06.07-01/27/97-01773

QUARTERLY MONITORING REPORT
OPERABLE UNIT NO. 5 – SITE 2

FOURTH QUARTER 1996 (OCT – DEC 96)

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0367

JANUARY 27, 1997

Prepared for:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
Norfolk, Virginia

Under the:

LANTDIV CLEAN program
Contract N62470-89-D-4814

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FOURTH QUARTER 1996 GROUNDWATER MONITORING REPORT

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DQOs	Data Quality Objectives
MCLs	maximum contaminant levels
MDL	method detection limit
NCWQS	North Carolina Water Quality Standards
NFESC	Naval Facilities Engineering Service Center
ROD	Record of Decision
TAL	target analyte list
TCL	target compound list
TDS	total dissolved solids
TOC	top-of-casing
TSS	total suspended solids
mg/L	milligrams per liter
µg/L	micrograms per liter
VOCs	volatile organic compounds

1.0 INTRODUCTION

The following quarterly monitoring report presents the sampling procedures and analytical findings, of the monitoring program at Operable Unit (OU) No. 5 (Site 2), Marine Corps Base (MCB) Camp Lejeune, North Carolina. This report describes the activities completed at Site 2 during the fourth quarter of calendar year 1996 and presents recommendations concerning the monitoring program.

1.1 Report Organization

This quarterly monitoring report is comprised of four text sections. Section 1.0 describes sampling program procedures and methodology. Section 1.0 also provides groundwater elevation data, groundwater flow direction, and various field observations. Analytical results and findings are presented in Section 2.0. A discussion of previous analytical findings versus the most recent results is also included within Section 2.0. Section 3.0 presents recommendations to improve the quarterly sampling program at Site 2. Finally, 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 quarterly report.

1.2 Quarterly Sampling Program

The fourth quarter sampling event commenced on October 1, 1996 and continued through October 11, 1996. The sampling program consisted of groundwater collection and analysis from each of the 11 shallow monitoring wells at Site 2. In addition to the shallow wells, one deep monitoring well and three water supply wells were also sampled as part of the quarterly monitoring effort. Figure 1-1 depicts the locations of both shallow and deep monitoring wells at Site 2; locations of the three water supply wells are depicted in Figure 1-2.

During the quarterly sampling event, a low flow purge and sampling technique was employed. The sampling methodology was developed in response to conversations with USEPA Region IV personnel in Athens, Georgia. Prior to groundwater purging, water level and total 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. Published information regarding base water supply wells HP-616, HP-646, and HP-647 was used to calculate the amount of water required to purge approximately three well volumes. Table 1-1 provides a summary of both monitoring well and supply well construction details.

A peristaltic pump, with the intake set two to four feet above the bottom of the well was used to purge each of the monitoring wells. While purging groundwater, a flow rate of less than 0.25 gallons per minute was maintained. Environmental samples were obtained directly from the pump discharge. Dedicated sections of polyethylene and silicon pump-head tubing were used during purge and sampling activities at each monitoring well. A minimum of three well volumes were purged from each monitoring well prior to sampling. Supply wells were permitted to pump at their maximum sustainable pumping capacity until a minimum of three well volumes had been purged. Measurements of pH, specific conductance, dissolved oxygen, temperature, and turbidity were recorded to ensure that groundwater characteristics had stabilized before sampling. These measurements were recorded in a field logbook and are provided in Table 1-2.

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 quarterly monitoring results and decision documents, the contaminants of concern were volatile organic compounds (VOCs) and selected metals. Groundwater samples were analyzed for full target compound list (TCL) organics, selected target analyte list (TAL) total metals, total suspended solids (TSS), and total dissolved solids (TDS). Samples were preserved at the time of collection with hydrochloric acid for volatile analyses, nitric acid for metal analyses, and sodium hydroxide for suspended and dissolved solid analyses. Table 1-3 provides a summary of requested analyses and groundwater samples submitted during the quarterly monitoring event. Groundwater samples were analyzed using various analytical methods, as provided in Table 1-3, and Level IV 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 1-4 provides the various analytical method detection limits and comparative state and federal groundwater quality standards.

Trip blanks were prepared 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 samples were cross-contaminated during storage and transportation to the laboratory.

Sample information, such as well number, sample identification, time and date of sample collection, samplers, analytical parameters, and required laboratory turn around time was recorded in a field logbook and on sample labels. Chain-of-custody documentation, provided in Attachment A, accompanied the groundwater samples to the laboratory. Chain-of-custody forms were 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 as Attachment B. The sample designation format used during the monitoring program at Site 2 is provided in Attachment C.

1.3 Groundwater Elevation and Flow Direction

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 both shallow and deep monitoring well casings. Groundwater measurements were recorded to the nearest 0.01-foot using an electric measuring tape. Table 1-5 provides a summary of water level measurements collected on August 8, 1996 (third quarter) and November 6, 1996 (fourth quarter). Figure 1-3 depicts the static elevations and approximate flow direction of groundwater at Site 2 based on the fourth quarter groundwater elevations. Groundwater was determined to generally flow north-northeasterly toward Overs Creek, a tributary of Northeast Creek. A drainage ditch that lies on both sides of the MCB, Camp Lejeune Railroad appears to have some affect upon groundwater flow particularly in the northern portion of the study area. To the east of monitoring well 2-GW09, a sloped embankment that runs parallel to the rail grade begins to become more pronounced. This rapid change in surface elevation may explain the more easterly component of groundwater flow from 2-GW09.

Localized groundwater flow, presented in Figure 1-3, should be considered an approximate interpretation of available elevation data. The monitoring wells installed during the 1984 Confirmation Study appear to have deteriorated during the past 12 years. The poor condition of these older monitoring wells and the recorded water level measurements suggest that the

groundwater elevation data may be unreliable. As a result, groundwater contours were estimated over portions of the study area adjacent to shallow monitoring wells 2-GW01 through 2-GW05.

1.4 Field Observations

The following field observations were noted during the fourth quarter sampling event. Recommendations regarding the field observations are presented in Section 3.0.

Monitoring wells at Site 2 were redeveloped during the third quarter of 1996. The wells were not redeveloped, however, prior to the most recent sampling event. The field observations made during redevelopment of the wells and subsequent sampling episodes suggest that some of the monitoring wells installed during 1984 are in poor condition. Five of the 11 shallow monitoring wells are now approximately 12 years old and are showing signs of deterioration both above and below grade. Recommendations pertaining to the five shallow monitoring wells installed during the Confirmation Study are discussed within the third quarter monitoring report. Similar observations were noted during fourth quarter sampling and are summarized below.

- The well screen and sand pack at deep monitoring well 2-GW03DW appear to have been clogged by bentonite clay. This assumption is based on higher than normal pH and turbidity readings, low recharge rates, and the presence of gray material suspended in groundwater samples collected from this well.

- The well screens and sand packs of some of the older shallow wells appear to have been clogged by fine grained material, limiting well recharge and sample collection.

- The protective steel casings and bollards have begun to rust and the paint has peeled on the wells installed during the 1984 Confirmation Study.

Water quality parameters measured at the time of sample collection, low recharge rates, and elevated turbidity readings suggest that a number of the monitoring wells have begun or continue to deteriorate below grade. Fine-grain material or bentonite clay may have clogged the screen and sandpack of deep monitoring well 2-GW03DW and shallow wells, 2-GW01, 2-GW02, and 2-GW04. The deterioration of these wells below grade or clogging of the well screen and sandpack may limit groundwater collection from only a restricted portion of the aquifer; possibly an uncontaminated portion. As a result, groundwater samples collected from these wells may not be representative of the entire screened portion of the aquifer.

2.0 ANALYTICAL RESULTS AND FINDINGS

The section which follows presents analytical results and findings from groundwater monitoring performed at Site 2 during the fourth quarter of 1996. The quarterly sampling program at Site 2 entailed the collection of groundwater samples from 11 shallow monitoring wells (2-GW01 through 2-GW11), one deep monitoring well (2-GW03DW), and three water supply wells (HP-616, HP-646, and HP-647). Analytical results from the monitoring program at Site 2 are provided in the paragraphs which follow. A summary of groundwater analytical results is provided in Table 2-1. A positive detection summary of VOCs, selected TAL metals, TDS, and TSS is provided in Table 2-2. Attachment D provides all the analytical results from the fourth quarter of 1996.

Two trip blanks accompanied the groundwater samples during field collection, shipment, and laboratory analysis. Methylene chloride was detected in one of the two trip blanks at a concentration of 0.9 micrograms per liter (µg/L). Methylene chloride is a common laboratory contaminant often detected among laboratory related quality assurance and quality control samples. Methylene chloride was not detected in any environmental sample; therefore, it is considered to be a laboratory artifact in the trip blank 02-TB02-96D. Analytical results from the two trip blanks are presented in Table 2-3.

2.1 Shallow Groundwater

Groundwater conditions within the upper portion of the surficial aquifer were evaluated through collection and analysis of samples obtained from each of the 11 shallow monitoring wells at Site 2 (refer to Table 1-2 for well construction details). The subsections which follow provide not only the most recent analytical data, but a comparison of those results versus previous investigative results.

2.1.1 Volatile Organic Compounds

Four volatile organic compounds (VOCs) were detected among samples obtained from two of the shallow monitoring wells at Site 2. As depicted in Figure 2-1, positive VOC detections were limited to shallow wells 2-GW03 and 2-GW07. Chlorobenzene, ethylbenzene, toluene, and xylenes (total) were detected at concentrations of 2.0 µg/L, 220 µg/L, 6.0 µg/L and, 2,100 µg/L in the sample obtained from monitoring well 2-GW03. None of the positive VOC concentrations exceeded the Federal Maximum Contaminant Level (MCL); however, the concentrations of ethylbenzene and xylenes (total) exceeded applicable North Carolina Water Quality Standards (NCWQS). Analytical results from the fourth quarter sampling event and a comparison of those results versus applicable groundwater standards are provided in Table 2-1.

The VOCs ethylbenzene and xylenes (total) have been detected in samples from monitoring well 2-GW03 at concentrations exceeding water quality standards during previous quarterly sampling events. Figures 2-2 and 2-3 depict ethylbenzene and total xylene concentrations detected in samples obtained from 2-GW03 since the inception of monitoring program activities at Site 2. Both VOCs have consistently been detected at levels exceeding applicable water quality standards in samples obtained from shallow monitoring well 2-GW03. The same VOCs were identified in the Record of Decision (ROD Baker, 1994a) as contaminants of concern, particularly among samples obtained from 2-GW03.

Benzene, styrene, and 1,1,2-trichloroethane have been detected in samples obtained from well 2-GW03 during previous sampling activities. Previous results have not indicated VOCs in any of

the adjacent shallow wells, suggesting that the observed contaminants remain in the southern portion of the study area. During the fourth quarter sampling event however, chlorobenzene was detected at 0.6 µg/L in a sample obtained from monitoring well 2-GW07. Based upon the potentiometric surface map, (refer to Figure 1-3) contaminants transported by groundwater should not migrate from monitoring well 2-GW03 toward 2-GW07. Analytical data collected to date suggests that a localized area of groundwater contamination exists near monitoring well 2-GW03 with little to no horizontal migration of contaminants. Future samples collected in the southern portion of the site will be required to confirm or disprove the migration of contaminants to 2-GW07 from the area surrounding 2-GW03.

Aside from the detections of contaminants in shallow monitoring wells 2-GW03 and 2-GW07, there were no other VOCs detected during the fourth quarter sampling event. Chloroform had been detected in samples obtained from monitoring well 2-GW06 during the second and third quarter sampling events of 1996. Chloroform is a common laboratory contaminant however, and may have been introduced during sample preparation. Evidence that confirms the presence of chloroform in groundwater at Site 2 will need to be provided during future sampling events.

2.1.2 Selected Total Metals

As presented in Table 2-2, target metals were detected in each of the 11 shallow groundwater samples submitted for analysis from Site 2. Barium and manganese were the most frequently detected metals in samples obtained from the shallow aquifer. Both barium and manganese were detected in each of the 11 shallow groundwater samples. Lead was detected in 7 of the 11 shallow groundwater samples. None of the positive metal detections exceeded either North Carolina standards or Federal MCLs.

Although none of the detected metals exceeded applicable groundwater standards during the fourth quarter sampling event, a number of metal detections among shallow groundwater samples have exceeded the NCWQS during previous sampling events at Site 2. Manganese has typically been the most frequently detected metal above screening standards; however, there were detections of lead and chromium in samples obtained from 2-GW03DW above applicable standards during the second quarter of 1996.

During the third quarter 1996 sampling event, a low flow purge and sample method was implemented at Site 2. The low flow method reduces the amount of suspended material in groundwater samples. These suspended materials, if not removed before preservation and analysis, can produce a high bias concentration of inorganic analytes in a sample. Analytes that are bound to the soil particles that enter the monitoring well will produce variations within groundwater samples. Since the low flow methods have been applied at Site 2, none of the shallow groundwater samples have exhibited concentrations of metals which exceed the NCWQS. This suggests that the detections of total metals during previous monitoring events has been more a result of sampling methods rather than actual groundwater chemistry.

2.1.3 Suspended and Dissolved Solids

Both TSS and TDS analyses were performed for each of the 11 shallow groundwater samples obtained at Site 2. Suspended solids were reported at concentrations of 9 and 14 milligrams per liter (mg/L) in 2 of the 11 samples. Dissolved solids were reported in each of the

shallow groundwater samples at concentrations between 84 and 180 mg/L. None of the dissolved solid concentrations exceeded the 500 mg/L NCWQS.

2.2 Deep Groundwater

Groundwater conditions within the deeper, Castle Hayne Aquifer at Site 2 were evaluated through collection and analysis of samples from one deep monitoring well (2-GW03DW) and three water supply wells (HP-616, HP-646, and HP-647). The subsections which follow provide not only the most recent analytical data, but a comparison of those results versus previous investigative results.

2.2.1 Volatile Organic Compounds

There were no volatile contaminants detected among the deep groundwater samples obtained during the fourth quarter sampling event. The lack of positive detections in samples obtained from the three supply wells suggests that VOCs have not migrated to those locations.

Previous sampling results from deep monitoring well 2-GW03DW have exhibited positive detections of both toluene and xylenes (total) below 1.0 µg/L. These results suggest that contaminants may have begun to migrate vertically from the surficial aquifer near monitoring well 2-GW03. During the third sampling quarter of 1995 toluene was detected in 2-GW03DW at a concentration of 0.3 µg/L, and xylenes (total) were detected at a concentration of 0.1 µg/L during the fourth quarter of 1995. None of these positive detections in the deep aquifer at Site 2 exceeded applicable water quality standards. During 1996, there have been no detections of any VOCs in samples obtained from deep monitoring well 2-GW03DW.

2.2.2 Selected Total Metals

Both barium and manganese were detected among samples obtained from the three supply wells and the deep monitoring well at Site 2. The detections of barium in the deeper aquifer ranged from 3.5 µg/L to 45.8 µg/L while manganese concentrations ranged from 9.1 µg/L to 19.5 µg/L. Lead was detected in water supply well HP-616 at a concentration of 0.73 µg/L. Beryllium, cadmium, and chromium were not detected in any of the samples obtained from the supply wells, or in the sample obtained from deep monitoring well 2-GW03DW. None of the detected metals exceeded applicable state or federal water quality standards. A complete positive detection summary of total metals detected in groundwater is provided in Table 2-2.

During previous quarterly sampling events, manganese was detected in samples obtained from well 2-GW03DW at concentrations which exceeded applicable state standards. Concentrations of manganese have ranged from 11 to 1,290 µg/L. As cited in the 1996 third quarter groundwater monitoring report, bentonite clay from well construction is suspected to have clogged the well screen and sandpack of deep monitoring well 2-GW03DW. Bentonite clay, as a result, may also have been introduced into groundwater samples obtained from the deep well. Clay minerals are made of sheetlike units joined by very weak bonding forces, relative to hydrogen and other ion bonding. Various ion substitutions for silica and aluminum in the clay are likely to take place in the presence of water, resulting in a relatively large cation exchange capacity and affinity for metallic ions (Bowels, 1984). An abundance of available metallic ions, particularly manganese, from the surrounding geologic formation may then be attracted to and bond with the bentonite clay. The presence of bentonite in groundwater samples may, therefore, falsely compound total metal analytical results.

2.2.3 Suspended and Dissolved Solids

Both TSS and TDS analyses were performed for each of the four deep groundwater samples obtained at Site 2. Suspended solids were detected in monitoring well 2-GW03DW at 20 mg/L. Dissolved solids were reported in each of the deep groundwater samples, at concentrations ranging from 200 to 800 mg/L. Only the detection of 800 mg/L from well 2-GW03DW exceeded the NCWQS of 500 mg/L. The dissolved solids concentration in monitoring well 2-GW03DW also exceeded the NCWQS during the third quarter sampling event. The concentration of dissolved solids in deep monitoring well 2-GW03DW may substantiate the premise that bentonite clay has been artificially introduced to the surrounding geologic formation and the well screen; consequently, the presence of bentonite clay may be reflected in sample analyses. As mentioned, previous groundwater analytical results from deep monitoring well 2-GW03DW confirm the presence of both suspended and dissolved solids at higher than typical concentrations. Suspended solids have been reported at concentrations ranging from 9 to 42,000 mg/L. Four of the five previous dissolved solid analytical results exceeded the NCWQS of 500 mg/L; TDS concentrations have ranged between 5.6 and 1,000 mg/L.

3.0 RECOMMENDATIONS

The ROD for Site 2 stipulates that groundwater samples from both on-site monitoring and nearby supply wells be collected quarterly (Baker, 1994a). Possible off-site migration of known contaminants is monitored through quarterly groundwater sample collection and analysis. Groundwater monitoring was implemented to ensure that potential human and ecological receptors would not be exposed to known site contaminants.

Based upon the observations and findings presented in Sections 1.0 and 2.0 of this report, the subsections which follow provide recommendations for improvement of the monitoring program at Site 2. If non-significant changes are made to a component of the selected remedy described in the ROD (Baker, 1994a), they should be recorded in a post-decision document file; if significant changes are made, these changes will need to be documented in an Explanation of Significant Differences.

Some of the recommendations discussed below were initially presented in the third quarter groundwater monitoring report. They are repeated here because they remain applicable to the site and it is the intent of this report to provide a thorough listing of recommendations for the sampling program at Site 2.

3.1 Adjust Groundwater Sampling Scheme

The following subsections discuss the discontinuation of groundwater sample collection at two monitoring wells and three nearby water supply wells. The discussion of supply wells and monitoring wells are presented separately.

3.1.1 Discontinue Sampling Supply Wells HP-616, HP-646, and HP-647

It is recommended that water supply wells, HP-616, HP- 646, and HP-647 be eliminated from the monitoring program at Site 2. The supply wells are located more than 1,200 feet from the study area and have been sampled over six consecutive quarters with only one positive detection of a VOC (methylene chloride). Methylene chloride was detected in a sample obtained from HP-616 at a concentration of 1 µg/L during the third quarter of 1996. As mentioned, this compound is a common laboratory contaminant which is often introduced to the sample during preparation or analysis of the environmental samples. None of the VOC and total metal detections among any of the groundwater samples obtained from the supply wells exceeded applicable water quality standards. In addition, supply wells at MCB Camp Lejeune are currently sampled as part of an ongoing monitoring program administered by MCB Camp Lejeune. Based upon this information, it is recommended that the identified supply wells be eliminated from the sampling program.

3.1.2 Discontinue Sampling Shallow Monitoring Wells

It is recommended that monitoring wells 2-GW06 and 2-GW09 be eliminated from the sampling program at Site 2. As depicted in Figure 1-3, the two monitoring wells are not positioned hydraulically down gradient of the suspected area of groundwater contamination at Site 2. Methylene chloride and chloroform, contaminants believed to be the result of laboratory sample preparation, have each been detected twice among samples obtained from 2-GW06 during the six quarters of sampling. No other VOCs have been detected in samples obtained from both 2-GW06 and 2-GW09 during the six sampling events that have taken place at Site 2. Additional information

gained from monitoring wells 2-GW06 and 2-GW09 is not expected to provide relevant data in support of the decision making process at Site 2. It is therefore recommended that the identified monitoring wells be eliminated from the sampling program.

3.2 Modify Sampling Frequency

The majority of groundwater samples obtained from Site 2 have exhibited little or no contamination during the previous six sampling events. Only two contaminants, ethylbenzene and xylenes (total), have consistently been detected above state water quality standards in 1 of the 12 monitoring wells. Ethylbenzene and xylenes (total) were detected in the same well, 2-GW03, and at similar concentrations during the 1993 RI (Baker, 1994b). Ethylbenzene was detected in shallow monitoring well 2-GW03 during the 1984 Confirmation Study (ES&E, 1990). In addition, there is little evidence to suggest that contaminants have migrated from the area immediately surrounding 2-GW03. Based upon this information, a reduction in the number of yearly sampling events from four to two is recommended. Semiannual sampling will sufficiently monitor the groundwater conditions at Site 2.

3.3 Modify Sample Analyses

It is recommended that the sampling program for Site 2 be modified such that total metals, TDS, and TSS are eliminated from the program. Although, positive detections of metals and total dissolved solids have been greater than applicable North Carolina standards, these analyses are not necessary data requirements for the groundwater monitoring program at Site 2. There is no history or evidence to suggest that metal disposal activities may have occurred at Site 2. The sediments of the North Carolina coastal plain are naturally rich in metals, especially iron and manganese. It is not uncommon to detect total metal concentrations in groundwater at MCB Camp Lejeune that are greater than the applicable water quality standards. The analyses of total dissolved and total suspended solids should be eliminated from the program because these results are not required to determine contaminant migration throughout Site 2.

3.4 Abandon Deep Monitoring Well And Replace With Intermediate Well

Deep monitoring well 2-GW03DW is situated adjacent to shallow monitoring well 2-GW03. The screened portion of 2-GW03DW is below a semi-confining unit that separates the surficial and Castle Hayne aquifers. As provided in Section 2.0, both ethylbenzene and total xylenes were detected at concentrations exceeding applicable water quality standards in shallow monitoring well 2-GW03. Although both ethylbenzene and total xylenes were detected at concentrations below 1.0 µg/L in 2-GW03DW during a previous monitoring event, their presence has not been confirmed by additional positive detections. Field observations suggest that bentonite clay, installed during well construction, has begun to enter the screen and sandpack of deep monitoring well 2-GW03DW. The sandpack is presumably being clogged with bentonite, limiting the ability of groundwater to enter the well screen. Bentonite clay, as a result, may also have been introduced into groundwater samples obtained from the deep well causing total dissolved solids and metal concentrations to be detected above the North Carolina standards. The bentonite may falsely bias high total metal and dissolved solid results because naturally occurring metals from the surrounding formation are attracted to the clay particles and may adhere to their surfaces by a weak ionic bond.

Based on this information, it is recommended that well 2-GW03DW be abandoned according to accepted procedures. An intermediate well, set immediately above the semi-confining unit, should

then be installed to replace the deep monitoring well. The intermediate well should be located adjacent to shallow monitoring well 2-GW03 and extend to a depth of approximately 60 feet below ground surface. Groundwater samples collected at this depth will determine if contaminants have migrated from the upper portion of the surficial aquifer to the lower portion of the surficial aquifer immediately above the semi-confining unit. If contaminants are identified in the lower portion of the surficial aquifer, the need for another deep monitoring well, screened below the semi-confining unit, in the Castle Hayne aquifer can be determined.

3.5 Abandon Shallow Monitoring Wells

Recorded field observations suggest that three of the five monitoring wells installed at Site 2 during 1984 have begun to deteriorate and that both well screen and sandpack are clogged with fine-grained material from the surrounding formation. During redevelopment, monitoring wells 2-GW01 and 2-GW04 did not recharge adequately and often the extracted groundwater appeared very turbid. Well 2-GW02 was not redeveloped due to an insufficient amount of groundwater in the screened portion of the well casing. As a result of deterioration or obstruction, environmental samples could possibly be obtained from only an uncontaminated interval of the surficial aquifer where groundwater is permitted to enter the well screen, inaccurately representing true groundwater conditions. Based upon this information, it is recommended that monitoring wells 2-GW01, 2-GW02, and 2-GW04 be abandoned according to accepted procedures.

3.6 Maintain Well Security and Aesthetics

As discussed, shallow monitoring wells that were installed during the 1984 Confirmation Study have begun to show signs of deterioration. The bollards and protective casings of wells 2-GW01 through 2-GW05 have developed peeling paint and rust. In addition, a number of the padlocks used to secure the protective steel covers are either missing or no longer function properly. Both the usability and security of each monitoring well should be maintained if they are going to remain reliable groundwater sample collection points in the future. As suggested, the bollards and well casings should be painted with a weather and rust resistant paint. New padlocks that operate with a universal key should be installed on each of the monitoring wells at Site 2.

4.0 REFERENCES

Baker Environmental, Incorporated (Baker). 1994a. Record of Decision for Operable Unit No. 5 (Site 2), Marine Corps Base Camp Lejeune, North Carolina. Final. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk, Virginia.

Baker Environmental, Incorporated (Baker). 1994b. Remedial Investigation Report for Operable Unit No. 5 (Site 2), Marine Corps Base Camp Lejeune, North Carolina. Final. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk, Virginia.

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TABLES

TABLE 1-1

SUMMARY OF WELL CONSTRUCTION DETAILS
OPERABLE UNIT NO. 5 - SITE 2
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, bgs)	Well Depth (feet, bgs)	Screen Interval Depth (feet, bgs)	Depth to Sand Pack (feet, bgs)	Depth to Bentonite (feet, bgs)	Stick-Up (feet, ags)
2-GW01	1984	34.15	32.30	NA	25.0	10.0 to 25.0	NA	NA	2.0
2-GW02	1984	34.15	31.90	NA	25.0	10.0 to 25.0	NA	NA	NA
2-GW03	1984	35.40	33.00	NA	25.0	10.0 to 25.0	NA	NA	NA
2-GW03DW	1993	36.07	33.10	100.0	100.0	90.0 to 100.0	85.0	83.0	3.0
2-GW04	1984	32.73	30.70	NA	25.0	10.0 to 25.0	NA	NA	NA
2-GW05	1984	33.72	31.80	NA	25.0	10.0 to 25.0	NA	NA	NA
2-GW06	1993	34.40	31.8	12.5	12.5	2.6 to 12.6	1.5	0.5	2.6
2-GW07	1993	34.03	31.6	16.0	13.0	3.0 to 13.0	2.0	1.0	2.4
2-GW08	1993	34.92	31.90	12.5	12.5	2.5 to 12.5	1.5	0.5	3
2-GW09	1993	35.02	32.60	13.0	13.0	3.0 to 13.0	2.0	1.0	2.4
2-GW10	1994	32.28	32.47	15.0	13.5	3.5 to 13.5	2.5	1.5	3.5
2-GW11	1994	35.20	33.94	15.0	14.0	1.0 to 14.0	3.0	2.0	3
HP-616[1]	1942	NA	33.30	NA	170.0	95.0 to 115.0	NA	NA	NA
		NA	NA	NA	NA	130.0 to 140.0	NA	NA	NA
		NA	NA	NA	NA	160.0 to 170.0	NA	NA	NA
HP-646[1]	1971	NA	26.00	NA	270.0	90.0 to 100.0	NA	NA	NA
		NA	NA	NA	NA	240.0 to 250.0	NA	NA	NA
		NA	NA	NA	NA	255.0 to 265.0	NA	NA	NA
HP-647[1]	1970	NA	33.00	NA	200.0	105.0 to 115.0	NA	NA	NA
		NA	NA	NA	NA	138.0 to 143.0	NA	NA	NA
		NA	NA	NA	NA	175.0 to 190.0	NA	NA	NA

Notes:

[1] Water Supply Well
msl = Mean sea level
bgs = Below ground surface
NA = Information not available
ags = Above ground surface

TABLE 1-2

SUMMARY OF GROUNDWATER FIELD PARAMETERS
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Number	Well Volumes	Field Parameters				
		Dissolved Oxygen (mg/L)	Specific Conductance (µmhos/cm)	Temperature (°C)	pH (S.U.)	Turbidity (N.T.U.)
2-GW01 10/1/96	0	2.2	242.3	23.5	4.6	128.5
	1.0	3.2	226.8	23.5	4.5	18
	2.0	5.0	230.8	23.3	4.44	3.4
	3.0	4.0	230.8	23.4	4.51	2
2-GW02 10/1/96	0	1.8	212.5	24.8	5.2	>200
	1.0	1.6	210.3	24.9	5.28	6
	2.0	1.8	165.3	24.8	5.28	>200
2-GW03 10/1/96	0	1.8	180.9	21.6	5.1	2.0
	1.0	1.6	195.8	20.8	4.98	3.0
	2.0	3.2	180.8	20.6	4.99	2.5
	3.0	4.4	162.0	20.8	5.08	1.9
2-GW03DW 10/2/96	0	2.2	327.0	18.9	12.0	10.0
	1.0	1.8	332.3	18.7	11.9	9.0
	2.0	2.0	332.0	18.6	11.9	19.0
	3.0	2.2	343.3	18.6	12.0	110.0
2-GW04 10/1/96	0	1.8	168.9	23.7	5.45	8.5
	1.0	4.0	159.3	23.5	5.52	3.1
	2.0	4.0	158.3	23.8	5.49	1.3
	3.0	4.0	158.8	23.5	5.45	1.8
2-GW05 10/1/96	0	2.0	311.9	22.8	5.03	>200
	1.0	2.4	303.9	21.9	5.02	57.5
	2.0	2.0	300.9	21.9	4.87	64.4
	3.0	2.0	303.8	21.9	4.98	3.7
2-GW06 10/2/96	0	1.6	289.8	20.8	4.16	16.7
	1.0	2.6	280.8	21.4	4.16	25.0
	2.0	2.0	294.8	21.4	4.25	4.0
	3.0	1.4	289.8	21.4	4.35	5.7
2-GW07 10/2/96	0	2.0	195.9	23.1	5.32	13.1
	1.0	2.0	276.9	23.4	5.39	13.5
	2.0	1.8	273.8	23.2	5.48	5.3
	3.0	2.4	272.8	23.1	5.34	8.0
2-GW08 10/2/96	0	1.6	163.8	21.6	4.33	5.3
	1.0	1.4	198.8	21.7	4.11	12.2
	2.0	2.8	223.8	21.3	4.07	2.8
	3.0	4.0	205.8	21.6	4.15	1.5

TABLE 1-2 (Continued)

SUMMARY OF GROUNDWATER FIELD PARAMETERS
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Number	Well Volumes	Field Parameters				
		Dissolved Oxygen (mg/L)	Specific Conductance (µmhos/cm)	Temperature (°C)	pH (S.U.)	Turbidity (N.T.U.)
2-GW09 10/3/96	0	2.0	339.5	20.0	3.99	4.0
	1.0	2.6	282.2	21.0	4.27	4.0
	2.0	1.8	326.5	20.9	4.27	5.7
	3.0	2.0	364.6	20.8	4.26	3.5
2-GW10 10/1/96	0	2.0	348.9	24.0	6.11	5.1
	1.0	2.0	375.9	24.3	6.14	2.2
	2.0	2.4	367.9	24.2	6.21	3.2
	3.0	2.0	371.8	24.0	6.23	4.1
2-GW11 10/1/96	0	1.6	356.8	23.6	5.61	12.0
	1.0	1.4	305.8	24.0	5.52	2.2
	2.0	1.4	275.9	23.8	5.45	1.0
	3.0	1.6	263.0	23.8	5.5	1.1
HP-616 (Supply Well) 10/2/96	1.0	1.2	380.8	18.4	7.47	0.6
	2.0	1.2	378.8	18.2	7.53	0.4
	3.0	1.0	379.8	18.3	7.6	0.4
	4.0	1.0	378.8	18.4	7.52	0.4
	5.0	1.0	376.8	18.5	7.47	0.5
HP-646 (Supply Well) 10/2/96	1.0	4.8	400.8	18.1	7.62	0.5
	2.0	4.8	403.8	17.9	7.68	0.1
	3.0	4.8	400.8	17.9	7.68	0.5
	4.0	4.8	396.8	17.9	7.62	0.5
	5.0	5.0	402.8	17.8	7.61	0.5
HP-647 (Supply Well) 10/2/96	0	2.2	512.0	22.5	5.88	2.2
	1.0	1.8	476.7	21.7	5.87	1.8
	1.5	2.0	470.0	21.3	5.9	2.0
	2.0	2.2	468.5	20.8	5.94	2.2
	2.5	2.25	473.0	20.7	5.97	2.25
	3.0	2.25	477.1	20.8	5.99	2.25

Notes:

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

TABLE 1-3

GROUNDWATER SAMPLING SUMMARY
OPERABLE UNIT NO.5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample Location	Media	TCL Volatiles[1]	Selected TAL Metals[2]	Total Dissolved Solids[3]	Total Suspended Solids[3]	Sample Identification
2-GW01	GW	X	X	X	X	02-GW01-96D
2-GW02	GW	X	X	X	X	02-GW02-96D
2-GW03	GW	X	X	X	X	02-GW03-96D
2-GW03DW	GW	X	X	X	X	02-GW03DW-96D
2-GW04	GW	X	X	X	X	02-GW04-96D
2-GW05	GW	X	X	X	X	02-GW05-96D
2-GW06	GW	X	X	X	X	02-GW06-96D
2-GW07	GW	X	X	X	X	02-GW07-96D
2-GW08	GW	X	X	X	X	02-GW08-96D
2-GW09	GW	X	X	X	X	02-GW09-96D
2-GW10	GW	X	X	X	X	02-GW10-96D
2-GW11	GW	X	X	X	X	02-GW11-96D
HP-616[4]	GW	X	X	X	X	02-PRW616-96D
HP-646[4]	GW	X	X	X	X	02-PRW646-96D
HP-647[4]	GW	X	X	X	X	02-PRW647-96D

Notes:

[1] Target Compound List Organics by Environmental Protection Agency (EPA) Method 8260.
[3] Selected Target Analyte List Metals (Barium, Beryllium, Cadmium, Chromium, Lead and Manganese) by Solid Waste Method 6010.
[3] Total Suspended and Dissolved Solids by EPA Method 160.
[4] Water Supply Well

X = Requested Analysis

TABLE 1-4

ANALYTICAL METHOD DETECTION LIMITS
OPERABLE UNIT NO.5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Parameter	Analytical Method	MDL	NCWQS	MCL
Volatile Organics µg/L:				
Chloromethane	8260	0.5	NA	NA
Vinyl Chloride	8260	0.5[1]	0.015	2
Bromomethane	8260	0.5	NA	NA
Chloroethane	8260	0.5	NA	NA
1,1-dichloroethene	8260	0.5	7	7
Acetone	8260	2	700	NA
Carbon Disulfide	8260	2	700	NA
Methylene Chloride	8260	0.5	5	5
1,2-dichloroethene (Total)	8260	0.5	70	70
1,1-dichloroethane	8260	0.5	700	NA
2-butanone	8260	2	NA	NA
Chloroform	8260	0.5[1]	0.19	100
1,1,1-trichloroethane	8260	0.5	200	200
Carbon Tetrachloride	8260	0.5[1]	0.3	5
Benzene	8260	0.5	1	5
1,2-dichloroethane	8260	0.5[1]	0.38	5
Trichloroethene	8260	0.5	NA	5
1,2-dichloropropane	8260	0.5	0.56	5
Bromodichloromethane	8260	0.5	0.6	100
Cis-1,3-dichloropropene	8260	0.5	NA	NA
4-methyl-2-pentanone	8260	2	NA	NA
Toluene	8260	0.5	1000	1000
Trans-1,3-dichloropropene	8260	0.5[1]	0.2	NA
1,1,2-trichloroethane	8260	0.5	NA	5
Tetrachloroethene	8260	0.5	0.7	5
2-hexanone	8260	2	NA	NA
Dibromochloromethane	8260	0.5	NA	NA
Chlorobenzene	8260	0.5	50	100
Ethylbenzene	8260	0.5	29	700
Xylene, Total	8260	0.5	530	10000
Styrene	8260	0.5	100	100
Bromoform	8260	0.5[1]	0.19	100
1,1,2,2-tetrachloroethane	8260	0.5	NA	NA

TABLE 1-4 (Continued)

ANALYTICAL METHOD DETECTION LIMITS
OPERABLE UNIT NO.5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Parameter	Analytical Method	MDL	NCWQS	MCL
Metals (µg/L):				
Barium, Total	6010A	1.4	2000	2000
Beryllium, Total	6010A	0.7	NA	4
Cadmium, Total	6010A	2.6	5	5
Chromium, Total	6010A	3.3	50	100
Lead, Total	7421	1.2	15	15
Manganese, Total	6010A	1.6	NA	50
Wet Chemistry (mg/L):				
Total Dissolved Solids	160.1	10	500	500
Total Suspended Solids	160.2	5	NA	NA

Notes:

(1) Method Detection Limit greater than North Carolina Water Quality Standard

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.)
MDL = Method Detection Limit
NA = standard not available
NCWQS = North Carolina Water Quality Standards. Values Applicable to Groundwater (North Carolina Administrative Code, Title 15A, Subchapter 2L).
mg/L = milligrams per liter or parts per million
µg/L = micrograms per liter or parts per billion

TABLE 1-5

SUMMARY OF WATER LEVEL MEASUREMENTS
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Identification	Reference Elevation [1]	SWL (August 8, 1996)	SWE (August 8, 1996)	SWL (Nov. 6, 1996)	SWE (Nov. 6, 1996)
2-GW01	34.15	7.13	27.02	7.34	26.81
2-GW02	34.15	25.51	8.64	24.43	9.72
2-GW03	35.40	15.17	20.23	6.76	28.67
2-GW03DW	36.07	47.71	-11.64	34.56	1.51
2-GW04	32.73	11.12	21.61	6.72	26.01
2-GW05	33.72	15.48	18.24	9.37	24.35
2-GW06	34.40	2.79	31.61	3.85	30.55
2-GW07	34.03	3.97	30.06	4.78	29.25
2-GW08	34.92	3.18	31.74	3.88	31.04
2-GW09	35.02	3.60	31.42	4.95	30.07
2-GW10	32.28	4.99	27.29	NR	NR
2-GW11	35.20	6.23	28.97	6.84	28.36

Notes:

[1] Top of well casing in feet above mean sea level (msl)
SWL = Static water level taken from top of well casing
SWE = Static water elevation in feet above msl
NR = Not recorded

TABLE 2-1

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
OPERABLE UNIT No. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction (units)	Detected Contaminants or Analytes	Comparison Criteria		Concentration Range		Location(s) of Maximum Detection	Detection Frequency	Detections Above		Qualitative Assessment of Positive Detections
		NCWQS	MCL	Min.	Max.			NCWQS	MCL	
Volatile Organics (µg/L)	Toluene	1,000	1,000	6.0	6.0	GW03	1/15	0/15	0/15	Did not exceed screening standards
	Ethylbenzene	29	700	220	220	GW03	1/15	1/15	0/15	1 Exceeds NCWQS
	Chlorobenzene	50	100	0.6	2.0	GW03	2/15	0/15	0/15	Did not exceed screening standards
	Xylene (Total)	530	10,000	2,100	2,100	GW03	1/15	1/15	0/15	1 Exceeds NCWQS
Total Metals (µg/L)	Barium, Total	2,000	2,000	3.5	422	GW03DW	15/15	0/15	0/15	None exceed screening standards
	Lead, Total	15	15	0.72	2.80	GW02	7/15	0/15	0/15	None exceed screening standards
	Manganese, Total	50	NE	1.2	40.1	GW05	15/15	0/15	NA	None exceed screening standards
Wet Chemistry (mg/L)	Total Dissolved Solids	500	NE	84	800	GW03DW	15/15	1/15	NA	1 Exceeds NCWQS
	Total Suspended Solids	NE	NE	9	20	GW03DW	14/15	NA	NA	No screening standards applicable

Notes:

- Concentrations presented in micrograms per liter (µg/L) or parts per billion for organic and metal results, wet chemistry results presented in milligrams per liter (mg/L) or parts per million.

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 - Not applicable

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

NE - Not Established

TABLE 2-2
POSITIVE DETECTIONS IN GROUNDWATER
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	02-GW01-96D	02-GW02-96D	02-GW03-96D	02-GW03DW-96D	02-GW04-96D	02-GW05-96D	02-GW06-96D	02-GW07-96D
DATE SAMPLED	10/01/96	10/01/96	10/01/96	10/03/96	10/01/96	10/01/96	10/02/96	10/02/96
VOLATILES (ug/L)								
TOLUENE	0.5 U	0.5 U	6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	0.5 U	0.5 U	2	0.5 U	0.5 U	0.5 U	0.5 U	0.6
ETHYLBENZENE	0.5 U	0.5 U	220	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
XYLENE (TOTAL)	0.5 U	0.5 U	2100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TOTAL METALS (ug/L)								
BARIUM, TOTAL	48.5	42.6	45.8	422	80.6	96.1	86	90.2
LEAD, TOTAL	1.1	2.8	0.7 U	0.7 U	0.7 U	0.7 U	0.72	0.99
MANGANESE, TOTAL	36.6	4.8	9.1	1.2	12.6	40.1	12.8	30.6
WET CHEMISTRY (mg/L)								
TOTAL DISSOLVED SOLIDS	140	100	92	800	84	170	150	150
TOTAL SUSPENDED SOLIDS	5 U	5 U	5 U	20	5 U	9	5 U	5 U

NOTES
ug/L = micrograms per liter
mg/L = miligrams per liter
U = not detected

TABLE 2-2
POSITIVE DETECTIONS IN GROUNDWATER
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	02-GW08-96D	02-GW09-96D	02-GW10-96D	02-GW11-96D	02-PRW616-96D	02-PRW646-96D	02-PRW647-96D
DATE SAMPLED	10/02/96	10/03/96	10/01/96	10/01/96	10/02/96	10/02/96	10/02/96
VOLATILES (ug/L)							
TOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ETHYLBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
XYLENE (TOTAL)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TOTAL METALS (ug/L)							
BARIUM, TOTAL	65.2	46.9	40.3	75	5.6	3.5	8.5
LEAD, TOTAL	1.9	1	0.7 U	0.7 U	0.73	0.7 U	0.7 U
MANGANESE, TOTAL	34.1	23.4	11.4	29.9	18.3	19.5	18.4
WET CHEMISTRY (mg/L)							
TOTAL DISSOLVED SOLIDS	84	170	180	140	200	230	210
TOTAL SUSPENDED SOLIDS	5 U	5 U	14	5 U	5 U	5 U	5 U

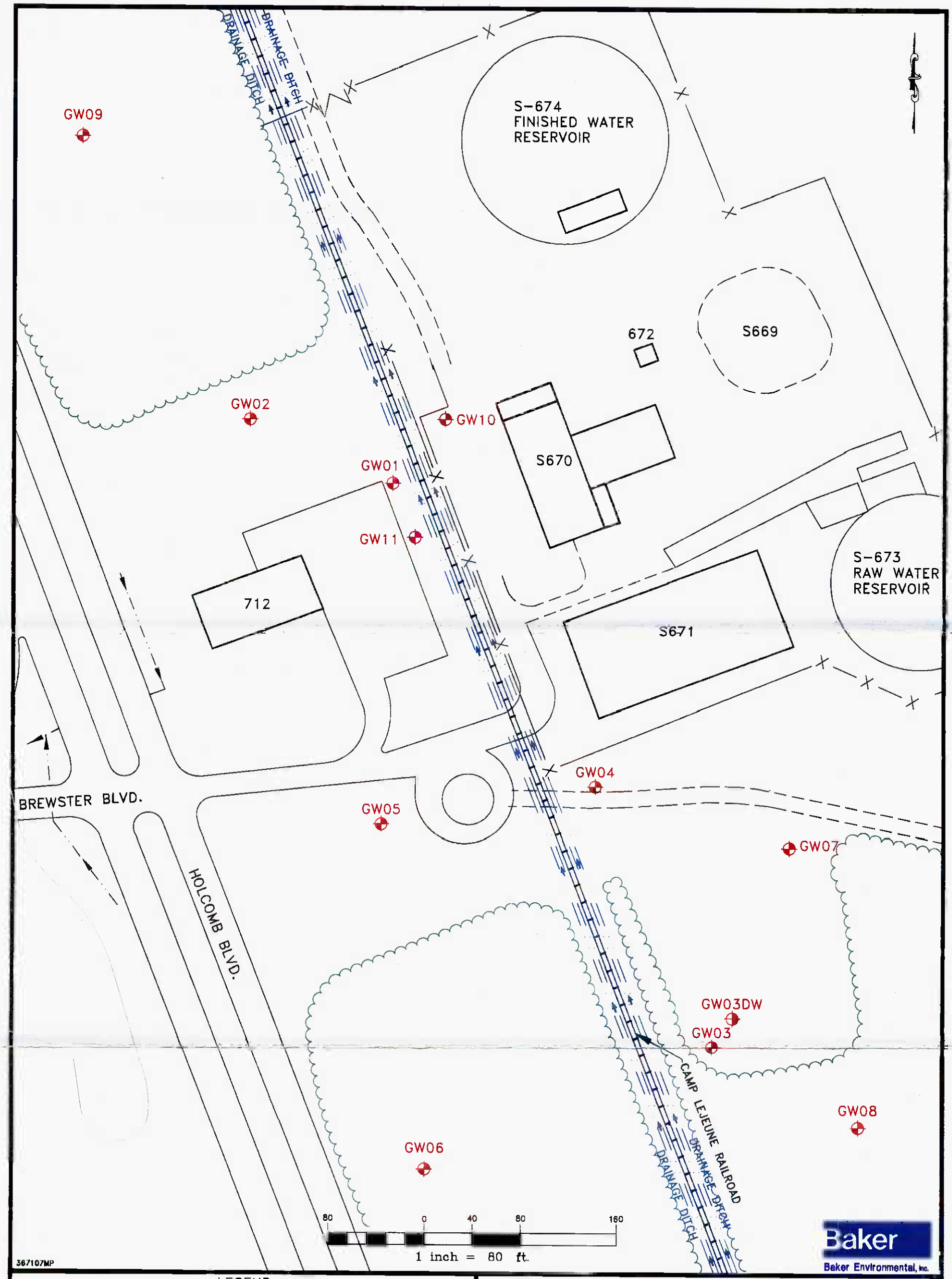
NOTES
ug/L = micrograms per liter
mg/L = miligrams per liter
U = not detected

TABLE 2-3
TRIP BLANK ANALYTICAL RESULTS
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	02-TB01-96D	02-TB02-96D
DATE SAMPLED	10/02/96	10/04/96
VOLATILES (ug/L)		
CHLOROMETHANE	0.5 U	0.5 U
VINYL CHLORIDE	0.5 U	0.5 U
BROMOMETHANE	0.5 U	0.5 U
CHLOROETHANE	0.5 U	0.5 U
1,1-DICHLOROETHENE	0.5 U	0.5 U
ACETONE	2 U	2 U
CARBON DISULFIDE	2 U	2 U
METHYLENE CHLORIDE	0.5 U	0.9
1,2-DICHLOROETHENE (TOTAL)	0.5 U	0.5 U
1,1-DICHLOROETHANE	0.5 U	0.5 U
2-BUTANONE	2 U	2 U
CHLOROFORM	0.5 U	0.5 U
1,1,1-TRICHLOROETHANE	0.5 U	0.5 U
CARBON TETRACHLORIDE	0.5 U	0.5 U
BENZENE	0.5 U	0.5 U
1,2-DICHLOROETHANE	0.5 U	0.5 U
TRICHLOROETHENE	0.5 U	0.5 U
1,2-DICHLOROPROPANE	0.5 U	0.5 U
BROMODICHLOROMETHANE	0.5 U	0.5 U
CIS-1,3-DICHLOROPROPENE	0.5 U	0.5 U
4-METHYL-2-PENTANONE	2 U	2 U
TOLUENE	0.5 U	0.5 U
TRANS-1,3-DICHLOROPROPENE	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE	0.5 U	0.5 U
TETRACHLOROETHENE	0.5 U	0.5 U
2-HEXANONE	2 U	2 U
DIBROMOCHLOROMETHANE	0.5 U	0.5 U
CHLOROBENZENE	0.5 U	0.5 U
ETHYLBENZENE	0.5 U	0.5 U
XYLENE (TOTAL)	0.5 U	0.5 U
STYRENE	0.5 U	0.5 U
BROMOFORM	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	0.5 U	0.5 U

NOTES
ug/L = micrograms per liter
U = not detected

FIGURES



LEGEND

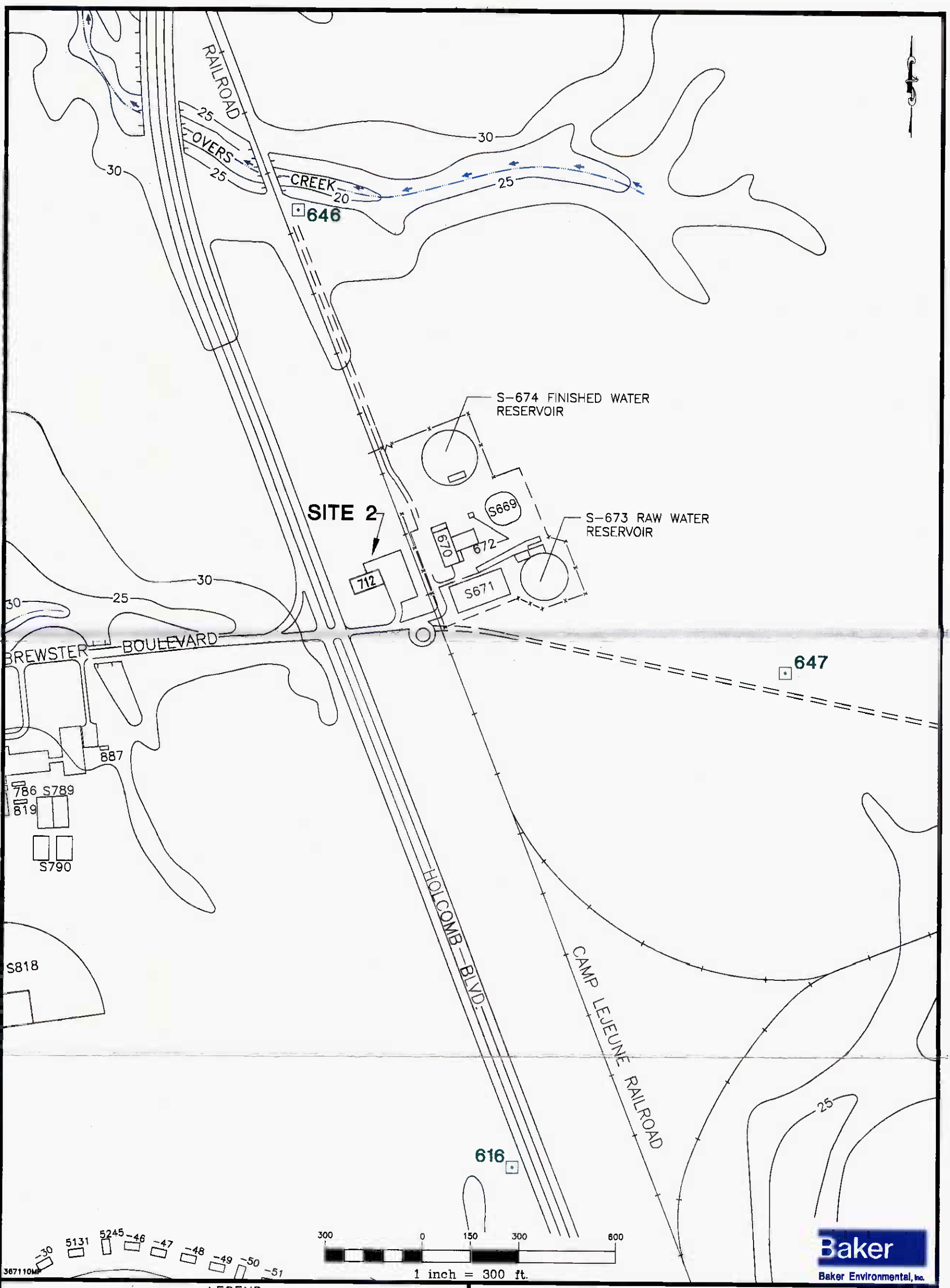
- GW02 SHALLOW MONITORING WELL
- GW03DW DEEP MONITORING WELL
- DIRECTION OF SURFACE WATER FLOW
- RAILROAD
- TREE LINE

SOURCE: LANTDIV, FEB. 1992

FIGURE 1-1
MONITORING WELL LOCATION MAP
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO - 0367

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

01772TTRIV



LEGEND

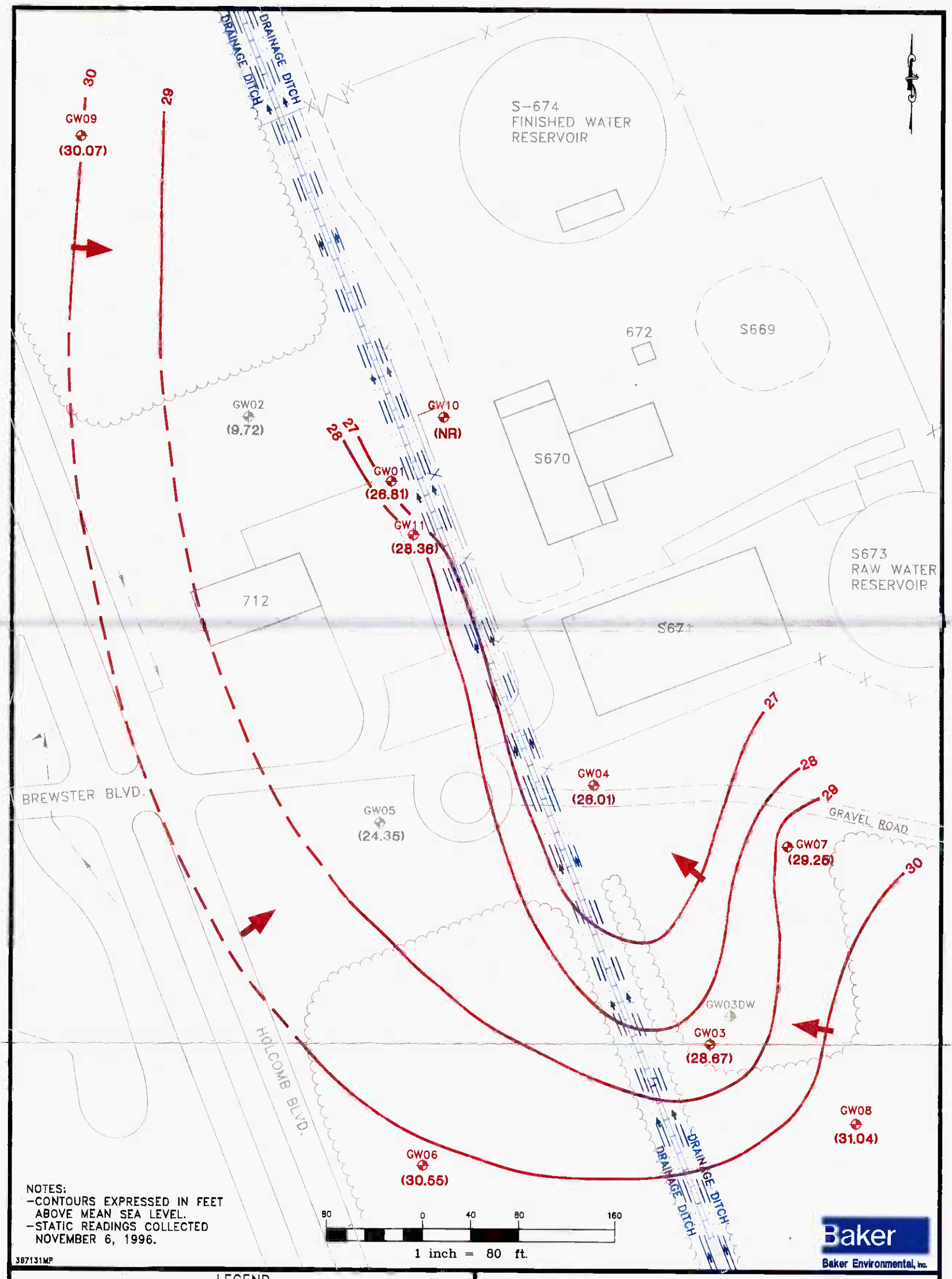
616 ⊡ WATER SUPPLY WELL

→ DIRECTION OF SURFACE WATER

SOURCE: LANTDIV, FEB. 1992

FIGURE 1-2
SUPPLY WELL LOCATION MAP
OPERABLE UNIT No. 5 – SITE 2
MONITORING AND O&M SUPPORT, CTO – 0367

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

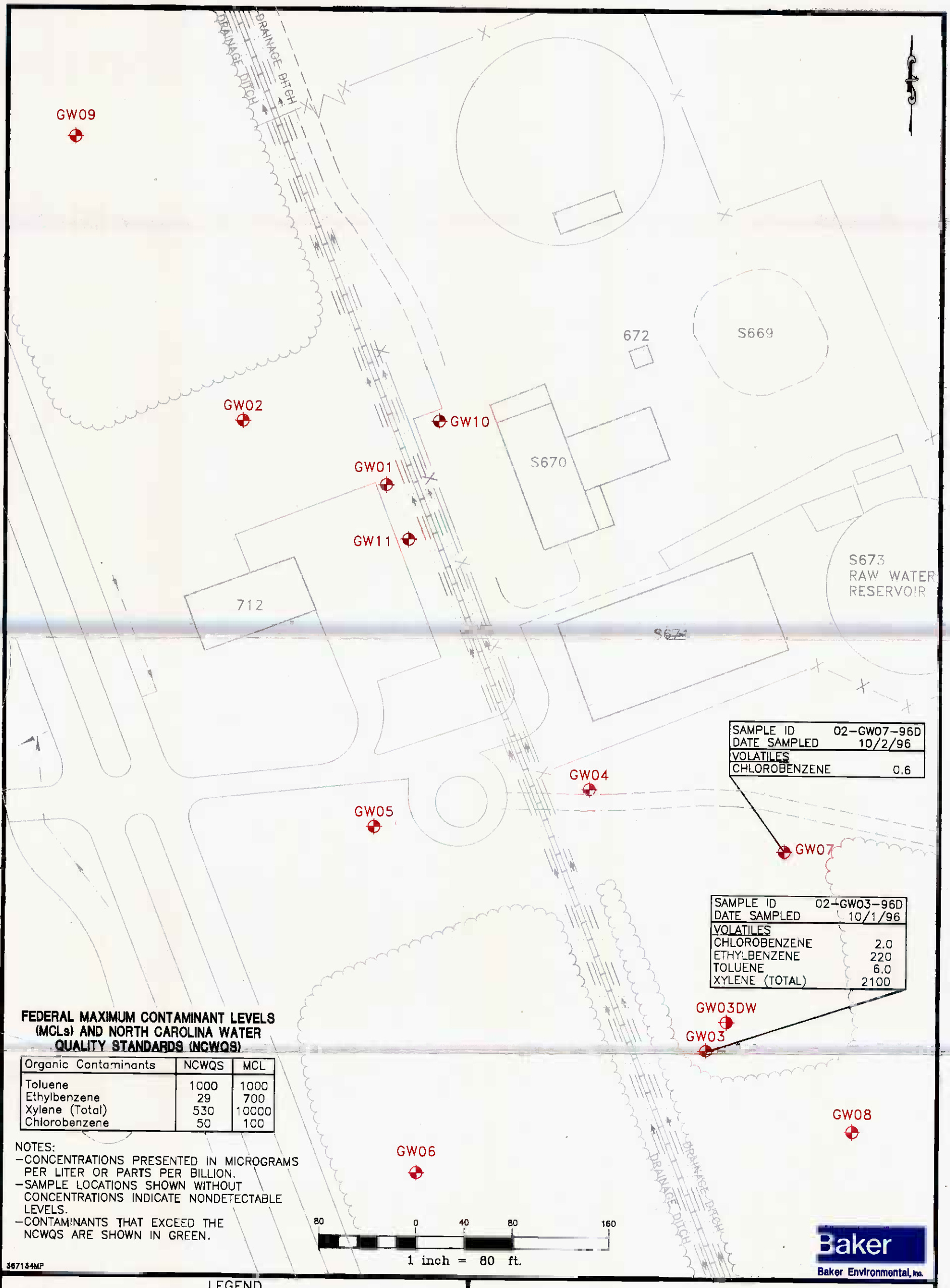


LEGEND

- GW02 — SHALLOW MONITORING WELL
- 2GW03DW — DEEP MONITORING WELL
- (28.67) — STATIC GROUNDWATER ELEVATION
- —30— — GROUNDWATER ELEVATION CONTOUR
- APPROXIMATE DIRECTION OF GROUNDWATER FLOW
- DIRECTION OF SURFACE WATER FLOW
- (NR) — NOT RECORDED

SOURCE: LANTDIV, FEB. 1992

FIGURE 1-3
SHALLOW GROUNDWATER
CONTOUR MAP - NOVEMBER 6, 1996
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT CTO - 0367
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



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

Organic Contaminants	NCWQS	MCL
Toluene	1000	1000
Ethylbenzene	29	700
Xylene (Total)	530	10000
Chlorobenzene	50	100

NOTES:
- CONCENTRATIONS PRESENTED IN MICROGRAMS PER LITER OR PARTS PER BILLION.
- SAMPLE LOCATIONS SHOWN WITHOUT CONCENTRATIONS INDICATE NONDETECTABLE LEVELS.
- CONTAMINANTS THAT EXCEED THE NCWQS ARE SHOWN IN GREEN.

367134MP

Baker Environmental, Inc.

LEGEND

GW02 SHALLOW MONITORING WELL

GW03DW DEEP MONITORING WELL

DIRECTION OF SURFACE WATER FLOW

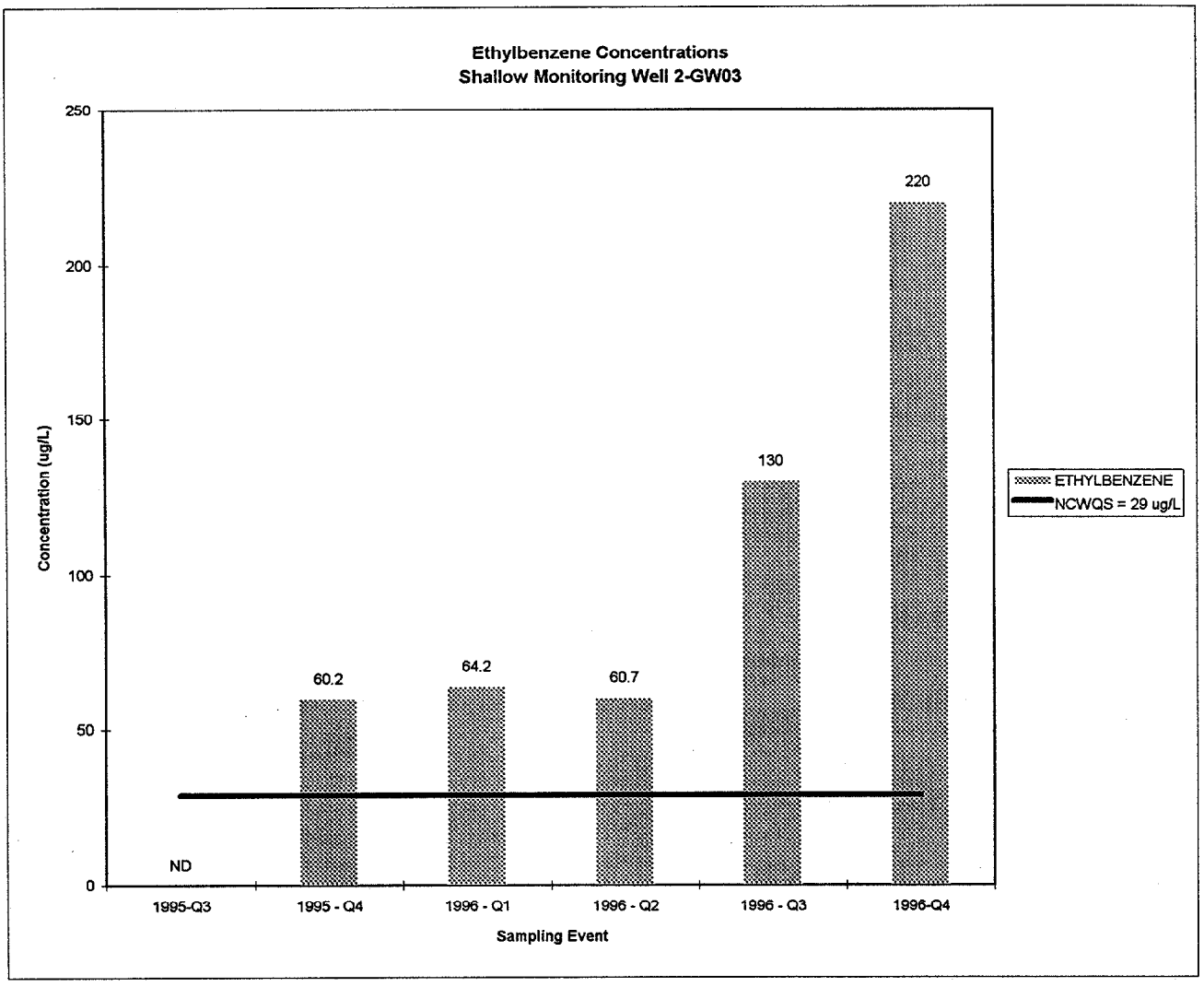
SOURCE: LANTDIV, FEB. 1992

FIGURE 2-1
VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO - 0367

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

FIGURE 2-2

ETHYLBENZENE RESULTS FROM 2-GW03
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-367
MCB, CAMP LEJEUNE, NORTH CAROLINA



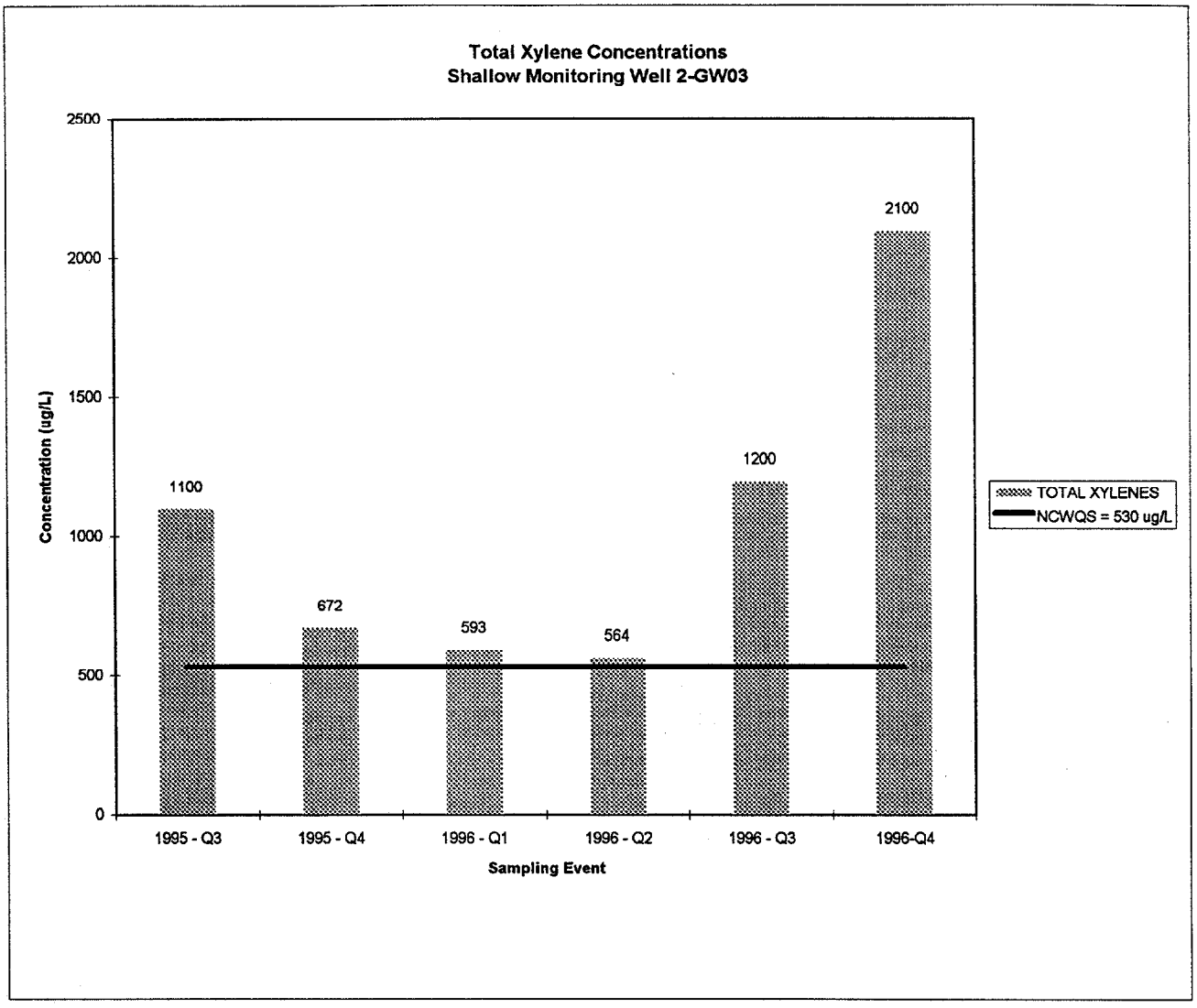
Q1 - Quarter 1 (January - March)
Q2 - Quarter 2 (April - June)
Q3 - Quarter 3 (July - September)
Q4 - Quarter 4 (October - December)

Notes:
Federal Maximum Contaminant Level (MCL) = 700 micrograms per liter (ug/L)
North Carolina Water Quality Standard (NCWQS) = 29 micrograms per liter (ug/L)

Contaminant	Mean Detection (ug/L)	Median Detection (ug/L)	Detection Frequency	Detections Above Standards
ETHYLBENZENE	107	62	5/6	5/6

FIGURE 2-3

TOTAL XYLENE RESULTS FROM 2-GW03
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-367
MCB, CAMP LEJEUNE, NORTH CAROLINA



Q1 - Quarter 1 (January - March)
Q2 - Quarter 2 (April - June)
Q3 - Quarter 3 (July - September)
Q4 - Quarter 4 (October - December)

Notes:
Federal Maximum Contaminant Level (MCL) = 10,000 micrograms per liter (ug/L)
North Carolina Water Quality Standard (NCWQS) = 530 micrograms per liter (ug/L)

Contaminant	Mean Detection (ug/L)	Median Detection (ug/L)	Detection Frequency	Detections Above Standards
TOTAL XYLENES	1038.2	886	6/6	6/6

ATTACHMENTS

ATTACHMENT A
CHAIN-OF-CUSTODY DOCUMENTATION

CHAIN OF-CUSTODY RECORD

Pg. 1 of 2

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

Lab and BOA #:
Delivery Order #
Project Number: 12470-367
Project Name: LTM
Field Team: Yackosky / Kriven
SEND RESULTS TO:

Notes ~~Sample Number~~	1996 Date	Time	Sample Location	Matrix Type (1) GB (2)	Matrix Type (1) COM (2)	Analytical Methods: TCL VOA EPA 8260	TAL Metals SW 6010	TDS / TSS	Type of Container(s) (3)	Number of Container(s)	General Comments: ~~Remarks~~ Sample Id.
						G	P	P			COC# 001501-96D
Routine	10/1	1215	Site 2	GW		2	1	1			02-GW02-96D
Turn-	10/1	1340	Site 2	GW		2	1	1			02-GW01-96D
around	10/1	1520	Site 2	GW		2	1	1			02-GW11-96D
↓	10/1	1550	Site 2	GW		2	1	1			02-GW05-96D
	10/1	1710	Site 2	GW		2	1	1			02-GW04-96D
	10/1	1745	Site 2	GW		2	1	1			02-GW10-96D
↓	10/1	1830	Site 2	GW		2	1	1			02-GW03-96D
BLANK	10/2	1600	~~Site 2~~			2					02-TB01-96D
↓	10/2	0845	Site 2	GW		2	1	1			02-PRW647-96D
↓	10/2	0920	Site 2	GW		2	1	1			02-PRW646-96D

Relinquished By: [signature] Date: 10/2/96 Time: 1700
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 ☒ (1) 0042976 (2) 0042988 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
data hard copy 11/1/96

Courier Name: Fed Ex
Courier Pickup Number: 136980446
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 #:
Delivery Order #:
Project Number: 62470-367
Project Name: LTM
Field Team: Yackosky / Krivan
SEND RESULTS TO:

Notes Sample Number	1996 Date	Time	Sample Location	Matrix Type (1) GB (2)	Matrix Type (1) COM (2)	Analytical Methods: TCL VOAs EPA 8260	TAL Metals Sw6010	TDS/TSS	Type of Container(s) (3)	Number of Container(s)	General Comments: Sample Id. Remarks
Routine	10/2	0955	Site 2	GW		2	1	1	G P P		02-PRW16-96D
turn-	10/2	1155	Site 2	GW		2	1	1			02-GW08-96D
around	10/2	1600	Site 2	GW		2	1	1			02-GW06-96D
	10/2	1470	Site 2	GW		2	1	1			02-GW07-96D

COC# 0U501-96D

Relinquished By: _____ Date: 10/2/96 Time: 1700
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
(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: 136980444 6
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

Pg. 1 of 1

Lab and BOA #:
Delivery Order #
Project Number: 02470-367
Project Name: LTM
Field Team: YASKOSKY / KEIVAN
SEND RESULTS TO:

Notes ~~Sample Number~~	1996 Date	Time	Sample Location	Matrix Type (1) GB (2)	Matrix Type (1) COM (2)	Analytical Methods: TCL VOA EPA 8260	Analytical Methods: Methane SW 8010	Analytical Methods: TDS/TSS	Type of Container(s) (3)	Number of Container(s)	General Comments: ~~Remarks~~ Sample Id
~~Sample Number~~						G	P	P			
Autumn	10/3	0755	Site 2	GW		2	1	1			02-GW03DW-96D
Tusa	10/3	0955	Site 2	GW		2	1	1			02-GW19-96D
BLANK	10/4	1620				2					02-TB02-96D

COC # 001 # 502-96D

Relinquished By: Arnold Keivan Date: 10/4/96 Time: 1630
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: 004990 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

data hard copy - 11/1/96

Courier Name: Fed Ex
Courier Pickup Number: 1369804380
File Name:

ATTACHMENT B
SAMPLE TRACKING FORM

Sample Tracking and Chain-of-Custody Documentation - Site 2
Monitoring and O&M Program Support, CTO-367
MCB, Camp Lejeune, North Carolina

MATRIX	DATE SHIPPED	SAMPLE ID	Analysis Requested				Analysis Received				DATE RECEIVED	TURNAROUND TIME	RFW #	COMMENTS
			TCL Volatiles (EPA 8260)	TAL Metals (SW 6010)	Total Dissolved Solids	Total Suspended Solids	TCL Volatiles (EPA 8260)	TAL Metals (SW 6010)	Total Dissolved Solids	Total Suspended Solids				
Groundwater		**COC# OU501-96D**												
	10/1/96	02-GW02-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-GW01-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-GW11-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-GW05-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-GW04-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-GW10-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-GW03-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-TB01-96D	X				X				11/1/96	30	9610G654	
	10/1/96	02-PWR647-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-PWR646-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-PWR616-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-GW08-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-GW06-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
	10/1/96	02-GW07-96D	X	X	X	X	X	X	X	X	11/1/96	30	9610G654	
		COC# OU502-96D												
	10/3/96	02-GW03DW-96D	X	X	X	X	X	X	X	X	11/1/96	28	9610G654	
	10/3/96	02-GW09-96D	X	X	X	X	X	X	X	X	11/1/96	28	9610G654	
	10/3/96	02-TB02-96D	X				X				11/1/96	28	9610G654	
TOTAL ANALYSES			17	15	15	15	17	15	15	15				

TAL Metals (SW 6010) - Barium, Beryllium, Cadmium, Chromium, Lead, Manganese

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 Site 2.
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, "GW" which denotes groundwater, or "PRW" which denotes a production or supply well.
Year	The investigation was conducted during 1996.
Quarter	The investigation was conducted during the fourth 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 02-GW03DW-96D refers to:

02-GW03DW-96D	Site 2
02-GW03DW-96D	Groundwater sample
02-GW03DW-96D	Monitoring well No.3
02-GW03DW-96D	Deep monitoring well
02-GW03DW-96D	Year 1996.
02-GW03DW-96D	The fourth quarter (i.e., October through December)

ATTACHMENT D
ANALYTICAL RESULTS - OCTOBER 1996

GROUNDWATER ANALYTICAL RESULTS
OCTOBER 1996
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA
VOLATILE ORGANICS

SAMPLE ID	02-GW01-96D	02-GW02-96D	02-GW03-96D	02-GW03DW-96D	02-GW04-96D	02-GW05-96D	02-GW06-96D
DATE SAMPLED	10/01/96	10/01/96	10/01/96	10/03/96	10/01/96	10/01/96	10/02/96
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
VOLATILES							
CHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VINYL CHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ACETONE	2 U	2 U	2 U	2 U	2 U	2 U	2 U
CARBON DISULFIDE	2 U	2 U	2 U	2 U	2 U	2 U	2 U
METHYLENE CHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHENE (TOTAL)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-BUTANONE	2 U	2 U	2 U	2 U	2 U	2 U	2 U
CHLOROFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROPROPANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMODICHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CIS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
4-METHYL-2-PENTANONE	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TOLUENE	0.5 U	0.5 U	6	0.5 U	0.5 U	0.5 U	0.5 U
TRANS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TETRACHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-HEXANONE	2 U	2 U	2 U	2 U	2 U	2 U	2 U
DIBROMOCHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	0.5 U	0.5 U	2	0.5 U	0.5 U	0.5 U	0.5 U
ETHYLBENZENE	0.5 U	0.5 U	220	0.5 U	0.5 U	0.5 U	0.5 U
XYLENE (TOTAL)	0.5 U	0.5 U	2100	0.5 U	0.5 U	0.5 U	0.5 U
STYRENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

GROUNDWATER ANALYTICAL RESULTS
OCTOBER 1996
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA
VOLATILE ORGANICS

SAMPLE ID	02-GW07-96D	02-GW08-96D	02-GW09-96D	02-GW10-96D	02-GW11-96D	02-PRW616-96D	02-PRW646-96D	02-PRW647-96D
DATE SAMPLED	10/02/96	10/02/96	10/03/96	10/01/96	10/01/96	10/02/96	10/02/96	10/02/96
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
VOLATILES								
CHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VINYL CHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ACETONE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
CARBON DISULFIDE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
METHYLENE CHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHENE (TOTAL)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-BUTANONE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
CHLOROFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROPROPANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMODICHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CIS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
4-METHYL-2-PENTANONE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRANS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TETRACHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-HEXANONE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
DIBROMOCHLOROMETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	0.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ETHYLBENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
XYLENE (TOTAL)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
STYRENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOFORM	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

GROUNDWATER ANALYTICAL RESULTS
OCTOBER 1996
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

SAMPLE ID	02-GW01-96D	02-GW02-96D	02-GW03-96D	02-GW03DW-96D	02-GW04-96D	02-GW05-96D	02-GW06-96D
DATE SAMPLED	10/01/96	10/01/96	10/01/96	10/03/96	10/01/96	10/01/96	10/02/96
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
TOTAL METALS							
BARIUM, TOTAL	48.5	42.6	45.8	422	80.6	96.1	86
BERYLLIUM, TOTAL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
CADMIUM, TOTAL	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
CHROMIUM, TOTAL	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U
LEAD, TOTAL	1.1	2.8	0.7 U	0.7 U	0.7 U	0.7 U	0.72
MANGANESE, TOTAL	36.6	4.8	9.1	1.2	12.6	40.1	12.8

GROUNDWATER ANALYTICAL RESULTS
OCTOBER 1996
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

SAMPLE ID	02-GW07-96D	02-GW08-96D	02-GW09-96D	02-GW10-96D	02-GW11-96D	02-PRW616-96D	02-PRW646-96D	02-PRW647-96D
DATE SAMPLED	10/02/96	10/02/96	10/03/96	10/01/96	10/01/96	10/02/96	10/02/96	10/02/96
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
TOTAL METALS								
BARIUM, TOTAL	90.2	65.2	46.9	40.3	75	5.6	3.5	8.5
BERYLLIUM, TOTAL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
CADMIUM, TOTAL	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
CHROMIUM, TOTAL	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U
LEAD, TOTAL	0.99	1.9	1	0.7 U	0.7 U	0.73	0.7 U	0.7 U
MANGANESE, TOTAL	30.6	34.1	23.4	11.4	29.9	18.3	19.5	18.4

GROUNDWATER ANALYTICAL RESULTS
OCTOBER 1996
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA
WET CHEMISTRY

SAMPLE ID	02-GW01-96D	02-GW02-96D	02-GW03-96D	02-GW03DW-96D	02-GW04-96D	02-GW05-96D	02-GW06-96D	02-GW07-96D
DATE SAMPLED	10/01/96	10/01/96	10/01/96	10/03/96	10/01/96	10/01/96	10/02/96	10/02/96
UNITS	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
TOTAL DISSOLVED SOLIDS	140	100	92	800	84	170	150	150
TOTAL SUSPENDED SOLIDS	5 U	5 U	5 U	20	5 U	9	5 U	5 U

GROUNDWATER ANALYTICAL RESULTS
OCTOBER 1996
OPERABLE UNIT NO. 5 - SITE 2
MONITORING AND O&M SUPPORT, CTO-0367
MCB, CAMP LEJEUNE, NORTH CAROLINA
WET CHEMISTRY

SAMPLE ID	02-GW08-96D	02-GW09-96D	02-GW10-96D	02-GW11-96D	02-PRW616-96D	02-PRW646-96D	02-PRW647-96D
DATE SAMPLED	10/02/96	10/03/96	10/01/96	10/01/96	10/02/96	10/02/96	10/02/96
UNITS	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
TOTAL DISSOLVED SOLIDS	84	170	180	140	200	230	210
TOTAL SUSPENDED SOLIDS	5 U	5 U	14	5 U	5 U	5 U	5 U