidity Units
OU	Operable Unit
QA/QC	Quality Control and Quality Control
ROD	Record of Decision
SOP	Standard Operating Procedures
TAL	target analyte list
TCL	target compound list
TOC	top-of-casing
USGS	U.S. Geological Survey
USEPA	United States Environmental Protection Agency
VOC	volatile organic compounds
mg/kg	milligrams per kilogram
µg/L	micrograms per liter

1.0 INTRODUCTION

The following semiannual monitoring report presents the sampling procedures and analytical results of monitoring program activities conducted at Operable Unit (OU) No. 7 (Sites 1 and 28), Marine Corps Base (MCB) Camp Lejeune, North Carolina. The report describes sampling activities completed at Sites 1 and 28 during the first quarter of 1997 and provides the findings of that effort. In addition, recommendations concerning the monitoring program are also presented within this report.

1.1 Report Organization

This semiannual monitoring report is comprised of four text sections. Section 1.0 describes the sampling program procedures and methodology. Section 1.0 also provides groundwater elevation data, groundwater flow direction, and field observations. Analytical results and findings are presented in Section 2.0. A brief comparison of previous analytical findings versus the most recent findings is also included within Section 2.0. Section 3.0 presents recommendations of the semiannual monitoring program at Sites 1 and 28. Finally, the references used during preparation of this report are included in Section 4.0. All tables, figures, and attachments are provided after the text portion of this report.

1.2 Semiannual Sampling Program

The semiannual sampling program at OU No. 7 commenced on February 6, 1997 and concluded February 24, 1997. The sampling program at Site 1 consisted of groundwater sample collection and analysis from seven shallow monitoring wells and one deep monitoring well. Although stipulated in the Record of Decision (Baker, 1995), a groundwater sample was not obtained from shallow monitoring well 01-GW18 at Site 1. Monitoring well 01-GW18 was destroyed, presumably by a tracked vehicle, and therefore a sample could not be obtained. Figure 1-1 depicts groundwater sampling locations at Site 1. Groundwater samples from Site 28 were collected from five shallow monitoring wells and two deep monitoring wells. In addition to groundwater samples, one surface water and one sediment sample were collected from three distinct sample locations in the New River adjacent to Site 28. Figure 1-2 depicts the sampling locations at Site 28.

During the semiannual sampling event, a low flow groundwater purge and sampling technique was employed. The sampling methodology was developed in response to standard operating procedures (SOPs) issued by the U.S. Environmental Protection Agency (USEPA - Region IV, 1996). Prior to groundwater purging, water level and well depth measurements from each monitoring well were obtained. Water level and well depth measurements were used to calculate the volume of water necessary to purge each well. Tables 1-1 and 1-2 provide summaries of monitoring well construction details for wells included in the monitoring program.

A peristaltic pump, with intake set two to four feet from the bottom, was used to purge each monitoring well. While purging groundwater, a flow rate of less than 0.25 gallons per minute was maintained. Dedicated sections of polyethylene and silicon pump-head tubing were used during purge and sampling activities at each monitoring well. Groundwater samples were obtained directly from the pump discharge. A minimum of three well volumes were purged from each monitoring well prior to sampling. Measurements of pH, specific conductance, dissolved oxygen, temperature, and turbidity were recorded after each well volume was removed to ensure that groundwater characteristics had stabilized before sampling. These measurements were recorded in a field

logbook. A summary of the groundwater field parameters at Sites 1 and 28 are provided in Tables 1-3 and 1-4, respectively.

Groundwater samples were collected to assess whether contamination detected during previous investigative activities was present in the shallow aquifer or had migrated to the deeper, Castle Hayne, aquifer. Based upon previous monitoring results and decision documents, volatile organic compounds (VOCs) were identified as contaminants of concern at Site 1 and metals were identified at Site 28. As a result, groundwater samples collected at Site 1 were analyzed for target compound list (TCL) volatiles. Groundwater, surface water, and sediment samples collected at Site 28 were analyzed for target analyte list (TAL) metals. Aqueous samples were preserved at the time of collection with hydrochloric acid for volatile analyses and nitric acid for metal analyses. Tables 1-5 and 1-6 provide a summary of requested analyses and samples submitted during the semiannual monitoring program at Sites 1 and 28, respectively. As provided in Tables 1-5 and 1-6, environmental samples were analyzed using Contract Laboratory Program (CLP) methods and Level III Data Quality Objectives (DQOs). DQO Level IV is equivalent to the Naval Facilities Engineering Service Center (NFESC) Level D, as specified in the "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Programs" document. Table 1-7 provides the various Contract Required Quantitation Limits (CRQLs) for organic compounds, Contract Required Detection Limits (CRDLs) for inorganics, and comparative water quality standards.

In addition to groundwater samples, one surface water and one sediment sample were collected from three locations in the New River adjacent to Site 28. The surface water and sediment samples were collected to assess whether metals had migrated from an adjacent pistol firing range into the New River. Samples were obtained from the New River at regularly spaced intervals approximately 100 feet off the shore. The three surface water and sediment sampling locations are depicted in Figure 1-2. At each sampling station, surface water samples were collected by dipping laboratory prepared containers directly into the water. Sediment samples were collected below the water surface, from the river bed. A sediment corer, equipped with a disposable acetate sleeve, was manually pushed approximately six inches into the river bed. The sediment was then extruded from the disposable sampling tube and placed in appropriate laboratory containers. Each surface water and sediment sample was analyzed for TAL metals, as provided in Table 1-6.

Trip blanks were prepared by the laboratory prior to the sampling event, placed in sample storage containers, and kept with the investigative samples throughout the sampling event. The trip blanks were then packaged for shipment with the environmental samples and sent for analysis. Trip blanks were used to determine if environmental samples, obtained from Site 1, were cross-contaminated with volatile compounds during storage and transportation to the laboratory.

Sample information, including well number, sample identification, time and date of sample collection, samplers, analytical parameters, and required laboratory turnaround time, was recorded in a field logbook and on sample labels. Chain-of-custody documentation, provided in Attachment A, accompanied the samples to the laboratory. Chain-of-custody forms were then compared to the monitoring plan; this comparison was used to verify that appropriate laboratory analyses had been requested. Upon receipt of the laboratory analytical results, a further comparison was performed to verify that each sample was analyzed for the requested analyses. Sample tracking documentation is provided in Attachment B. The sample designation format used during the monitoring program at Sites 1 and 28 is provided in Attachment C.

1.3 Groundwater Elevation and Flow Direction

The following provides information concerning groundwater flow patterns at Sites 1 and 28. Static water level measurements were collected after all well sampling activities had been completed. Measurements were recorded from top-of-casing (TOC) reference points marked on each monitoring well. Groundwater measurements were recorded to the nearest 0.01-foot using an electric measuring tape. The elevation data were obtained by subtracting the measured depth to groundwater from the reference elevation. The groundwater elevation data are based upon water levels obtained during the sampling program. For ease of discussion, groundwater elevation and flow direction for the two sites are presented separately.

1.3.1 Site 1

Water level measurements were collected at Site 1 on February 24, 1997. Table 1-8 provides a summary of the measurements and Figure 1-3 depicts the static elevations and approximate flow direction of groundwater at Site 1. The groundwater flow regime throughout the northern portion of Site 1 is relatively consistent. As depicted in Figure 1-3, groundwater flow is generally west toward an unnamed tributary of Codgels Creek. The unnamed tributary discharges into Codgels Creek at Site 28, approximately 1,500 feet southwest of Site 1.

1.3.2 Site 28

Water level measurements at Site 28 were collected on February 7, 1997. Table 1-9 provides a summary of the measurements and Figure 1-4 depicts the static elevations and approximate flow direction of groundwater at Site 28. Groundwater flow within the surficial aquifer at Site 28 is influenced by the New River and Codgels Creek. As depicted in Figure 1-4, groundwater flow within the central and eastern portions of the site is toward Cogdels Creek.

1.4 Field Observations

The following field observation was noted during the semiannual monitoring activities at Sites 1 and 28. Recommendations regarding the field observations which follow are presented in Section 3.0.

Monitoring wells installed at Sites 1 and 28 during the 1984 Confirmation Study have begun to exhibit signs of deterioration. Turbidity readings, obtained during sampling activities, suggest that soil material from the surrounding formation has begun to infiltrate the well screens and sand packs of older monitoring wells. Less than ideal sampling conditions may result when consistent readings of greater than 50 nephlometric turbidity units (NTUs) in groundwater are obtained. In general, it is preferable that groundwater samples be collected after turbidity readings stabilize at less than 10 NTUs. Elevated turbidity readings are particularly evident among groundwater samples submitted for metal analyses; naturally-occurring metals that adhere to soil particles are reflected in the groundwater results. Metal analyses, however, were not requested for groundwater samples obtained from Site 1. Future sampling results will be used to determine if corrective measures will be required to obtain samples with lower levels of turbidity.

2.0 ANALYTICAL RESULTS AND FINDINGS

The section which follows presents analytical results and findings from sampling performed at Sites 1 and 28 during the first quarter of 1997. Groundwater samples from Site 1 were obtained from seven shallow monitoring wells and one deep monitoring well. The sampling program at Site 28 entailed the collection of groundwater samples from five shallow and two deep monitoring wells. In addition, one surface water sample and one sediment sample were obtained from three locations in the New River adjacent to Site 28.

As part of a continuing quality assurance and quality control (QA/QC) process, one trip blank was prepared for volatile organic analyses. The trip blank was prepared prior to the sampling event and kept with the environmental samples from Site 1 during field collection, shipment, and laboratory analysis. As provided in Table 2-1, there were no detections of any organic compounds in trip blank sample 01-TB01-97A.

2.1 Site 1

The following presents analytical results and findings from the monitoring program conducted at Site 1 during the first quarter of 1997. Each groundwater sample collected at Site 1 was analyzed for TCL volatiles. A summary of groundwater analytical results is provided in Table 2-2. A positive detection summary of VOCs in groundwater at Site 1 is provided in Table 2-3.

Two VOCs were detected among the eight groundwater samples collected at Site 1. The VOC 1,2-dichloroethene (total) was detected at a concentration of 16 micrograms per liter (µg/L) in the sample obtained from shallow monitoring well 01-GW10. Trichloroethene was detected in groundwater samples obtained from shallow monitoring wells 01-GW10 and 01-GW17; both detections at an estimated concentration of 3 µg/L. The 1,2-dichloroethene (total) detection did not exceed the applicable North Carolina Water Quality Standard (NCWQS) or federal maximum contaminant level (MCL) for drinking water. The two trichloroethene detections did, however, slightly exceed the NCWQS of 2.8 µg/L. Figure 2-1 depicts the locations and concentrations of the 1,2-dichloroethene (total) and trichloroethene detections.

The two positive detections of VOCs were limited to shallow groundwater samples. As depicted in Figure 2-1, the two wells with positive VOC detections are located approximately 750 feet from one another. The lack of positive VOC detections in other wells, suggests that VOC contamination in groundwater may be limited to the observed locations. In addition, the lack of positive VOC detections in the sample obtained from deep monitoring well 01-GW17DW suggests that volatile contaminants have not migrated from the surficial aquifer to the deeper Castle Hayne Aquifer.

Positive detections of VOCs at Site 1 have been documented in the past. Table 2-4 provides a summary of VOC results from groundwater samples obtained during the past three years at Site 1. Previous sampling results have indicated VOCs in samples obtained from monitoring wells 01-GW10, 01-GW11, 01-GW12, and 01-GW17. Overall, the latest sampling results show a decrease in both the number and concentrations of the VOCs. Due to the nature of the contaminants, the decrease may be a result of natural degradation of the organic compounds, natural fluctuations in groundwater levels, or migration of the contaminants. Future sampling will be employed to determine the nature and persistence of the observed contaminants at Site 1.

2.2 Site 28

The following subsections present analytical results and findings from the monitoring program conducted during the first quarter of 1997 at Site 28. Groundwater quality was evaluated at Site 28 by sampling five shallow monitoring wells and two deep monitoring wells. In addition to groundwater samples, three surface water and three sediment samples were collected from the New River which borders Site 28. Each of the samples collected at Site 28 were analyzed for TAL metals. Analytical results from the groundwater, surface water, and sediment sampling are presented separately.

2.2.1 Groundwater Analytical Results

Metals were detected in each of the groundwater samples obtained at Site 28. Table 2-5 provides a summary of the groundwater analytical results. A positive detection summary of metals in groundwater samples obtained at Site 28 is presented in Table 2-6. Figure 2-2 depicts the locations and groundwater sampling results of total metals that were detected at concentrations in excess of either NCWQS or MCL.

Aluminum, antimony, iron, and manganese were the only metals detected among the seven groundwater samples at concentrations in excess of either the NCWQS or MCL. Aluminum exceeded the secondary MCL of 50 µg/L in the sample obtained from monitoring well 28-GW07 (refer to Figure 2-2); aluminum was detected at a concentration of 153 µg/L. Antimony exceeded the MCL of 6 µg/L in samples obtained from monitoring wells 28-GW01 (25 µg/L) and 28-GW07 (23.6 µg/L). Iron exceeded the NCWQS and MCL of 300 µg/L in samples obtained from five of the seven monitoring wells. Iron was detected at concentrations ranging from 374 µg/L in the sample obtained from deep monitoring well 28-GW01DW to 26,600 µg/L in a sample obtained from shallow monitoring well 28-GW07. Concentrations of manganese ranging from 119 to 460 µg/L exceeded the NCWQS and MCL of 50 µg/L in samples obtained from monitoring wells 28-GW01, 28-GW01DW, 28-GW02, 28-GW07, and 28-GW08.

Aluminum, iron, and manganese were detected at their respective maximum concentrations in the sample obtained from shallow monitoring well 28-GW07, located within the former burn dump area. Iron and manganese were detected at maximum concentrations of 26,600 and 460 µg/L, respectively. The iron and manganese detections exceeded applicable NCWQS and MCL levels of 300 and 50 µg/L, respectively. Although the concentrations of both iron and manganese in groundwater samples often exceed established water quality standards, the levels are generally characteristic of natural site conditions. Soils found within the coastal plain of North Carolina are naturally rich in metals, particularly iron and manganese. The observed concentrations of iron and manganese in groundwater may be due more to geologic conditions (i.e., naturally occurring metals bound to unconsolidated soil particles) and sample acquisition methods than to mobile metal concentrations in the aquifer. The presence of metals in groundwater is often the result of solids or colloids in aqueous samples. The metals detected among groundwater samples obtained from Site 28 may also be indicative of buried metal material. Buried metal objects have been unearthed during previous investigations at Site 28, primarily west of Cogdels Creek (refer to Figure 1-2). Buried metal material in the presence of naturally-occurring acidic soils may provide another plausible explanation for the observed metal concentrations.

Aluminum and antimony were the only other total metals identified among groundwater samples at concentrations which exceeded applicable water quality standards. As depicted in Figure 2-2,

only one of the monitoring wells at Site 28 had a positive detection of aluminum above the 50 µg/L secondary MCL. Positive aluminum detections in groundwater samples ranged from 14.4 to 153 µg/L. Antimony was detected in only two groundwater samples; both at concentrations exceeding the 6 µg/L MCL. Antimony was detected at concentrations of 23.6 and 25.0 µg/L. The combination of acidic soil in the presence of confirmed buried metal material may have contributed to elevated aluminum and antimony concentrations. Several hundred or even several thousand milligrams per liter of aluminum is not unusual for natural waters obtained from slightly acidic environs (USGS, 1992).

The observed concentrations of total metals in the groundwater at Site 28 are believed to be the result of natural site conditions and suspended solids within samples, possibly compounded by known buried metal material. The slight acidity of natural soils, coupled with the natural occurrence of metals and the presence of buried metal material may have contributed to the observed concentrations of metals in groundwater at Site 28. Table 2-7 presents groundwater sampling results from the past two years. During the past three sampling events, iron and manganese have remained the most prevalent metals among groundwater samples obtained at Site 28. Iron and manganese concentrations have consistently exceeded NCWQS levels in samples obtained from monitoring wells 28-GW01, 28-GW01DW, 28-GW02, 28-GW07, and 28-GW08. To a much lesser extent, the metals antimony, aluminum, and cadmium have also been detected at concentrations in excess of applicable screening standards among wells included in the monitoring program.

2.2.2 Surface Water Analytical Results

Three surface water samples were collected from the New River adjacent to Site 28 and submitted for total metal analyses. Metals were detected in each of the three surface water samples obtained from the New River. Approximate locations of the surface water samples are depicted in Figure 1-2. Table 2-8 provides a summary of surface water analytical results. A positive detection summary of metals in the three surface water samples is presented in Table 2-9.

Laboratory analyses of the three surface water samples obtained from the New River indicate that 14 of 23 total metals were positively detected. As indicated in Table 2-8, cadmium was the only metal identified at concentration in excess of either state standards or federal criteria. Sampling stations 28-SW02 and 28-SW03 had positive detections of cadmium which exceeded the 5 µg/L North Carolina criteria. The two positive cadmium detections in samples obtained from the New River were 6.1 and 6.3 µg/L. No other total metal concentrations in the three surface water samples exceeded either state standards or federal criteria.

2.2.3 Sediment Analytical Results

Three sediment samples were collected in conjunction with surface water samples also obtained from the New River adjacent to Site 28. Each of the three sediment samples were submitted for metal analyses. Laboratory analyses of the three sediment samples obtained from the New River indicate that 14 of 23 metals were positively detected. As indicated in Table 2-10, copper and lead were the only metals identified among sediment samples at concentrations in excess of applicable screening values. Copper was detected at a concentration of 22.2 milligrams per kilogram (mg/kg) in the sample obtained from sample station 28-SD02. The comparison criteria for copper is 18.7 mg/kg. Concentrations of lead detected in samples 28-SD02 and 28-SD03 were 44.9 and

65 mg/kg, respectively. Both detections exceeded the lead screening value of 30.2 mg/kg. A positive detection summary of metals in the three sediment samples is presented in Table 2-11.

Positive detections of lead among sediment samples obtained from the New River near the pistol firing range have been documented in the past. Previous sampling results have implied that the presence of lead , in the form of lead shot, in samples obtained from the New River is the result of training activities at the adjacent pistol firing range. The most recent analytical results indicate that lead was detected in each of the three sediment samples at concentrations less than 65 mg/kg. The screening value for lead in sediment is 30.2 mg/kg. Although positively detected above the applicable screening value, observed concentrations of lead do not support the presumption that firing range activities have significantly contributed to the occurrence of lead in New River sediments.

3.0 RECOMMENDATIONS

Based upon the observations and findings presented in Sections 1.0 and 2.0 of this semiannual monitoring report, the following recommendations for the monitoring program at OU No. 7 are provided. If non-significant changes are made to a component of the selected remedy described in the ROD (Baker, 1995), the changes must be recorded in a post-decision document file. If significant changes are made to a component of the selected remedy, the changes will need to be presented in an Explanation of Significant Differences document.

3.1 Implemented Recommendations

Detailed information pertaining to the implemented recommendations which follow was presented within the previous monitoring report. The final disposition of each recommendation is presented here to update information regarding the monitoring program. It is also the intent of this report to provide a thorough listing of recommendations and implemented actions.

3.1.1 Well Security and Aesthetics

A number of monitoring wells at Sites 1 and 28 that were installed during the 1984 Confirmation Study had begun to show signs of deterioration. The bollards and protective casings of the wells had developed peeling paint and rust. In addition, a number of the padlocks used to secure the protective covers are either missing or no longer functioned properly. Both the usability and security of each monitoring well be maintained if the wells were going to remain reliable groundwater sample collection points in the future. As recommended, the bollards and well casings were painted with a weather and rust resistant paint. In addition, new padlocks that operate with a universal key were installed on each of the monitoring wells at Sites 1 and 28. Figures 3-1 through 3-6 depict the typical monitoring well repairs performed.

3.1.2 Abandon Monitoring Well

Field observations confirmed that shallow monitoring well 01-GW18 had been damaged beyond repair. The steel protective lid was cracked, the concrete apron was dislodged, and the well riser had been sheared off. At the time of the investigation, sand and gravel from the surrounding area had nearly filled the well screen and riser to ground surface. As a result, it was no longer possible to obtain groundwater samples from shallow monitoring well 01-GW18. Based upon this information, the well was abandoned.

3.2 Proposed Recommendations

Based upon the observations and findings presented in Sections 1.0 and 2.0 of this monitoring report, no significant changes to the monitoring program are currently recommended. The lack of metal contamination at Site 28 and the lack of significant VOC contamination at Site 1 suggests that future semiannual monitoring may not be required. The need for additional sampling, particularly at Site 28, may be more accurately and statistically determined after a third semiannual event has been completed during July 1997. If after thorough examination of the resultant analytical data and determination that future risks of exposure are negligible, it may be recommended that sampling program activities be discontinued.

4.0 REFERENCES

Baker Environmental, Inc. (Baker). December 1995. Record of Decision for Operable Unit No. 7 (Sites 1, 28 and 30). Final. Prepared for the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk, Virginia.

Baker Environmental, Inc. (Baker). June 1995. Remedial Investigation Report. Operable Unit No. 7 (Sites 1, 28, and 30). Final. Prepared for the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk, Virginia.

Environmental Science & Engineering (ES&E). 1990. Site Summary Report. Final. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk, Virginia. ESE Project No. 49-02036.

U.S. Geological Survey (USGS). 1992. Study and Interpretation of the Chemical Characteristics of Natural Water. Third Edition. Prepared by John D. Hem for the U.S. Department of the Interior.

U.S. Environmental Protection Agency, Region IV. May 1996. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual.

TABLES

TABLE 1-1

SUMMARY OF WELL CONSTRUCTION DETAILS
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Monitoring Well Number	Date Installed	Top of Casing Elevation (feet, msl)	Ground Surface Elevation (feet, msl)	Boring Depth (feet, msl)	Well Depth (feet, msl)	Screen Interval Depth (feet, bgs)	Depth to Bentonite (feet, bgs)	Depth to Sand Pack (feet, bgs)	Stick-Up (feet, ags)
01-GW01	1984	16.50	13.3	NA	24.0	NA	NA	NA	3.2
01-GW02	1984	17.95	15.7	NA	23.0	9.0 - 23.0	NA	NA	2.3
01-GW03	1984	21.78	19.7	NA	23.0	9.0 - 23.0	NA	NA	2.1
01-GW10	1994	18.07	15.3	24.0	24.0	9.1 - 23.4	5.0	7.0	2.8
01-GW11	1994	13.18	10.4	17.0	17.0	2.0 - 16.4	0.5	1.0	2.8
01-GW12	1994	16.33	13.8	17.0	17.0	3.1 - 17.3	0.5	2.0	2.5
01-GW17	1994	23.00	20.1	25.0	25.0	10.0 - 24.3	6.0	8.0	3.0
01-GW17DW	1994	21.91	19.1	122	122	105 - 120	92.0	97.0	2.8

Notes:

ags = above ground surface
msl = mean sea level
bgs = below ground surface
NA = Information not available

TABLE 1-2

SUMMARY OF WELL CONSTRUCTION DETAILS
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Monitoring Well Number	Date Installed	Top of Casing Elevation (feet, msl)	Ground Surface Elevation (feet, msl)	Boring Depth (feet, msl)	Well Depth (feet, msl)	Screen Interval Depth (feet, bgs)	Depth to Bentonite (feet, bgs)	Depth to Sand Pack (feet, bgs)	Stick-Up (feet, ags)
28-GW01	1994	7.34	4.8	17.0	17.0	2.5 - 16.2	0.0	1.5	2.5
28-GW01DW	1994	7.49	5.5	134	133	117 - 132	107	111	2.1
28-GW02	1984	5.96	4.8	NA	16.5	2.5 - 16.5	NA	NA	1.6
28-GW04	1984	8.17	4.4	NA	29.02	NA	NA	NA	3.8
28-GW07	1994	6.62	3.8	18.0	18.0	2.5 - 17.5	0.0	0.5	2.8
28-GW07DW	1994	6.03	3.6	132	131	114 - 129	104	109	2.4
28-GW08	1994	14.16	11.6	24.0	24.0	7.9 - 22.7	4.0.0	6.0	2.6

Notes:

ags = above ground surface
msl = mean sea level
bgs = below ground surface
NA = Information not available

TABLE 1-3

SUMMARY OF GROUNDWATER FIELD PARAMETERS
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Number (Sample Date)	Measuring Time	Well Volumes	Field Parameters				
			Dissolved Oxygen (mg/L)	Specific Conductance (µmhos/cm)	Temperature (°C)	pH (S.U.)	Turbidity (N.T.U.)
01-GW01 (02-23-97)	0823	0.5	3.0	438	16.5	6.99	50.9
	0830	1.0	2.3	428	17.0	7.01	35.2
	0837	1.5	2.4	428	17.0	7.00	33.6
	0845	2.0	2.0	420	17.0	7.06	29.4
	0853	2.5	2.1	397	17.0	7.07	31.8
	0901	3.0	2.0	412	17.0	7.07	25.4
01-GW02 (02-23-97)	1540	0.5	2.0	510	16.5	6.59	78.1
	1547	1.0	1.3	550	18.0	6.63	32.8
	1553	1.5	1.2	580	17.5	6.63	8.6
	1558	2.0	1.2	590	18.0	6.62	9.6
	1604	2.5	1.1	580	18.0	6.63	13.7
	1610	3.0	1.0	590	18.0	6.62	12.8
01-GW03 (02-23-97)	1445	0.5	3.9	139	19.0	5.59	74.0
	1450	1.0	4.0	133	19.0	5.64	128.8
	1455	1.5	4.0	132	19.0	5.61	78.2
	1500	2.0	4.1	133	19.0	5.61	19.6
	1505	2.5	4.1	141	18.5	5.61	9.8
	1510	3.0	4.0	131	19.0	5.61	5.5
01-GW10 (02-23-97)	1332	0.5	2.0	455	18.5	6.72	126.8
	1337	1.0	1.7	486	18.5	6.89	65.2
	1342	1.5	1.6	500	18.5	6.93	59.5
	1347	2.0	1.6	500	19.0	6.93	25.4
	1353	2.5	1.5	500	19.0	6.97	25.6
	1359	3.0	1.5	500	19.0	6.96	21.5
01-GW11 (02-23-97)	1058	0.5	3.1	190	16.0	6.74	79.5
	1104	1.0	2.8	248	16.0	6.83	56.5
	1110	1.5	2.5	274	16.0	6.86	45.8
	1116	2.0	2.2	289	16.0	6.89	27.3
	1121	2.5	2.3	299	16.0	6.92	18.4
	1126	3.0	2.4	310	16.0	6.92	14.2
01-GW12 (02-23-97)	0955	0.5	2.0	143	15.0	5.56	45.5
	0959	1.0	2.1	169	15.0	5.80	28.7
	1003	1.5	2.5	165	15.0	5.83	17.2
	1008	2.0	2.3	165	15.0	5.88	12.3
	1012	2.5	2.2	171	15.0	5.89	7.4
	1016	3.0	2.2	169	15.0	5.93	5.2

TABLE 1-3 (Continued)

SUMMARY OF GROUNDWATER FIELD PARAMETERS
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Number (Sample Date)	Measuring Time	Well Volumes	Field Parameters				
			Dissolved Oxygen (mg/L)	Specific Conductance (µmhos/cm)	Temperature (°C)	pH (S.U.)	Turbidity (N.T.U.)
01-GW17 (02-24-97)	0810	0.5	2.9	500	15.5	6.65	7.1
	0816	1.0	2.8	500	18.0	6.81	2.8
	0822	1.5	2.6	500	19.0	6.82	2.0
	0828	2.0	2.6	500	18.0	6.85	1.8
	0834	2.5	2.7	500	18.0	6.85	1.3
	0840	3.0	2.5	500	19.5	6.88	1.0
01-GW17DW (01-24-97)	0832	0.5	1.9	203	19.0	7.82	0.8
	0914	1.0	1.5	203	19.0	7.97	0.4
	0956	1.5	2.0	198	19.5	7.98	0.3
	1038	2.0	2.0	201	20.0	8.10	0.5
	1120	2.5	1.9	198	18.0	8.12	0.4
	1202	3.0	1.9	199	19.5	8.08	0.3

Notes:

N.T.U. = Nephelometric Turbidity Units
S.U. = Standard Units
µmhos/cm = micro ohms per centimeter
°C = Degrees Centigrade
mg/L = Milligrams per liter

TABLE 1-4

SUMMARY OF GROUNDWATER FIELD PARAMETERS
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Number (Sample Date)	Measuring Time	Well Volumes	Field Parameters				
			Dissolved Oxygen (mg/L)	Specific Conductance (µmhos/cm)	Temperature (°C)	pH (S.U.)	Turbidity (N.T.U.)
28-GW01 (02-06-97)	1438	0.5	2.0	1200	16.0	7.74	74.6
	1443	1.0	2.2	1090	15.0	7.93	26.5
	1448	1.5	2.2	1105	15.0	8.00	10.5
	1453	2.0	2.1	1100	15.0	8.02	4.4
	1458	2.5	2.3	1090	14.5	8.03	2.4
	1503	3.0	2.3	1100	14.5	8.09	1.9
28-GW01DW (02-06-97)	1500	0.5	2.6	4050	17.0	8.34	2.3
	1530	1.0	2.5	4350	20.5	8.40	2.5
	1550	1.5	2.5	4300	19.0	8.15	2.0
	1605	2.0	2.5	4250	19.0	8.15	2.5
	1625	2.5	1.8	4200	18.5	8.08	1.2
	1640	3.0	1.75	4200	18.0	8.12	1.1
28-GW02 (02-06-97)	1130	0.5	1.9	710	16.0	7.73	22.0
	1135	1.0	1.8	730	17.0	7.75	18.3
	1140	1.5	2.0	790	17.5	7.80	13.2
	1145	2.0	1.9	790	17.0	7.84	11.9
	1150	2.5	1.7	780	16.5	7.91	8.2
	1155	3.0	1.9	790	17.0	7.90	6.0
28-GW04 (02-06-97)	1310	0.5	2.1	500	17.0	6.35	2.8
	1317	1.0	2.0	500	17.0	6.57	1.7
	1324	1.5	2.2	500	16.5	6.76	1.5
	1331	2.0	2.2	500	17.5	6.81	1.3
	1338	2.5	1.8	500	17.0	6.92	1.0
	1345	3.0	2.0	500	17.0	6.97	1.0
28-GW07 (02-06-97)	0825	0.5	3.0	550	11.0	6.63	15.8
	0830	1.0	2.6	500	11.5	6.63	9.3
	0840	1.5	2.0	580	11.0	6.68	11.0
	0848	2.0	1.8	599	11.0	6.71	4.6
	0856	2.5	2.0	620	11.0	6.76	4.2
	0901	3.0	1.8	620	11.0	6.77	3.5
	0909	3.5	2.0	620	11.0	6.78	6.1

TABLE 1-4 (Continued)

SUMMARY OF GROUNDWATER FIELD PARAMETERS
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Number (Sample Date)	Measuring Time	Well Volumes	Field Parameters				
			Dissolved Oxygen (mg/L)	Specific Conductance (µmhos/cm)	Temperature (°C)	pH (S.U.)	Turbidity (N.T.U.)
28-GW07DW (02-06-97)	0845	0.5	3.4	107	15.0	8.69	2.5
	0923	1.0	3.8	140	15.5	9.55	2.8
	1000	1.5	3.5	160	15.0	9.29	1.3
	1040	2.0	3.6	170	16.0	9.22	1.2
	1120	2.5	3.5	175	16.0	9.11	0.9
	1210	3.0	3.0	182	18.0	9.29	1.0
28-GW08 (02-06-97)	1020	0.5	2.4	1220	17.5	7.63	27.0
	1025	1.0	1.8	1250	18.5	8.06	17.5
	1030	1.5	1.9	1190	17.5	8.15	10.0
	1035	2.0	1.9	1095	18.5	8.26	5.4
	1040	2.5	1.5	1030	18.5	8.25	4.2
	1045	3.0	1.5	1090	18.5	8.31	2.1

Notes:

N.T.U. = Nephelometric Turbidity Units
S.U. = Standard Units
µmhos/cm = micro ohms per centimeter
°C = Degrees Centigrade
mg/L = milligrams per liter

TABLE 1-5

SAMPLING SUMMARY - FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Location	Media	TCL Volatiles[1]	Laboratory Sample Identification
01-GW01	Groundwater	X	01-GW01-97A
01-GW02	Groundwater	X	01-GW02-97A
01-GW03	Groundwater	X	01-GW03-97A
01-GW10	Groundwater	X	01-GW10-97A
01-GW11	Groundwater	X	01-GW11-97A
01-GW12	Groundwater	X	01-GW12-97A
01-GW17	Groundwater	X	01-GW17-97A
01-GW17DW	Groundwater	X	01-GW17DW-97A
01-GW18[2]	Groundwater	--	--

Notes:

(1) Target Compound List Volatiles by U.S. Environmental Protection Agency, Contract Laboratory Program, Statement of Work, Document Number OLM01.8.
(2) Monitoring well abandoned. No samples collected.

X = Requested analysis

TABLE 1-6

SAMPLING SUMMARY - FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Location	Media	TAL Metals[1]	Laboratory Sample Identification
28-GW01	Groundwater	X	28-GW01-97A
28-GW01DW	Groundwater	X	28-GW01DW-97A
28-GW02	Groundwater	X	28-GW02-97A
28-GW04	Groundwater	X	28-GW04-97A
28-GW07	Groundwater	X	28-GW07-97A
28-GW07DW	Groundwater	X	28-GW07DW-97A
28-GW08	Groundwater	X	28-GW08-97A
28-SW01	Surface Water	X	28-SW01-97A
28-SW02	Surface Water	X	28-SW02-97A
28-SW03	Surface Water	X	28-SW03-97A
28-SD01	Sediment	X	28-SD01-97A
28-SD02	Sediment	X	28-SD02-97A
28-SD03	Sediment	X	28-SD03-97A

Notes:

(1) Target Analyte List Metals by U.S. Environmental Protection Agency, Contract Laboratory Protocol, Statement of Work, Document Number ILM03.0.

X = Requested analysis

TABLE 1-7

CONTRACT REQUIRED DETECTION LIMITS - FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITES 1 AND 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Parameter	Analytical Method	CRQL (µg/L)	NCWQS (µg/L)	MCL (µg/L)
Volatile Organics:				
Chloromethane	OLM01.8	10	NA	NA
Vinyl Chloride	OLM01.8	10(1)	0.015	2
Bromomethane	OLM01.8	10	NA	NA
Chloroethane	OLM01.8	10	NA	NA
1,1-dichloroethene	OLM01.8	10	7	7
Acetone	OLM01.8	10	700	NA
Carbon Disulfide	OLM01.8	10	700	NA
Methylene Chloride	OLM01.8	10(1)	5	5
1,2-dichloroethene (Total)	OLM01.8	10	70	70
1,1-dichloroethane	OLM01.8	10	700	NA
2-butanone	OLM01.8	10	NA	NA
Chloroform	OLM01.8	10(1)	0.19	100
1,1,1-trichloroethane	OLM01.8	10	200	200
Carbon Tetrachloride	OLM01.8	10(1)	0.3	5
Benzene	OLM01.8	10(1)	1	5
1,2-dichloroethane	OLM01.8	10(1)	0.38	5
Trichloroethene	OLM01.8	10(1)	NA	5
1,2-dichloropropane	OLM01.8	10(1)	0.56	5
Bromodichloromethane	OLM01.8	10(1)	0.6	100
Cis-1,3-dichloropropene	OLM01.8	10	NA	NA
4-methyl-2-pentanone	OLM01.8	10	NA	NA
Toluene	OLM01.8	10	1000	1000
Trans-1,3-dichloropropene	OLM01.8	10(1)	0.2	NA
1,1,2-trichloroethane	OLM01.8	10(1)	NA	5
Tetrachloroethene	OLM01.8	10(1)	0.7	5
2-hexanone	OLM01.8	10	NA	NA
Dibromochloromethane	OLM01.8	10	NA	NA
Chlorobenzene	OLM01.8	10	50	100
Ethylbenzene	OLM01.8	10	29	700
Xylene, Total	OLM01.8	10	530	10000
Styrene	OLM01.8	10	100	100
Bromoform	OLM01.8	10(1)	0.19	100
1,1,2,2-tetrachloroethane	OLM01.8	10	NA	NA

TABLE 1-7 (Continued)

CONTRACT REQUIRED DETECTION LIMITS - FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITES 1 AND 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Parameter	Analytical Method	CRQL (µg/L)	NCWQS (µg/L)	MCL (µg/L)
Metals:				
Aluminum	ILM03.0	100	NA	NA
Antimony	ILM03.0	60[1]	6	NA
Arsenic	ILM03.0	10	50	50
Barium	ILM03.0	200	2000	2000
Beryllium	ILM03.0	5[1]	4	NA
Cadmium	ILM03.0	5	5	5
Calcium	ILM03.0	5000	NA	NA
Chromium	ILM03.0	10	100	50
Cobalt	ILM03.0	50	NA	NA
Copper	ILM03.0	25	1300	1000
Iron	ILM03.0	100	NA	300
Lead	ILM03.0	3	15	15
Magnesium	ILM03.0	5000	NA	NA
Manganese	ILM03.0	15	NA	50
Mercury	ILM03.0	0.2	2	1.1
Nickel	ILM03.0	40	100	100
Potassium	ILM03.0	5000	NA	NA
Selenium	ILM03.0	5	50	50
Silver	ILM03.0	10	NA	18
Sodium	ILM03.0	5000	NA	NA
Thallium	ILM03.0	10[1]	2	NA
Vanadium	ILM03.0	50	NA	NA
Zinc	ILM03.0	20	NA	2100

Notes:

[1] Contract Required Detection Limit greater than North Carolina Water Quality Standard or Federal Maximum Contaminant Level

CRDL = Contract Required Detection Limit
CRQL = Contract Required Quantitation Limit
MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to any user of a public water system. (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories.)
NA = standard not available
NCWQS = North Carolina Water Quality Standards. Values Applicable to Groundwater (North Carolina Administrative Code, Title 15A, Subchapter 2L).
µg/L = micrograms per liter or parts per billion

TABLE 1-8

SUMMARY OF WATER LEVEL MEASUREMENTS
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well ID	Reference Elevation [1]	SWL (Date 07-30-96)	SWE (Date 07-30-96)	SWL (Date 02-24-97)	SWE (Date 02-24-97)
01-GW01	16.50	7.46	9.04	7.60	8.90
01-GW02	17.95	9.52	8.43	9.60	8.35
01-GW03	21.78	13.41	8.37	13.27	8.51
01-GW10	18.07	11.06	7.01	11.37	6.70
01-GW11	13.18	4.90	8.28	5.25	7.93
01-GW12	16.33	6.68	9.65	6.90	9.43
01-GW17	23.00	14.25	8.75	14.29	8.71
01-GW17DW	21.91	13.24	8.67	13.19	8.72

Notes:

[1] Top of well casing expressed in feet above mean sea level

SWL = Static water level taken from top of well casing
SWE = Static water elevation expressed in feet above mean sea level

TABLE 1-9

SUMMARY WATER LEVEL MEASUREMENTS
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well ID	Reference Elevation [1]	SWL (Date 07-30-96)	SWE (Date 07-30-96)	SWL (Date 02-07-97)	SWE (Date 02-07-97)
28-GW01	7.34	4.98	2.36	5.16	2.18
28-GW01DW	7.49	5.78	1.71	5.57	1.92
28-GW02	5.96	3.72	2.24	4.21	1.75
28-GW03	5.90	2.76	3.14	2.85	3.05
28-GW04	8.17	4.85	3.32	5.19	2.98
28-GW06	19.98	17.55	2.43	10.90	4.57
28-GW07	6.62	3.38	3.24	4.21	2.41
28-GW07DW	6.03	3.32	2.71	3.46	2.57
28-GW08	13.27	11.49	1.78	12.71	0.56

Notes:

[1] Top of well casing expressed in feet above mean sea level

SWL = Static water level taken from top of well casing
SWE = Static water elevation expressed in feet above mean sea level

TABLE 2-1

TRIP BLANK ANALYTICAL RESULTS
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	01-TB01-97A
DATE SAMPLED	02/23/97
UNITS	UG/L
VOLATILES	
CHLOROMETHANE	10 U
BROMOMETHANE	10 U
VINYL CHLORIDE	10 U
CHLOROETHANE	10 U
METHYLENE CHLORIDE	10 U
ACETONE	10 U
CARBON DISULFIDE	10 U
1,1-DICHLOROETHENE	10 U
1,1-DICHLOROETHANE	10 U
1,2-DICHLOROETHENE (TOTAL)	10 U
CHLOROFORM	10 U
1,2-DICHLOROETHANE	10 U
2-BUTANONE	10 U
1,1,1-TRICHLOROETHANE	10 U
CARBON TETRACHLORIDE	10 U
BROMODICHLOROMETHANE	10 U
1,2-DICHLOROPROPANE	10 U
CIS-1,3-DICHLOROPROPENE	10 U
TRICHLOROETHENE	10 U
DIBROMOCHLOROMETHANE	10 U
1,1,2-TRICHLOROETHANE	10 U
BENZENE	10 U
TRANS-1,3-DICHLOROPROPENE	10 U
BROMOFORM	10 U
4-METHYL-2-PENTANONE	10 U
2-HEXANONE	10 U
TETRACHLOROETHENE	10 U
1,1,2,2-TETRACHLOROETHANE	10 U
TOLUENE	10 U
CHLOROBENZENE	10 U
ETHYLBENZENE	10 U
STYRENE	10 U
XYLENE (TOTAL)	10 U

U = Not detected
ug/L = Micrograms per liter

TABLE 2-2

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Contaminants	Comparison Criteria		Concentration Range		Location of Maximum Detection	Detection Frequency	Detections Above	
		NCWQS	MCL	Min.	Max.			NCWQS	MCL
Volatile Organics	1,2-Dichloroethene (total)	70	70	16	16	01-GW10	1/8	0/8	0/8
	Trichloroethene	2.8	5	3 J	3 J	01-GW17	2/8	2/8	0/8

Notes:

- Concentrations presented in micrograms per liter (µg/L) or parts per billion.

J - Estimated Value.

NCWQS - North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).

MCL - Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to any user of a p (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).

TABLE 2-3

POSITIVE DETECTIONS IN GROUNDWATER
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	1-GW01-97A	01-GW02-97A	01-GW03-97A	01-GW10-97A	01-GW11-97A	01-GW12-97A	01-GW17-97A	01-GW17DW-97A
DATE SAMPLED	02/23/97	02/23/97	02/23/97	02/23/97	02/23/97	02/23/97	02/24/97	02/24/97
VOLATILES (ug/L)								
1,2-DICHLOROETHENE (TOTAL)	10 U	10 U	10 U	16	10 U	10 U	10 U	10 U
TRICHLOROETHENE	10 U	10 U	10 U	3 J	10 U	10 U	3 J	10 U

U = Not detected
J = estimated value
ug/L = microgram per liter

TABLE 2-4

SUMMARY OF VOLATILE COMPOUNDS IN GROUNDWATER
MAY 1994 - FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Monitoring Well/ Volatile Compound	May, 1994[1]	December, 1994[2]	August, 1995[3]	July, 1996[3]	February, 1997[3]
1-GW01	ND	ND	ND	ND	ND
1-GW02	ND	ND	ND	ND	ND
1-GW03	ND	ND	ND	ND	ND
1-GW10					
Vinyl Chloride	2	4	ND	ND	ND
1,2-Dichloroethene(Total)	10	21	23	19	16
1,1-Dichloroethene (Total)	ND	2	ND	ND	ND
Trichloroethene	4	8	4	ND	3J
1-GW11					
Trichloroethene	1	ND	ND	ND	ND
1-GW12					
Toluene	ND	ND	4	ND	ND
Ethylbenzene	ND	ND	4	ND	ND
Xylenes	3	9	150	6J	ND
1-GW17					
1,2-Dichloroethene (Total)	1	ND	ND	ND	ND
Trichloroethene	27	18	ND	ND	3J
1-GW17DW	ND	ND	ND	ND	ND

Notes:

Concentrations expressed in micrograms per liter (µg/L) or parts per billion.

(1) Samples collected using a Teflon bailer
(2) Samples collected using an environmental submersible pump
(3) Samples collected using a peristaltic pump

ND = Not detected

TABLE 2-5

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Analytes	Comparison Criteria		Concentration Range		Location of Maximum Detection	Detection Frequency	Detections Above	
		NCWQS	MCL	Min.	Max.			NCWQS	MCL
Total Metals	Aluminum	NE	50	14.4	153	28-GW07	6/7	NA	1
	Antimony	NE	6	23.6	25.0	28-GW01	2/7	NA	2
	Arsenic	50	50	2.7	3.8	28-GW08	3/7	0	0
	Barium	2000	2000	15.6	859	28-GW02	7/7	0	0
	Copper	1,000	1,300	1.9	1.9	28-GW07	1/7	0	0
	Iron	300	300	10	26600	28-GW07	7/7	5	5
	Lead	15	15	1.4	6.8	28-GW07	4/7	0	0
	Manganese	50	50	1.3	460	28-GW07	7/7	5	5
	Vanadium	NE	NE	1.8	1.8	28-GW07	1/7	NA	NA
	Zinc	2100	NE	3.1	10.2	28-GW07	3/7	0	NA

Notes:

- Concentrations presented in micrograms per liter (µg/L) or parts per billion.

NA - Not applicable

NCWQS - North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).

NE - Not Established

MCL - Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to any user of a public water system (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).

TABLE 2-6

POSITIVE DETECTIONS IN GROUNDWATER
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	28-GW01-97A	28-GW01DW-97A	28-GW02-97A	28-GW04-97A	28-GW07-97A	28-GW07DW-97A	28-GW08-97A
DATE SAMPLED	02/06/97	02/06/97	02/06/97	02/06/97	02/06/97	02/06/97	02/06/97
TOTAL METALS (ug/L)							
ALUMINUM, TOTAL	22.9	14.2 U	33.9	14.4	153	25.9	40.1
ANTIMONY, TOTAL	25	15.1 U	15.1 U	15.1 U	23.6	15.1 U	15.1 U
ARSENIC, TOTAL	1.7 U	1.7 U	2.7	1.7 U	3.1	1.7 U	3.8
BARIUM, TOTAL	281	20.5	859	60	127	15.6	782
CALCIUM, TOTAL	163000	110000	56600	63100	130000	37700	50400
COBALT, TOTAL	2.4	1.8 U	2.1	2.2	1.8 U	3.2	1.8 U
COPPER, TOTAL	1.7 U	1.7 U	1.7 U	1.7 U	1.9	1.7 U	1.7 U
IRON, TOTAL	1930	374	5150	73.1	26600	10	4000
LEAD, TOTAL	1.6	1.4	1.1 U	1.1 U	6.8	1.1 U	2
MAGNESIUM, TOTAL	22400	22400	27000	5290	12200	493	31200
MANGANESE, TOTAL	214	119	185	33.5	460	1.3	175
POTASSIUM, TOTAL	16000	19900	45400	1390	2460	994	64700
SODIUM, TOTAL	70800	859000	71800	41900	29900	5920	120000
VANADIUM, TOTAL	1.6 U	1.6 U	1.6 U	1.6 U	1.8	1.6 U	1.6 U
ZINC, TOTAL	1 U	1 U	1 U	3.3	10.2	1 U	3.1

U = not detected
ug/L = micrograms per liter

H28GWI.WK4 06/05/97

TABLE 2-7

SUMMARY OF METALS DETECTED IN GROUNDWATER ABOVE SCREENING STANDARDS
AUGUST 1995 - FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Monitoring Well/ Volatile Compound	August 1995	July 1996	February 1997	MCL	NCWQS
28-GW01					
Antimony	ND	ND	25	6	NA
Iron	1,690	1,840	1,930	NA	300
Manganese	120	250	214	NA	50
28-GW01DW					
Iron	ND	364	374	NA	300
Manganese	92.8	109	119	NA	50
28-GW02					
Aluminum	ND	137	ND	NA	50
Antimony	ND	14.7	ND	6	NA
Iron	4,080	4,320	5,150	NA	300
Manganese	191	174	185	NA	50
28-GW04					
Aluminum	ND	121	ND	NA	50
Manganese	56.1	67	ND	NA	50
28-GW07					
Aluminum	ND	56.1	153	NA	50
Antimony	ND	19.2	23.6	6	NA
Cadmium	10.7	ND	ND	5	5
Iron	23,000	36,300	26,600	NA	300
Manganese	431	860	460	NA	50
28-GW07DW					
Aluminum	ND	72	ND	NA	50
28-GW08					
Iron	1,180	3,910	4,000	NA	300
Manganese	160	212	175	NA	50

Notes:

-Concentrations expressed in micrograms per liter (µg/L) or parts per billion.
-Samples collected using a peristaltic pump

ND = Not detected above screening value
N = Not applicable
MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to any user of a public water system. (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories.)
NCWQS = North Carolina Water Quality Standards. Values Applicable to Groundwater (North Carolina Administrative Code, Title 15A, Subchapter 2L).

TABLE 2-8

SUMMARY OF SURFACE WATER ANALYTICAL RESULTS - FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Analytes	Comparison Criteria		Concentration Range		Location of Maximum Detection	Detection Frequency	Detections Above	
		NCWQS	Region IV	Min.	Max.			NCWQS	Region IV
Total Metals	Aluminum	NE	NE	89.8	156	28-SW03	3/3	NA	NA
	Antimony	NE	NE	22.4	22.4	28-SW03	1/3	NA	NA
	Arsenic	50	36	1.9	1.9	28-SW01	1/3	0	0
	Barium	NE	NE	11.9	12.5	28-SW03	3/3	NA	NA
	Cadmium	5.0	9.3	4.6	6.3	28-SW02	3/3	2	0
	Copper	3.0	2.9	2.1	2.1	28-SW03	1/3	0	0
	Iron	NE	NE	33.7	72.2	28-SW03	3/3	NA	NA
	Lead	25	8.5	1.6	2.7	28-SW03	2/3	0	0
	Manganese	NE	NE	1.4	1.4	28-SW03	1/3	NA	NA
	Zinc	86	86	3.6	3.6	28-SW03	1/3	0	0

Notes:

- Concentrations presented in micrograms per liter (µg/L) or parts per billion.

NA - Not applicable

NCWQS - North Carolina Salt Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2B).

NE - Not Established

Region IV - U.S. Environmental Protection Agency, Region IV - Surface Water Screening Values Protective of Aquatic Life.

TABLE 2-9

POSITIVE DETECTIONS IN SURFACE WATER
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	28-SW01-97A	28-SW02-97A	28-SW03-97A
DATE SAMPLED	02/06/97	02/06/97	02/06/97
TOTAL METALS (ug/L)			
ALUMINUM, TOTAL	90.5	89.8	156
ANTIMONY, TOTAL	15.1 U	15.1 U	22.4
ARSENIC, TOTAL	1.9	1.7 U	1.7 U
BARIUM, TOTAL	12.2	11.9	12.5
CADMIUM, TOTAL	4.6	6.3	6.1
CALCIUM, TOTAL	179000	180000	174000
COPPER, TOTAL	1.7 U	1.7 U	2.1
IRON, TOTAL	33.7	36	72.2
LEAD, TOTAL	1.1 U	1.6	2.7
MAGNESIUM, TOTAL	539000	542000	524000
MANGANESE, TOTAL	1 U	1 U	1.4
POTASSIUM, TOTAL	163000	165000	158000
SODIUM, TOTAL	4180000	4160000	4020000
ZINC, TOTAL	1 U	1 U	3.6

U = not detected
ug/L = micrograms per liter

TABLE 2-10

SUMMARY OF SEDIMENT ANALYTICAL RESULTS -FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Analytes	Comparison Criteria	Comparison Criteria		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria
			Min.	Max.			
Metals	Aluminum	NE	850	1360	28-SD02	3/3	NA
	Arsenic	7.24	0.65	0.66	28-SD02	2/3	0
	Barium	NE	2.2	3.9	28-SD03	3/3	NA
	Chromium	52.3	1.8	3.0	28-SD03	3/3	0
	Copper	18.7	2.7	22.2	28-SD02	3/3	1
	Iron	NE	664	1180	28-SD03	3/3	NA
	Lead	30.2	8.3	65	28-SD03	3/3	2
	Manganese	NE	3.9	5.9	28-SD03	3/3	NA
	Vanadium	NE	2.4	3.6	28-SD02	3/3	NA
	Zinc	124	3.8	14.7	28-SD03	3/3	0

Notes:

- Concentrations presented in milligrams per kilogram (mg/kg) or parts per million.

NA - Not applicable

NE - Not Established

Comparison Criteria - U.S. Environmental Protection Agency, Region IV - Adoption of Risk-Based Values for Aquatic Life from the National Oceanic and Atmospheric Administration (NOAA).

TABLE 2-11

POSITIVE DETECTIONS IN SEDIMENT
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	28-SD01-97A	28-SD02-97A	28-SD03-97A
DATE SAMPLED	02/06/97	02/06/97	02/06/97
TOTAL METALS (mg/kg)			
ALUMINUM, TOTAL	850	1360	1120
ARSENIC, TOTAL	0.33 U	0.66	0.65
BARIUM, TOTAL	2.2	2.6	3.9
CALCIUM, TOTAL	138	239	227
CHROMIUM, TOTAL	1.8	2.9	3
COPPER, TOTAL	2.7	22.2	11.9
IRON, TOTAL	664	1040	1180
LEAD, TOTAL	8.3	44.9	65
MAGNESIUM, TOTAL	241	344	341
MANGANESE, TOTAL	3.9	5.5	5.9
POTASSIUM, TOTAL	150	173	204
SODIUM, TOTAL	1070	1170	940
VANADIUM, TOTAL	2.4	3.6	3.1
ZINC, TOTAL	3.8	7.1	14.7

U = not detected
mg/kg = milligrams per kilogram

FIGURES

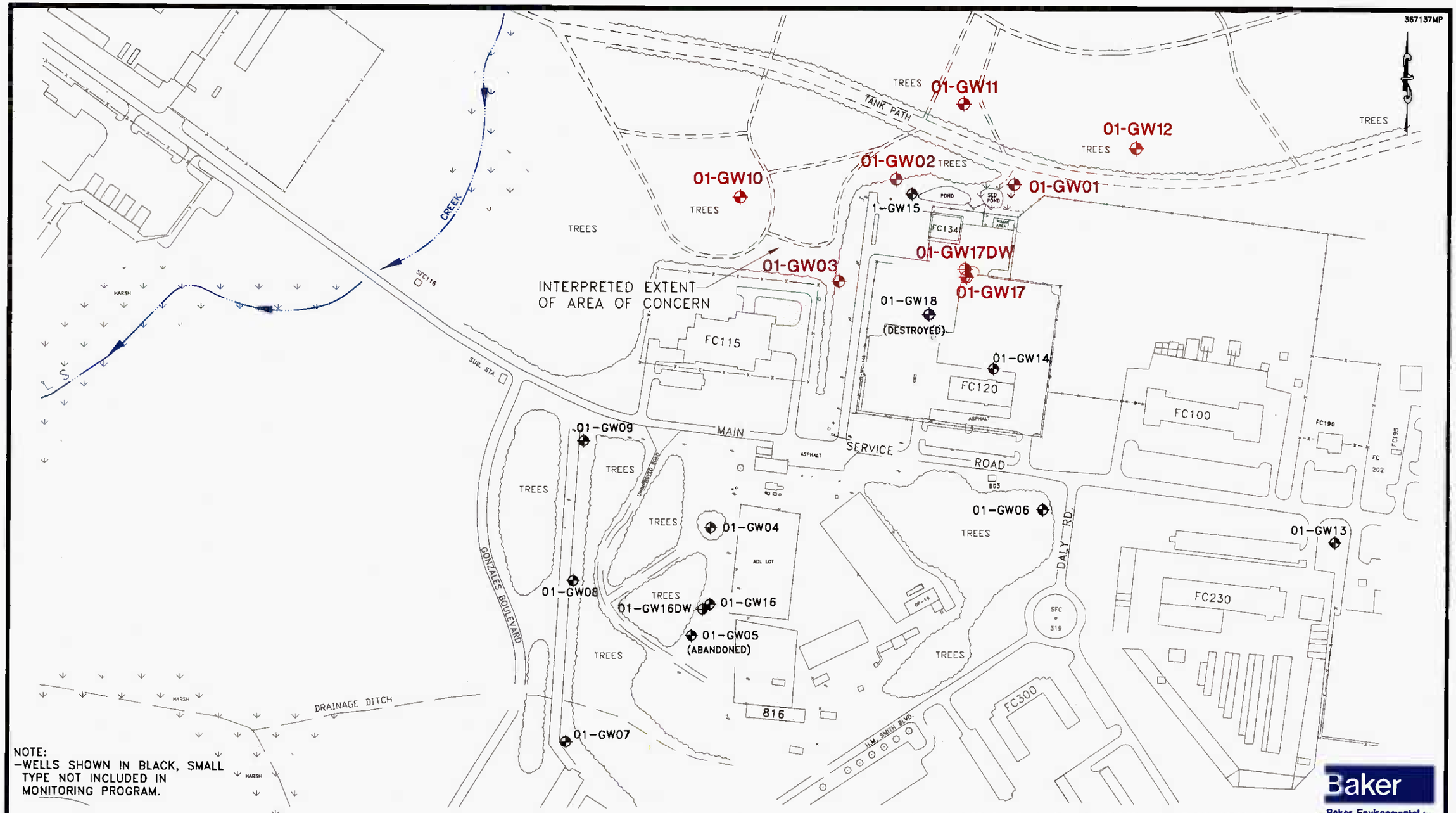
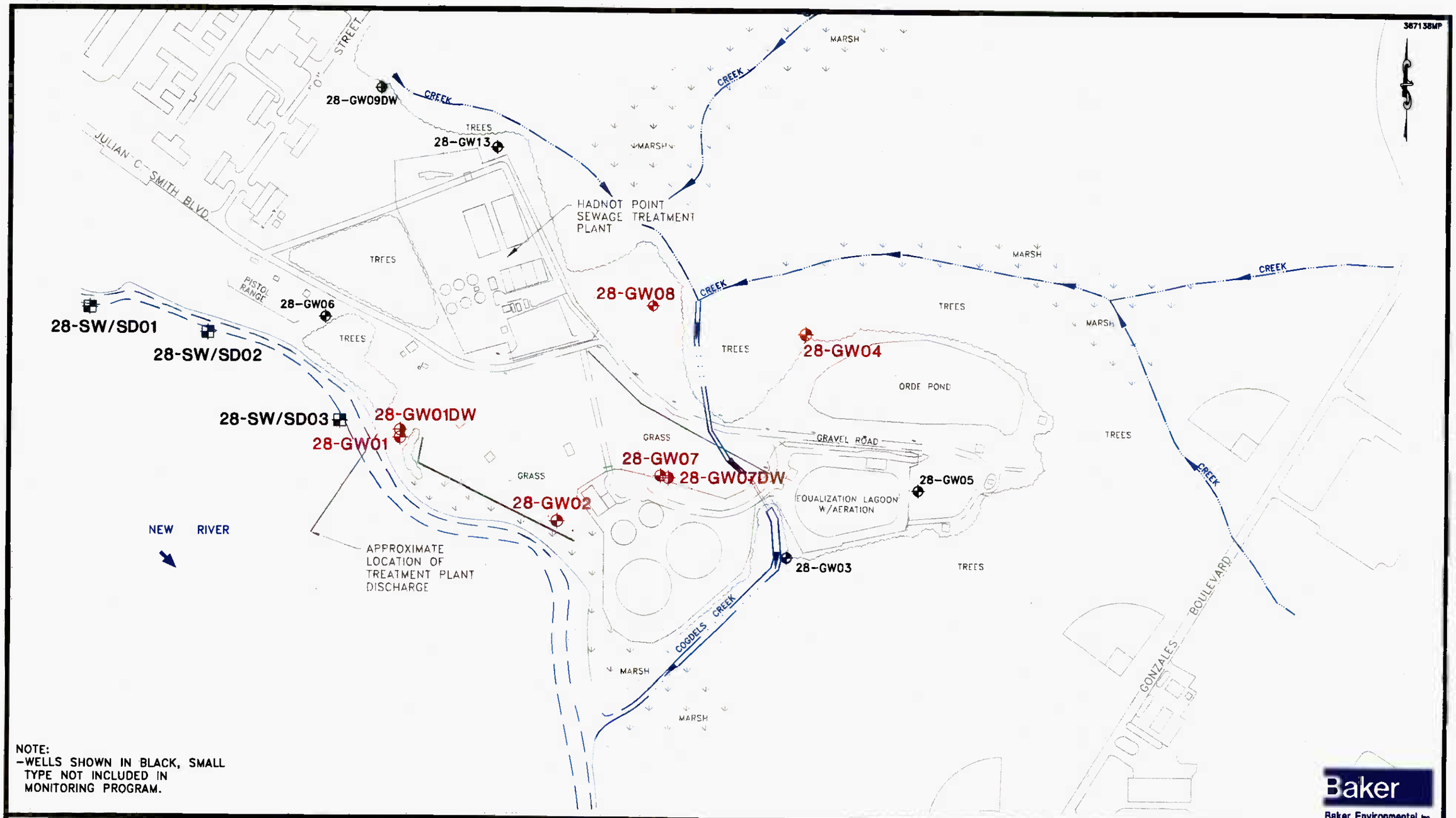


FIGURE 1-1
SAMPLING LOCATION MAP
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO - 0367

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

0177IJJB1Y



NOTE:
-WELLS SHOWN IN BLACK, SMALL TYPE NOT INCLUDED IN MONITORING PROGRAM.

Baker
Baker Environmental, Inc.

LEGEND

28-GW01 — SHALLOW MONITORING WELL

28-GW01DW — DEEP MONITORING WELL

28-SW/SD01 — SURFACE WATER AND SEDIMENT SAMPLE LOCATION

APPROXIMATE SURFACE WATER FLOW DIRECTION

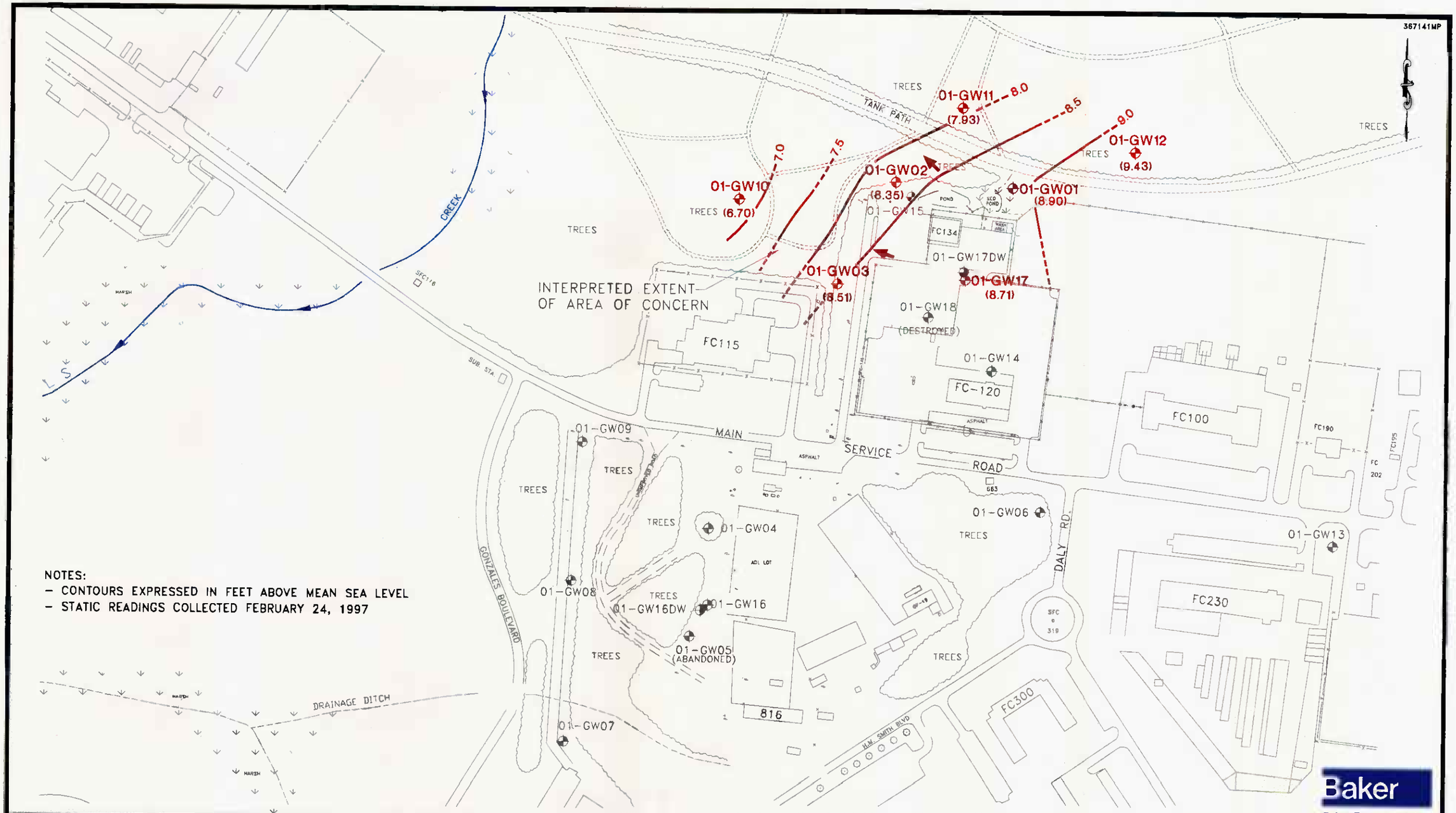
SOURCE: LANTDIV, FEBRUARY 1992 AND W.K. DICKSON, JUNE 1994

300 0 150 300 600

1 inch = 300 ft.

FIGURE 1-2
SAMPLING LOCATION MAP
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO - 0367

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTES:
- CONTOURS EXPRESSED IN FEET ABOVE MEAN SEA LEVEL
- STATIC READINGS COLLECTED FEBRUARY 24, 1997

LEGEND

- 01-GW07 — SHALLOW MONITORING WELL
- 01-GW16DW — DEEP MONITORING WELL
- (7.01) — GROUNDWATER ELEVATION
- —9.0— — GROUNDWATER ELEVATION CONTOUR
- APPROXIMATE DIRECTION OF GROUNDWATER FLOW
- APPROXIMATE DIRECTION OF SURFACE WATER FLOW

SOURCE: LANTDIV, FEBRUARY 1992 AND W.K. DICKSON & ASSOC., JUNE 1994

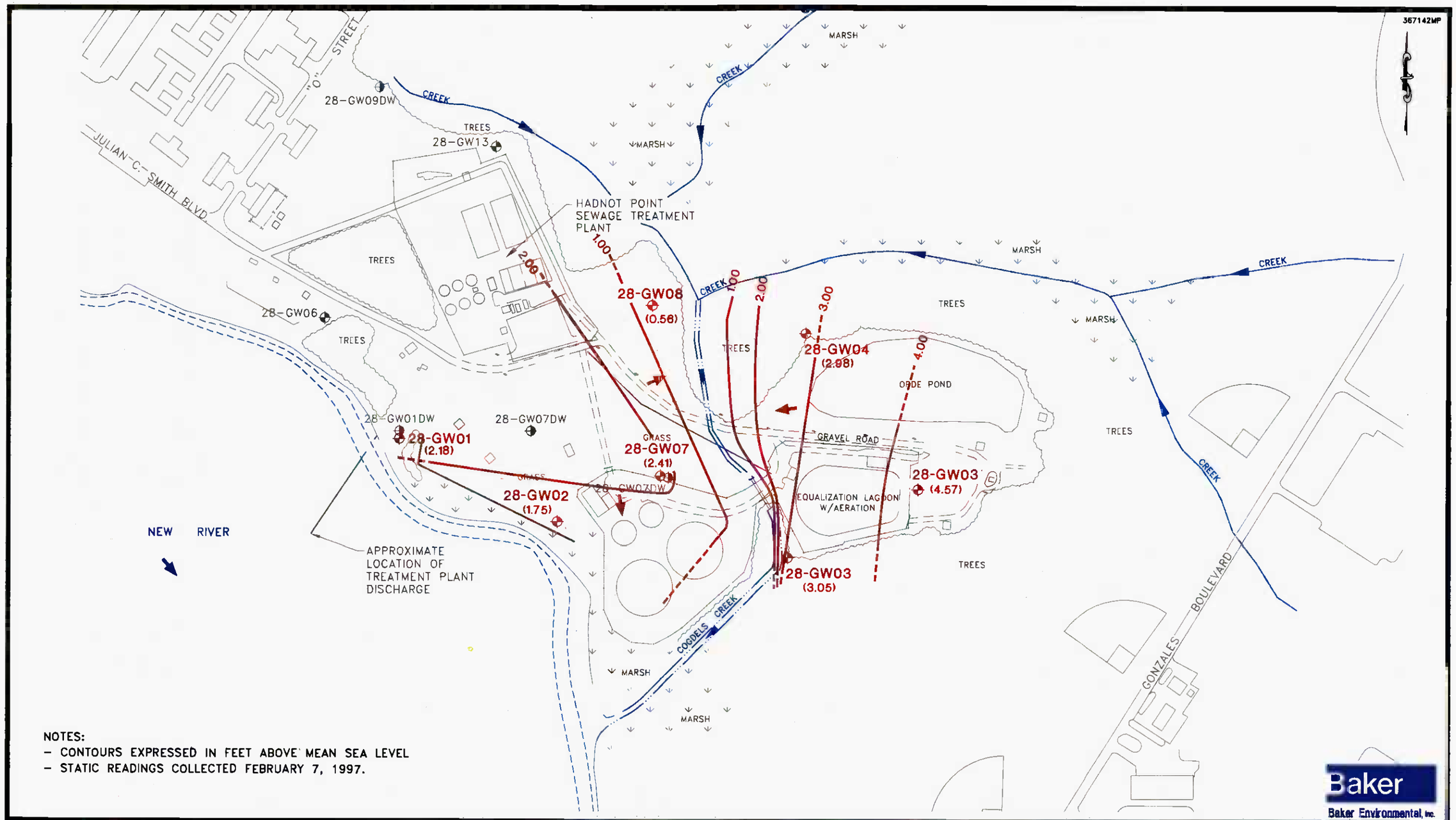
300 0 150 300 600

1 inch = 300 ft.

FIGURE 1-3
SHALLOW GROUNDWATER CONTOUR MAP
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO - 0367

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

Baker
Baker Environmental, Inc.



LEGEND

- 28-GW01 — SHALLOW MONITORING WELL
- 28-GW01DW — DEEP MONITORING WELL
- (1.78) — GROUNDWATER ELEVATION
- 3.00 — GROUNDWATER ELEVATION CONTOUR
- APPROXIMATE DIRECTION OF SURFACE WATER FLOW
- APPROXIMATE DIRECTION OF GROUNDWATER FLOW

SOURCE: LANTDIV, FEBRUARY 1992 AND W.K. DICKSON, JUNE 1994

300 0 150 300 600

1 inch = 300 ft.

FIGURE 1-4
SHALLOW GROUNDWATER CONTOUR MAP
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO - 0367

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

367139MP

SAMPLE ID	01-GW10-97A
SAMPLE DATE	2/23/97
1,2-DICHLOROETHENE (TOTAL)	16
TRICHLOROETHENE	3 J

SAMPLE ID	01-GW17-97A
SAMPLE DATE	2/24/97
TRICHLOROETHENE	3 J

FEDERAL MAXIMUM CONTAMINANT LEVELS (MCLs) AND NORTH CAROLINA WATER QUALITY STANDARDS (NCWQS)

Organic Contaminants	NCWQS	MCL
1,2-Dichloroethene (Total)	70	
Trichloroethene	2.8	5

NOTE:
- CONCENTRATIONS PRESENTED IN MICROGRAMS PER LITER OR PARTS PER BILLION.
- WELLS SHOWN WITHOUT CONCENTRATIONS INDICATE NONDETECTABLE LEVELS.

LEGEND

- 01-GW07 SHALLOW MONITORING WELL
- 01-GW16DW DEEP MONITORING WELL
- APPROXIMATE SURFACE WATER FLOW DIRECTION

SOURCE: LANTDIV, FEBRUARY 1992 AND W.K. DICKSON & ASSOC., JUNE 1994

300 0 150 300 600

1 inch = 300 ft.

FIGURE 2-1
VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO - 0367

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

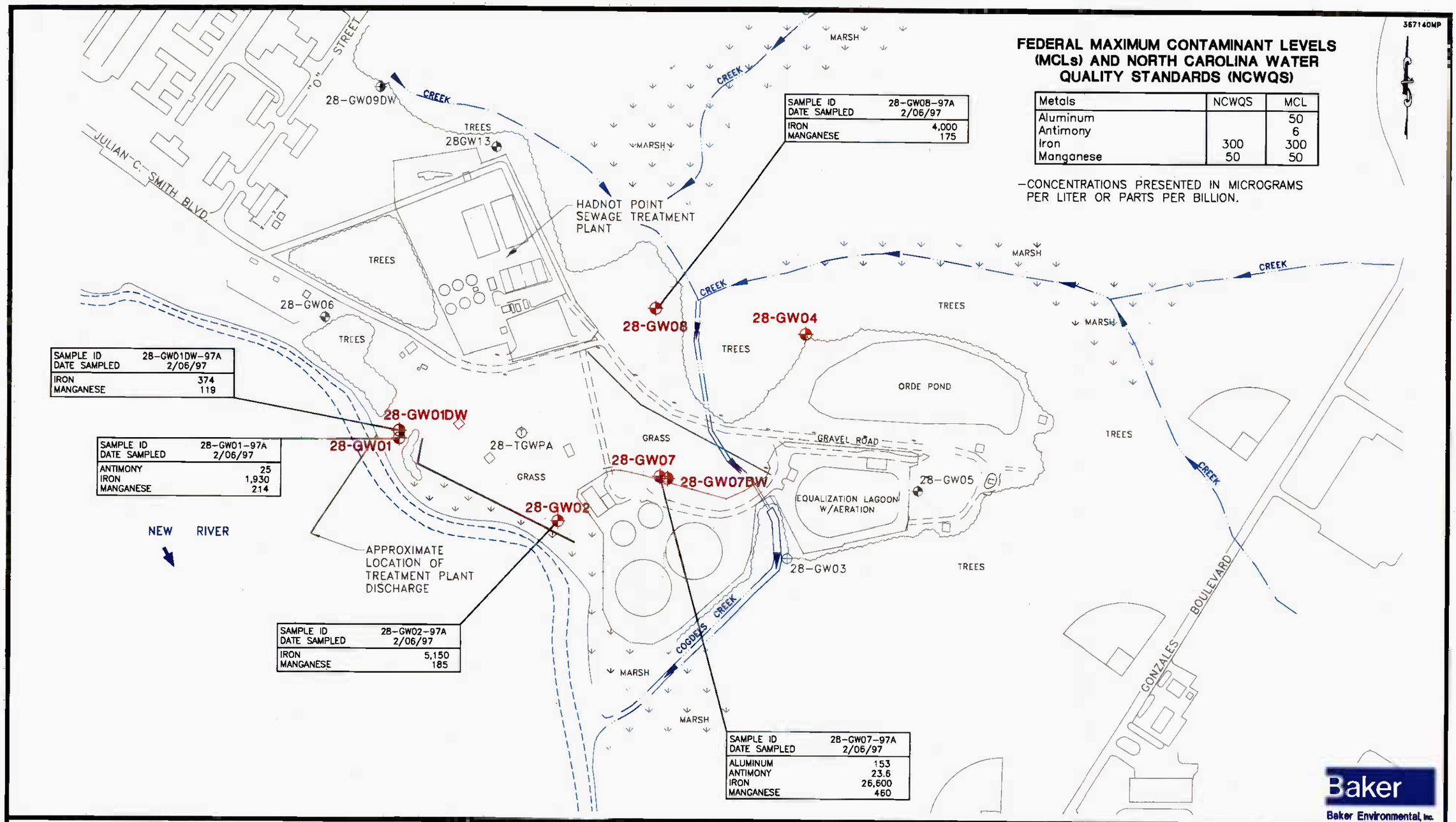
Baker Environmental, Inc.

367140MP

FEDERAL MAXIMUM CONTAMINANT LEVELS (MCLs) AND NORTH CAROLINA WATER QUALITY STANDARDS (NCWQS)

Metals	NCWQS	MCL
Aluminum		50
Antimony		6
Iron	300	300
Manganese	50	50

–CONCENTRATIONS PRESENTED IN MICROGRAMS PER LITER OR PARTS PER BILLION.



Baker
Baker Environmental, Inc.

LEGEND

28-GW01 SHALLOW MONITORING WELL

28-GW01DW DEEP MONITORING WELL

SOURCE: LANTDIV, FEBRUARY 1992 AND W.K. DICKSON, JUNE 1994

300 0 150 300 600

1 inch = 300 ft.

FIGURE 2-2
METALS IN GROUNDWATER
ABOVE SCREENING STANDARDS
OPERABLE UNIT NO. 7 – SITE 28
MONITORING AND O&M SUPPORT, CTO – 0367

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

Figure 3-1 Shallow monitoring well 01-GW02 was constructed during the 1984 Confirmation Study. The well had begun to exhibit signs of neglect and deterioration.

Figure 3-2 The protective bollards of monitoring well 01-GW02 were straightened and two coats of weather resistant paint were applied. A mound of soil, which had accumulated on the concrete pad, was also removed.

Figure 3-3 The tree lying across monitoring well 01-GW11 pictured here, was knocked down during recent hurricanes.

Figure 3-4 The fallen tree and debris were cleared and removed from 01-GW11.

Figure 3-5 Shallow monitoring well 28-GW02 was installed during the 1984 Confirmation Study. The well had begun to exhibit signs of neglect and deterioration.

Figure 3-6 Peeling paint and rust were removed and two coats of weather resistant paint were then applied.

ATTACHMENTS

ATTACHMENT A
CHAIN-OF-CUSTODY DOCUMENTATION

Baker Environmental, Inc.
Airport Office Park, Bldg. 3
420 Rouser Road
Coraopolis, PA 15108
412-269-6000
412-269-6097 (fax)

CHAIN-OF-CUSTODY RECORD

Lab and BOA #: Weston B. Ramirez
Delivery Order #:
Project Number: 367
Project Name: Monitoring @ CLEJ, NC
Field Team: JPI/TFT
SEND RESULTS TO: Tom Trebilcock

Notes ~~Sample Number~~	1997 Date	Time	Sample Location	Matrix Type (1) GB (2)	Matrix Type (1) COM (2)	Analytical Methods: CLP Volatiles	Type of Container(s) (3): G/2	Number of Container(s)	General Comments: Sample No. ~~Remarks~~
GW	2/23	0905	Site 1	X		X		1	01-GW01-97A
GW	2/23	1019	Site 1	X		X		1	01-GW12-97A
GW	2/23	1130	Site 1	X		X		1	01-GW11-97A
GW	2/23	1401	Site 1	X		X		1	01-GW10-97A
GW	2/23	1515	Site 1	X		X		1	01-GW03-97A
GW	2/23	1611	Site 1	X		X		1	01-GW02-97A
GW	2/24	0845	Site 1	X		X		1	01-GW17-97A
GW	2/24	1205	Site 1	X		X		1	01-GW17DW-97A
Blank	2/23	0800	—			X		1	01-TB01-97A

General Comments: COC # OU97A-002

Relinquished By: Tom Trebilcock Date: 2/24/97 Time: 1500
Received By: Fed Ex Date: Time:
Shipped by (check one): Hand ☐ Overnight ☒ Other ☐

Relinquished By: Date: Time:
Received By: Date: Time:
Shipped by (check one): Hand ☐ Overnight ☐ Other ☐

Relinquished By: Date: Time:
Received By: Date: Time:
Shipped by (check one): Hand ☐ Overnight ☐ Other ☐

Sample Stored at 4 Degrees C: Yes ☒ No ☐
Chain-of-custody seal on cooler: Yes ☒ Number: No ☐
Analysis turnaround: Priority ☐ hrs. Regular ☒
See Work Order ☐
See Analysis Request Form ☐

Sample Disposal: Return to Baker ☐ Lab Disposal ☒
Archive until: (date)

NOTES:
(1) A - Air; GW - Groundwater; L - Leachate; S - Spring; SS - Surface Soil; SB - SubSurface Soil; SW - Surface Water; W - Waste; WP - Wipe; WW - Wastewater
(2) GB - Grab; COM - Composite
(3) P - Plastic; G - Glass

White - Return with analytical results; Yellow - Laboratory Copy; Pink - Field Copy

Courier Name: Fed Ex
Courier Pickup Number:
File Name:

Baker Environmental, Inc.
Airport Office Park, Bldg. 3
420 Rouser Road
Coraopolis, PA 15108
412-269-6000
412-269-6097 (fax)

CHAIN-O -CUSTODY RECORD

Lab and BOA #: Weston B. Ramirez
Delivery Order #:
Project Number: 367
Project Name: Monitoring
Field Team: JPT/TFT
SEND RESULTS TO: Tom Trebilcock

Notes ~~Sample Number~~	1997 Date	Time	Sample Location	Matrix Type (1) GB (2)	Matrix Type (1) COM (2)	Analytical Methods: TAL Metals	Type of Container(s) (3)	Number of Container(s)	General Comments: Sample No. ~~Remarks~~
GW	2/6	0910	Site 28	X		X			28-GW07-97A
		1050		X		X			28-GW08-97A
		1200		X		X			28-GW02-97A
		1215		X		X			28-GW07DW-97A
		1345		X		X			28-GW04-97A
		1505		X		X			28-GW01-97A
↓		1650		X		X			28-GW01DW-97A
SW		1540		X		X			28-SW03-97A
SED		1543		X		X			28-SD03-97A
SW	↓	1600	↓	X		X			28-SW02-97A

COC# OU797A-001

Relinquished By: [signature] Date: 2/6/97 Time: 1730
Received By: Date: Time:
Shipped by (check one): Hand ☐ Overnight ☐ Other ☐

Relinquished By: Date: Time:
Received By: Date: Time:
Shipped by (check one): Hand ☐ Overnight ☐ Other ☐

Relinquished By: Date: Time:
Received By: Date: Time:
Shipped by (check one): Hand ☐ Overnight ☐ Other ☐

Sample Stored at 4 Degrees C: Yes ☐ No ☐
Chain-of-custody seal on cooler: Yes ☐ Number: entered 2/11/97 No ☐
Analysis turnaround: Priority ☐ ____ hrs. Regular ☐
See Work Order ☐
See Analysis Request Form ☐

Sample Disposal Return to Baker ☐ Lab Disposal ☐
Archive until: ____ (date)

NOTES:
(1) A - Air; GW - Groundwater; L - Leachate; S - Spring; SS - Surface Soil; SB - SubSurface Soil; SW - Surface Water; W - Waste; WP - Wipe; WW - Wastewater
(2) GB - Grab; COM - Composite
(3) P - Plastic; G - Glass

White - Return with analytical results; Yellow - Laboratory Copy; Pink - Field Copy

Courier Name: Fed Ex
Courier Pickup Number: 3558274274
File Name:

Baker Environmental, Inc.
Airport Office Park, Bldg. 3
420 Rouser Road
Coraopolis, PA 15108
412-269-6000
412-269-6097 (fax)

CHAIN-OF-CUSTODY RECORD

Lab and BOA #: Weston B. Ramirez
Delivery Order #:
Project Number: 367
Project Name: Monitoring
Field Team: JPT/TFT
SEND RESULTS TO: Tom Trebilcock

Notes ~~Sample Number~~	1997 Date	Time	Sample Location	Matrix Type (1) GB (1)	Matrix Type (1) COM (1)	Analytical Methods: TAL Metals	Type of Container(s) (3)	Number of Container(s)	~~Remarks~~
SED		1600	Site 28	X		X			28-SD02-97A
SW		1615	↓	X		X			28-SW01-97A
SED		1615	↓	X		X			28-SD01-97A

General Comments: COC # OU797A-001

Relinquished By: [signature] Date: 7/6/97 Time: 1730
Received By: Date: Time:
Shipped by (check one): Hand ☐ Overnight ☐ Other ☐

Relinquished By: Date: Time:
Received By: Date: Time:
Shipped by (check one): Hand ☐ Overnight ☐ Other ☐

Relinquished By: Date: Time:
Received By: Date: Time:
Shipped by (check one): Hand ☐ Overnight ☐ Other ☐

Sample Stored at 4 Degrees C: Yes ☒ No ☐
Chain-of-custody seal on cooler: Yes ☒ Number: No ☐
Analysis turnaround: Priority ☐ hrs. Regular ☒
See Work Order ☐
See Analysis Request Form ☐
Sample Disposal: Return to Baker ☐ Lab Disposal ☒
Archive until: (date)

NOTES:
(1) A - Air; GW - Groundwater; L - Leachate; S - Spring; SS - Surface Soil; SB - SubSurface Soil; SW - Surface Water; W - Waste; WP - Wipe; WW - Wastewater; GB - Grab; COM - Composite
(3) P - Plastic; G - Glass

White - Return with analytical results; Yellow - Laboratory Copy; Pink - Field Copy

Courier Name: FedEx
Courier Pickup Number:
File Name:

ATTACHMENT B
SAMPLE TRACKING FORM

Sample Tracking and Chain-of-Custody Documentation - Site 1
Monitoring and O&M Program Support, CTO-367
MCB, Camp Lejeune, North Carolina

MATRIX	SAMPLE ID	DATE SHIPPED	Analysis Requested	Analysis Received	DATE RECEIVED	TURNAROUND TIME	RFW #	COMMENTS
			CLP Volatiles (SOW OLM01.8)	CLP Volatiles (SOW OLM01.8)				
Groundwater	**COC# OU797A-002**							
	01-GW01-97A	2/24/97	X	X	4/23/97	59	9702G215	
	01-GW02-97A	2/24/97	X	X	4/23/97	59	9702G215	
	01-GW03-97A	2/24/97	X	X	4/23/97	59	9702G215	
	01-GW10-97A	2/24/97	X	X	4/23/97	59	9702G215	
	01-GW11-97A	2/24/97	X	X	4/23/97	59	9702G215	
	01-GW12-97A	2/24/97	X	X	4/23/97	59	9702G215	
	01-GW17-97A	2/24/97	X	X	4/23/97	59	9702G215	
	01-GW17DW-97A	2/24/97	X	X	4/23/97	59	9702G215	
	01-GW18-97A	2/24/97	X	X	4/23/97	59	9702G215	
	01-TB01-97A	2/24/97	X	X	4/23/97	59	9702G215	
TOTALS			9	9				

Sample Tracking and Chain-of-Custody Documentation - Site 28
Monitoring and O&M Program Support, CTO-367
MCB, Camp Lejeune, North Carolina

MATRIX	SAMPLE ID	DATE SHIPPED	Analysis Requested	Analysis Received	DATE RECEIVED	TURNAROUND TIME	RFW #	COMMENTS
			TAL Metals (CLP SOW ILM03.0)	TAL Metals (CLP SOW ILM03.0)				
Groundwater	**COC# OU797A-001**							
	28-GW01-97A	2/6/97	X	X	3/3/97	27	9702G928	
	28-GW01DW-97A	2/6/97	X	X	3/3/97	27	9702G928	
	28-GW02-97A	2/6/97	X	X	3/3/97	27	9702G928	
	28-GW04-97A	2/6/97	X	X	3/3/97	27	9702G928	
	28-GW07-97A	2/6/97	X	X	3/3/97	27	9702G928	
	28-GW07DW-97A	2/6/97	X	X	3/3/97	27	9702G928	
	28-GW08-97A	2/6/97	X	X	3/3/97	27	9702G928	
Surface Water	28-SW01-97A	2/6/97	X	X	3/3/97	27	9702G928	
	28-SW02-97A	2/6/97	X	X	3/3/97	27	9702G928	
	28-SW03-97A	2/6/97	X	X	3/3/97	27	9702G928	
Sediment	28-SD01-97A	2/6/97	X	X	3/3/97	27	9702G928	
	28-SD02-97A	2/6/97	X	X	3/3/97	27	9702G928	
	28-SD03-97A	2/6/97	X	X	3/3/97	27	9702G928	
TOTALS			13	13				

ATTACHMENT C
SAMPLE DESIGNATIONS

SAMPLE DESIGNATIONS

In order to accurately identify and differentiate samples collected during the monitoring program, all samples were designated with a unique identification number. The unique sample number identifies the site, the sample media, the sampling station's number, and the quarter in which the sample was collected. The sample designation format is as follows:

Site Number - Sample Station Identifier - Year and Quarter

An explanation of each identifier is provided below:

Site Number	The investigation was conducted at Sites 1 and 28.
Sample Station Identifier	Each monitoring well has been assigned a unique identification number. The identification number may include the qualifiers "DW" which denotes a deep monitoring well, "IW" which denotes an intermediate monitoring well, and "GW" which denotes groundwater.
Year	The investigation was conducted during 1997.
Quarter	The investigation was conducted during the first quarter. The four quarters of year are identified by the first four letters of the alphabet (i.e., A, B, C and D).

Under this sample designation format the sample number 01-GW07DW-97A refers to:

01-GW07DW-97A	Site 01
01-GW07DW-97A	Groundwater sample
01-GW07DW-97A	Monitoring well No.7
01-GW07DW-97A	Deep monitoring well
01-GW07DW-97A	Year 1997.
01-GW07DW-97A	The first quarter (i.e., January through March)

Under this sample designation format the sample number 28-SW02-97A refers to:

28-SW02-97A	Site 28
28-SW02-97A	Surface water sample
28-SW02-97A	Sampling station No. 2
28-SW02-97A	Year 1997.
28-SW02-97A	The first quarter (i.e., January through March)

SAMPLE DESIGNATIONS (Continued)

Under this sample designation format the sample number 28-SD02-97A refers to:

28-SD02-97A Site 28

28-SD02-97A Sediment sample

28-SD02-97A Sampling station No. 2

28-SD02-97A Year 1997.

28-SD02-97A The first quarter (i.e., January through March)

ATTACHMENT D
MONITORING PROGRAM ANALYTICAL RESULTS

GROUNDWATER ANALYTICAL RESULTS
FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 1
MONITORING AND O&M SUPPORT, CTO-0367
VOLATILE ORGANICS

SAMPLE ID	1-GW01-97A	01-GW02-97A	01-GW03-97A	01-GW10-97A	01-GW11-97A	01-GW12-97A	01-GW17-97A	01-GW17DW-97A
DATE SAMPLED	02/23/97	02/23/97	02/23/97	02/23/97	02/23/97	02/23/97	02/24/97	02/24/97
VOLATILES (ug/L)								
CHLOROMETHANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
BROMOMETHANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
VINYL CHLORIDE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
CHLOROETHANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
METHYLENE CHLORIDE	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
CARBON DISULFIDE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-DICHLOROETHENE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-DICHLOROETHANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-DICHLOROETHENE (TOTAL)	10 U	10 U	10 U	16	10 U	10 U	10 U	10 U
CHLOROFORM	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-DICHLOROETHANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-BUTANONE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,1-TRICHLOROETHANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
CARBON TETRACHLORIDE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
BROMODICHLOROMETHANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-DICHLOROPROPANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
CIS-1,3-DICHLOROPROPENE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
TRICHLOROETHENE	10 U	10 U	10 U	3 J	10 U	10 U	3 J	10 U
DIBROMOCHLOROMETHANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2-TRICHLOROETHANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
BENZENE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
TRANS-1,3-DICHLOROPROPENE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
BROMOFORM	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
2-HEXANONE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
TETRACHLOROETHENE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2,2-TETRACHLOROETHANE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
TOLUENE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
CHLOROBENZENE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ETHYLBENZENE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
STYRENE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
XYLENE (TOTAL)	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

GROUNDWATER ANALYTICAL RESULTS
FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
TOTAL METALS

SAMPLE ID	28-GW01-97A	28-GW01DW-97A	28-GW02-97A	28-GW04-97A	28-GW07-97A	28-GW07DW-97A	28-GW08-97A
DATE SAMPLED	02/06/97	02/06/97	02/06/97	02/06/97	02/06/97	02/06/97	02/06/97
TOTAL METALS (ug/L)							
ALUMINUM, TOTAL	22.9	14.2 U	33.9	14.4	153	25.9	40.1
ANTIMONY, TOTAL	25	15.1 U	15.1 U	15.1 U	23.6	15.1 U	15.1 U
ARSENIC, TOTAL	1.7 U	1.7 U	2.7	1.7 U	3.1	1.7 U	3.8
BARIUM, TOTAL	281	20.5	859	60	127	15.6	782
BERYLLIUM, TOTAL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CADMIUM, TOTAL	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U
CALCIUM, TOTAL	163000	110000	56600	63100	130000	37700	50400
CHROMIUM, TOTAL	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
COBALT, TOTAL	2.4	1.8 U	2.1	2.2	1.8 U	3.2	1.8 U
COPPER, TOTAL	1.7 U	1.7 U	1.7 U	1.7 U	1.9	1.7 U	1.7 U
IRON, TOTAL	1930	374	5150	73.1	26600	10	4000
LEAD, TOTAL	1.6	1.4	1.1 U	1.1 U	6.8	1.1 U	2
MAGNESIUM, TOTAL	22400	22400	27000	5290	12200	493	31200
MANGANESE, TOTAL	214	119	185	33.5	460	1.3	175
MERCURY, TOTAL	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
NICKEL, TOTAL	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U
POTASSIUM, TOTAL	16000	19900	45400	1390	2460	994	64700
SELENIUM, TOTAL	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
SILVER, TOTAL	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U
SODIUM, TOTAL	70800	859000	71800	41900	29900	5920	120000
THALLIUM, TOTAL	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U
VANADIUM, TOTAL	1.6 U	1.6 U	1.6 U	1.6 U	1.8	1.6 U	1.6 U
ZINC, TOTAL	1 U	1 U	1 U	3.3	10.2	1 U	3.1

SURFACE WATER ANALYTICAL RESULTS
FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
TOTAL METALS

SAMPLE ID	28-SW01-97A	28-SW02-97A	28-SW03-97A
DATE SAMPLED	02/06/97	02/06/97	02/06/97
TOTAL METALS (ug/L)			
ALUMINUM, TOTAL	90.5	89.8	156
ANTIMONY, TOTAL	15.1 U	15.1 U	22.4
ARSENIC, TOTAL	1.9	1.7 U	1.7 U
BARIUM, TOTAL	12.2	11.9	12.5
BERYLLIUM, TOTAL	0.5 U	0.5 U	0.5 U
CADMIUM, TOTAL	4.6	6.3	6.1
CALCIUM, TOTAL	179000	180000	174000
CHROMIUM, TOTAL	1.8 U	1.8 U	1.8 U
COBALT, TOTAL	1.8 U	1.8 U	1.8 U
COPPER, TOTAL	1.7 U	1.7 U	2.1
IRON, TOTAL	33.7	36	72.2
LEAD, TOTAL	1.1 U	1.6	2.7
MAGNESIUM, TOTAL	539000	542000	524000
MANGANESE, TOTAL	1 U	1 U	1.4
MERCURY, TOTAL	0.1 U	0.1 U	0.1 U
NICKEL, TOTAL	8.7 U	8.7 U	8.7 U
POTASSIUM, TOTAL	163000	165000	158000
SELENIUM, TOTAL	1.6 U	1.6 U	1.6 U
SILVER, TOTAL	2.9 U	2.9 U	2.9 U
SODIUM, TOTAL	4180000	4160000	4020000
THALLIUM, TOTAL	8.5 U	8.5 U	8.5 U
VANADIUM, TOTAL	1.6 U	1.6 U	1.6 U
ZINC, TOTAL	1 U	1 U	3.6

SEDIMENT ANALYTICAL RESULTS
FEBRUARY 1997
OPERABLE UNIT NO. 7 - SITE 28
MONITORING AND O&M SUPPORT, CTO-0367
TOTAL METALS

SAMPLE ID	28-SD01-97A	28-SD02-97A	28-SD03-97A
DATE SAMPLED	02/06/97	02/06/97	02/06/97
TOTAL METALS (mg/kg)			
ALUMINUM, TOTAL	850	1360	1120
ANTIMONY, TOTAL	2.9 U	3.1 U	3.2 U
ARSENIC, TOTAL	0.33 U	0.66	0.65
BARIUM, TOTAL	2.2	2.6	3.9
BERYLLIUM, TOTAL	0.1 U	0.1 U	0.11 U
CADMIUM, TOTAL	0.47 U	0.49 U	0.51 U
CALCIUM, TOTAL	138	239	227
CHROMIUM, TOTAL	1.8	2.9	3
COBALT, TOTAL	0.35 U	0.37 U	0.38 U
COPPER, TOTAL	2.7	22.2	11.9
IRON, TOTAL	664	1040	1180
LEAD, TOTAL	8.3	44.9	65
MAGNESIUM, TOTAL	241	344	341
MANGANESE, TOTAL	3.9	5.5	5.9
MERCURY, TOTAL	0.06 U	0.06 U	0.06 U
NICKEL, TOTAL	1.7 U	1.8 U	1.8 U
POTASSIUM, TOTAL	150	173	204
SELENIUM, TOTAL	0.31 U	0.33 U	0.33 U
SILVER, TOTAL	0.56 U	0.6 U	0.61 U
SODIUM, TOTAL	1070	1170	940
THALLIUM, TOTAL	0.33 U	0.35 U	0.35 U
VANADIUM, TOTAL	2.4	3.6	3.1
ZINC, TOTAL	3.8	7.1	14.7