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CERTIFIED MAIL RETURN RECEIPT REQUESTED

North Carolina Department of Environment,
Health, and Natural Resources
Attn: Mr. Patrick Watters
P.O. Box 27687
401 Oberlin Road
Raleigh, North Carolina 27611

Re: MCB Camp Lejeune; Results of the Pre-Design Study at Operable Unit No. 2

Dear Mr. Watters:

This correspondence contains the results of the Pre-Design Study conducted by Baker Environmental, Inc. (Baker) at Operable Unit No. 2 (OU No. 2). The Pre-Design Study was conducted based on discussions and comments to the Remedial Investigation/ Feasibility Study (RI/FS) provided by the Atlantic Division, Naval Facilities Engineering command (LANTDIV), Marine Corps Base (MCB) Camp Lejeune, the United States Environmental Protection Agency (EPA) Region IV, and the North Carolina Department of Environment, Health and Natural Resources (DEHNR).

If you have any comments or require further information, the LANTDIV designated point of contact is Ms. L. G. Berry, P.E., who may be reached at (804) 322-4793.

Sincerely,

L. A. BOUCHER, P.E.
Head
Installation Restoration Section
(South)
Environmental Programs Branch
Environmental Quality Division
By direction of the Commander

Copy to:
U.S. EPA (Gena Townsend)
MCB Camp Lejeune (Mr. Neal Paul)
Baker Environmental (Mr. Ray Wattras)

Re: MCB Camp Lejeune; Results of the Pre-Design Study at Operable Unit No. 2

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RESULTS OF PREDESIGN STUDY

OBJECTIVES

The objective of the Pre-Design Study was to gather additional data required to support the remedial design. The additional data included the following:

- groundwater data regarding the extent of contamination in the deep aquifer at Site 82 to support the design of the groundwater extraction and treatment system;
- location, extent, and thickness of the underlying clay layer;
- subsurface soil data from Area of Concern (AOC) No. 1 regarding the extent of volatile organic compound (VOC) soil contamination for the vapor extraction system design;
- subsurface soil data from AOC Nos. 1, 2, 3, 4, and 6 for determining whether the contaminated soils can be classified for subsequent handing and disposal as hazardous or non-hazardous waste;
- stream data from Wallace Creek to afford an evaluation of the tidal influences in the vicinity of OU No. 2, which could influence treated groundwater discharge options associated with design of the groundwater extraction and treatment system.

SCOPE OF WORK

The scope of work for the Pre-Design Study included the performance of field investigation data gathering activities, laboratory analysis of groundwater and soil samples, and the presentation of results in this letter report. Field investigation activities included the following: subsurface drilling, installing four deep groundwater monitoring wells, and groundwater sampling; drilling four shallow borings via hand auger at AOC No. 1 to obtain eight shallow subsurface soil samples (top two feet and just above the water table); obtaining five shallow (0.5 to 2 feet below the ground surface) subsurface soil samples from five locations near the center of AOC Nos. 1, 2, 3, 4, and 6 (sufficient waste characterization data are available for AOC No. 5); and monitoring stream levels in Wallace Creek.

Groundwater samples obtained from the four deep wells were analyzed for Target Compound List (TCL) VOCs (EPA Method 601/602). The eight subsurface soil samples obtained from AOC No. 1 were analyzed for TCL VOCs. The subsurface soil samples obtained from AOC Nos. 1, 2, 3, 4, and 6 were analyzed for RCRA hazardous waste characteristics (TCLP, ignitability, reactivity, and corrosivity).

FIELD INVESTIGATION

Drilling and Deep Well Installation

Baker drilled and installed four deep monitoring wells (6GW1DB, 6GW27DA, 6GW38D, and 6GW39D) between July 29 and September 10, 1993. The well locations are depicted on Figure 1.

The borings for wells 6GW1DB, 6GW27DA, and 6GW38D were drilled to provide data regarding the continuity of the underlying clay layer that was previously encountered in well 6GW1DA at a depth of 232 feet below the ground surface (bgs). Well 6GW1DB was installed adjacent to existing wells 6GW1D and 6GW1DA, whereas, well 6GW27DA was installed adjacent to existing well 6GW27D. Well 6GW38D was installed roughly 620 feet southeast of well 6GW27D. Well 6GW39D was installed west of Site 82 and south of Wallace Creek. It is intended to provide data regarding deep groundwater quality off site and outside of the identified limits of the contaminant plume.

All of the well borings were drilled using the mud rotary drilling method. Split-spoon (1-3/8 inch I.D.) samples were obtained at approximate two-foot intervals beginning at depths of 226, 200, and 215 feet for borings 6GW1DB, 6GW27DA, and 6GW38D, respectively. Sampling did not start until the above depths were reached because subsurface data (above these depths) were available from adjacent borings. No subsurface soil samples were obtained from boring 6GW39D as subsurface data from nearby existing well 6GW37D was considered sufficient to determine the depth of the screened interval for this well.

All of the wells were constructed with 2-inch diameter, schedule 40, PVC risers and screens (0.1 slot). Twenty-foot screens were installed below the clay layer at wells 6GW1DB and 6GW38D while a 10-foot screen section was installed just above the clay layer in well 6GW27DA. This information is presented in Table 1 and depicted in Figures 2 and 3. Well 6GW39D was constructed with a 10-foot well screen section set above the clay layer based on the subsurface data presented in the boring log for well 6GW37D.

Groundwater Sampling

Baker obtained a single round of groundwater samples from each of the deep wells installed as part of this Pre-Design Study. The samples were packaged on site and shipped to an off-site laboratory for analysis of TCL VOCs via EPA Methods 601 and 602.

Shallow Drilling and Soil Sampling

Baker drilled four shallow soil borings (6-OSA-SB12-A, -B, -C, and -D) via hand augering at AOC 1. These borings were located approximately 100 feet in each compass direction (north, south, east, and west) from existing boring OSA-SB12, which exhibited elevated levels of VOCs in the RI (see Figure 2-7 of Final RI Report for OU No. 2, Baker 1993). Samples were obtained at intervals of 0.5 to 2.0 feet and 5.0 to 7.0 feet bgs from each boring. Based on data obtained during previous drilling, the 5.0 to 7.0 feet bgs interval was estimated to be just above the shallow groundwater table. The samples were packaged on site and shipped to an off-site laboratory for analysis of TCL VOCs.

Shallow soil samples (0.5 to 2.0 feet) were obtained via hand auger from AOC Nos. 1, 2, 3, 4, and 6 for analysis of RCRA characteristics (leachability via TCLP, corrosivity, ignitability, and reactivity). Previous sampling results indicated that the highest contaminant levels were detected in the top two feet of soil.

The boring at AOC No. 1 was drilled adjacent to RI boring OSA-SB12. The boring at AOC No. 3 was drilled adjacent to well 6GW15. The boring at AOC No. 4 was drilled adjacent to well 6GW11 while the boring at AOC No. 6 was drilled adjacent to RI boring 210E-SB15. At AOC No. 2, a single composite soil sample was obtained from three shallow borings drilled adjacent to RI borings RAV-SB13, SB07, and SB14. The AOCs are depicted on Figure 2-2 in the Final FS Report for OU No. 2 (Baker, 1993).

Wallace Creek Water Level Measurements

Baker obtained surface level measurements in Wallace Creek every 30 minutes over a seven-day period beginning September 27, 1993 and ending October 4, 1993. The measurements were obtained using an In-Situ Hermit 2000 Data Logger set up along the upstream side of the railroad bridge, just downstream of the site.

RESULTS

Clay Layer Presence

The underlying clay layer was encountered in the three borings (6GW1DB, 6GW27DA, and 6GW38D) specifically drilled to locate this strata. The highest elevation at which the top of the clay layer was encountered was -201.37 feet (below mean sea level: msl) at boring 6GW1DB. The lowest elevation at which the top of the clay layer was encountered was -217.72 feet below msl at boring 6GW38D. The horizontal distance between borings 6GW1DB and 6GW38D is approximately 900 feet. Baker field personnel observed the gradation change between strata located above and below the clay layer to be gradual rather than abrupt.

Deep Groundwater Quality

Results of groundwater analyses indicate that low levels of VOCs were encountered in three (6GW1DB, 6GW27DA, and 6GW38D) of the four deep monitoring wells installed. These wells were installed both above and below the reported clay layer and, consequently, it is doubtful that the clay layer is impermeable or continuous to serve as an aquitard. No elevated organics were encountered in well 6GW39D, which was installed off site to monitor the horizontal extent of the VOC groundwater plume.

Detected VOCs in groundwater samples are summarized on Table 2. No VOCs were detected in the groundwater sample obtained from the downgradient well 6GW39D. Low levels of 2-chloroethylvinyl ether (1.0, 2.6, and 1.8 •g/L) were detected at wells 6GW1DB, 6GW27DA, and 6GW38D, respectively. In addition, 1,2-dichloroethane was detected at 3.1 •g/L in well 6GW27DA, which is screened just above the clay layer. Trichloroethene (6.5 •g/L) was detected slightly above Federal and State drinking water standards in well 6GW1DB, which is screened below the clay layer.

Soil

Shallow soil sampling and analysis at AOC No. 1 provided additional data regarding the extent of VOC contamination in this area. Detected VOCs in soil samples obtained at AOC No. 1 are summarized in Tables 3 and 4 for the intervals 0.5 to 2.0 feet bgs and 5.0 to 7.0 feet bgs, respectively. Acetone and methylene chloride were detected in several samples, however, these compounds were also detected in the trip blank and rinsate samples indicating that their presence is not due to soil contamination but rather to laboratory or decontamination procedures. Trichloroethene was detected in two of five samples obtained from 0.5 to 2.0 feet (sample SB12A and duplicate sample SB12A-D) at 14 •g/Kg and 2J •g/Kg, respectively. Tetrachloroethene was also detected in two of five samples obtained from 0.5 to 2.0 feet samples SB12A-D (16 •g/Kg) and SB12D (120 •g/Kg). Other than acetone, tetrachloroethene was the only contaminant detected in any of the soil samples obtained from the 5.0 to 7.0 feet bgs interval. It was detected in a single sample (SB12D) at 1J •g/Kg.

All five of the soil samples obtained for RCRA characteristics analysis yielded results which do not classify these soils as hazardous waste.

Water Level Measurements

Water level measurements obtained from Wallace Creek are depicted on Figure 4. The results indicate that Wallace Creek is subject to regular tidal influences as indicated by the measured pattern of a rising and falling water surface. The time between low and high tide was measured to be approximately six hours. This corresponds roughly to the expected tidal changes for the New River Inlet reported in the September 27, 1993 edition of the Jacksonville (NC) Daily News. The maximum change in water surface level was approximately one foot.

CONCLUSIONS

The results of the Pre-Design Study indicate that the objectives were accomplished and afford the following conclusions.

Extent of Deep Groundwater Contamination

1. Based on the RI data and Pre-Design Study data, significant levels of VOCs (maximum value of approximately 78,000 •g/L) are present in the intermediate zone of the Castle Hayne aquifer. The intermediate zone is approximately 100 to 110 feet deep. The contamination in this zone is primarily limited to the area between Lot 203 and Wallace Creek (see Final RI Report, Figure 4-26). Offsite contamination in this zone was not detected downgradient of the site.

2. VOC contaminants have migrated from the intermediate zone to the deeper zone in the vicinity of the clay layer. Contamination along and below the clay layer (approximately 220 feet bgs) is minimal.

3. The extent of deep groundwater contamination along or below the clay layer is limited to the area around wells 6GW1DA (screened above the clay layer) and 6GW1DB (screened below the clay layer). Low levels of VOC contamination was detected in downgradient deep wells 6GW27DA (screened just above the clay layer), but no VOCs were detected in well 6GW38D (screened just below the clay layer).

VOCs in Soil at AOC No. 1

1. The extent of VOC contamination at AOC No. 1 is not widespread, based on samples collected within a 100-foot radius of the source area. Therefore, the remediation of VOC-contaminated soil should be focused at soil borings SB-12 and SB-06, as stated in the Final FS Report for OU No. 2.

TCLP and RCRA Characteristics Test Results

1. Soil samples obtained from AOCs No. 1, 2, 3, 4, and 6 indicate that the shallow soils from the interval 0.5 to 2.0 feet bgs are not characteristically hazardous.

2. Disposal of contaminated soils from these areas should be performed in accordance with all State or Federal regulations applicable to non-hazardous solid waste.

Water Level Measurements

1. The results of water level measurements obtained at Wallace Creek indicate that it is tidally influenced.

2. The significance of this tidal effect needs to be considered during the design of the groundwater treatment system. According to the FS, it was estimated that the groundwater treatment system would yield approximately 300 gallons per minute of effluent. Based on field observations, the available Wallace Creek flow channel appears sufficiently broad to accommodate the discharge. Constrictions that exist at the Camp Lejeune Railroad and Holcomb Boulevard overpasses and the tidal influences could affect the surface water flow regime; however, no localized flooding is anticipated that would impact local facilities. This is based primarily on the volume of discharge which represents a small percentage of the available storage in the floodplain.

TABLE 1
DEEP MONITORING WELL SUMMARY
OPERABLE UNIT NO. 2
PRE-DESIGN STUDY, CTO-0133
MCB, CAMP LEJEUNE, NORTH CAROLINA

WELL NUMBER	DRILLING AND INSTALLATION PERIOD	BORING DEPTH/ELEV (FT BGS/FT MSL)	SCREENED INTERVAL (FT BGS/FT MSL)	CLAY LAYER INTERVAL (FT BGS/FT MSL)	GROUND SURFACE ELEVATION (FT MSL)
6GW1DB	8/29 to 9/10/93	263/-230.37	242 to 262/ -209.37 to -229.37	234 to 241/ -201.37 to -208.37	32.63
6GW27DA	8/2 to 8/05/93	237/-214.15	226 to 236/ -203.15 to -213.15	235 to 237/ -212.15 to -214.15	22.85
6GW38D	8/15 to 8/27/93	277/-247.72	255 to 275/ -225.72 to -245.72	247 to 253/ -217.72 to -223.72	29.28
6GW39D	7/29 to 7/30/93	203/-190.7	190 to 200/ -177.7 to -187.7	NS	12.3

NOTES:

NS - Denotes that no soil samples were obtained
BGS - Below ground surface
MSL - Mean sea level
FT - Feet

TABLE 2
DETECTED VOCs IN GROUNDWATER
OPERABLE UNIT NO. 2
PRE-DESIGN STUDY, CTO-0133
MCB, CAMP LEJEUNE, NORTH CAROLINA

DETECTED COMPOUND	UNITS	WELL NUMBER				NCWQS (µg/L)	MCL (µg/L)
		6GW1DB	6GW27DA	6GW38D	6GW39D		
2-Chloroethylvinyl Ether	µg/L	1.0	2.6	1.8	ND	NONE	NONE
1,2-Dichloroethane	µg/L	ND	3.1	ND	ND	0.38	5.0
Trichloroethene	µg/L	6.5	ND	ND	ND	2.8	5.0

ND: Denotes not detected above instrument detection level.

TABLE 3
DETECTED VOCs IN SOIL
SAMPLE INTERVAL 0.5 TO 2.0 FEET
OPERABLE UNIT NO. 2
PRE-DESIGN STUDY, CTO-0133
MCB, CAMP LEJEUNE, NORTH CAROLINA

DETECTED COMPOUND	UNITS	BORING NUMBER				
		SB12A	SB12A-D(1)	SB12B	SB12C	SB12D
Methylene Chloride	µg/Kg	ND	ND	250B	3JB	18B
Acetone	µg/Kg	9J	ND	ND	10JB	180B
Trichloroethene	µg/Kg	14	2J	ND	ND	ND
Tetrachloroethene	µg/Kg	ND	16	ND	ND	120

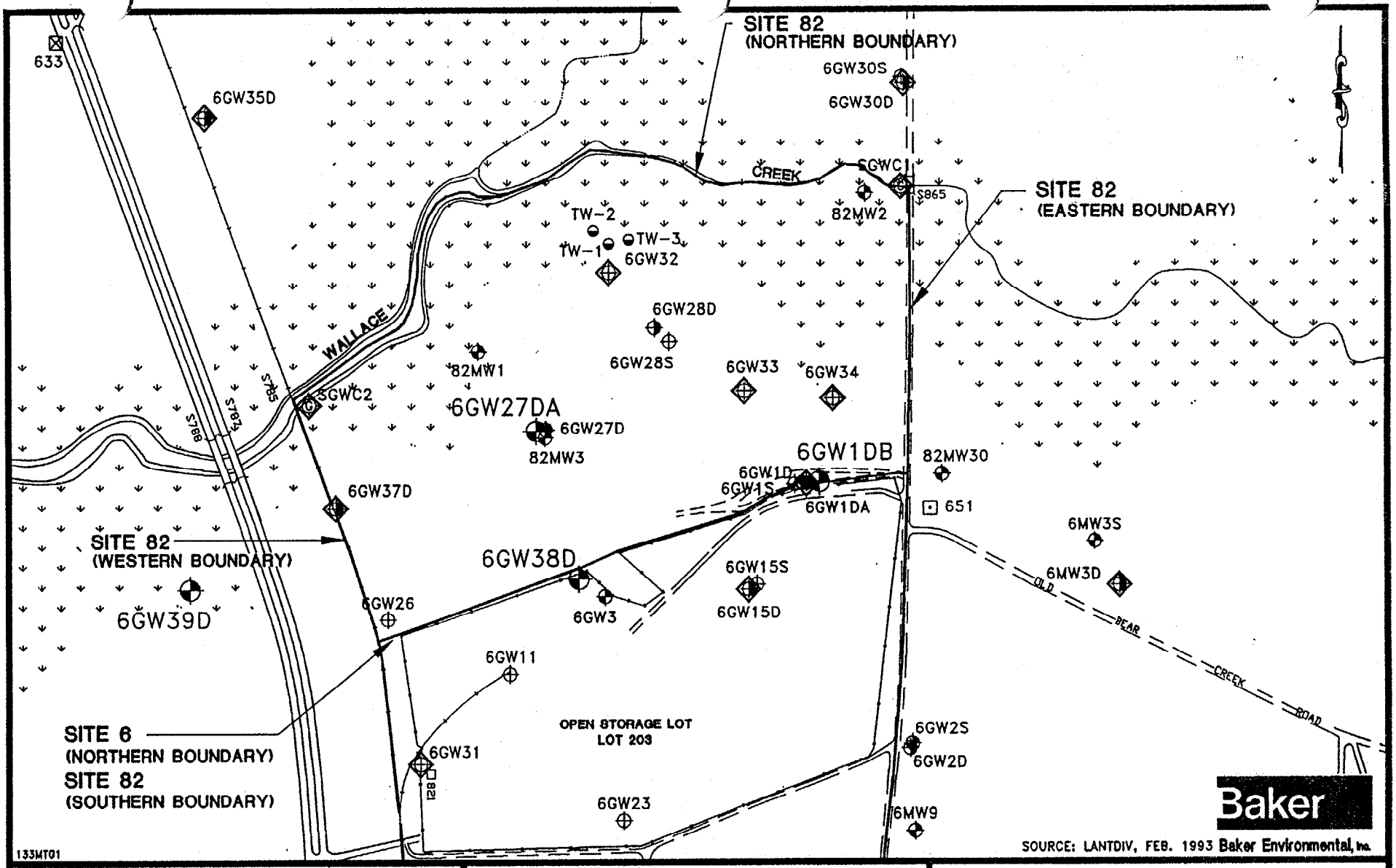
NOTE:
1) Duplicate Sample of SB12A

ND - Denotes not detected above instrument detection level.
B - Denotes compound was detected in an equipment rinsate sample.
J - Denotes estimated value.

TABLE 4
DETECTED VOCs IN SOIL
SAMPLE INTERVAL 5.0 TO 7.0 FEET
PRE-DESIGN STUDY, CTO-0133
MCB, CAMP LEJEUNE, NORTH CAROLINA

DETECTED COMPOUND	UNITS	BORING NUMBER			
		SB12A	SB12B	SB12C	SB12D
Acetone	µg/Kg	19B	9JB	8JB	19B
Tetrachloroethene	µg/Kg	ND	ND	ND	1J

ND - Denotes not detected above instrument detection.
B - Denotes compound was detected in a blank of equipment rinsate sample.
J - Denotes estimated value.



LEGEND

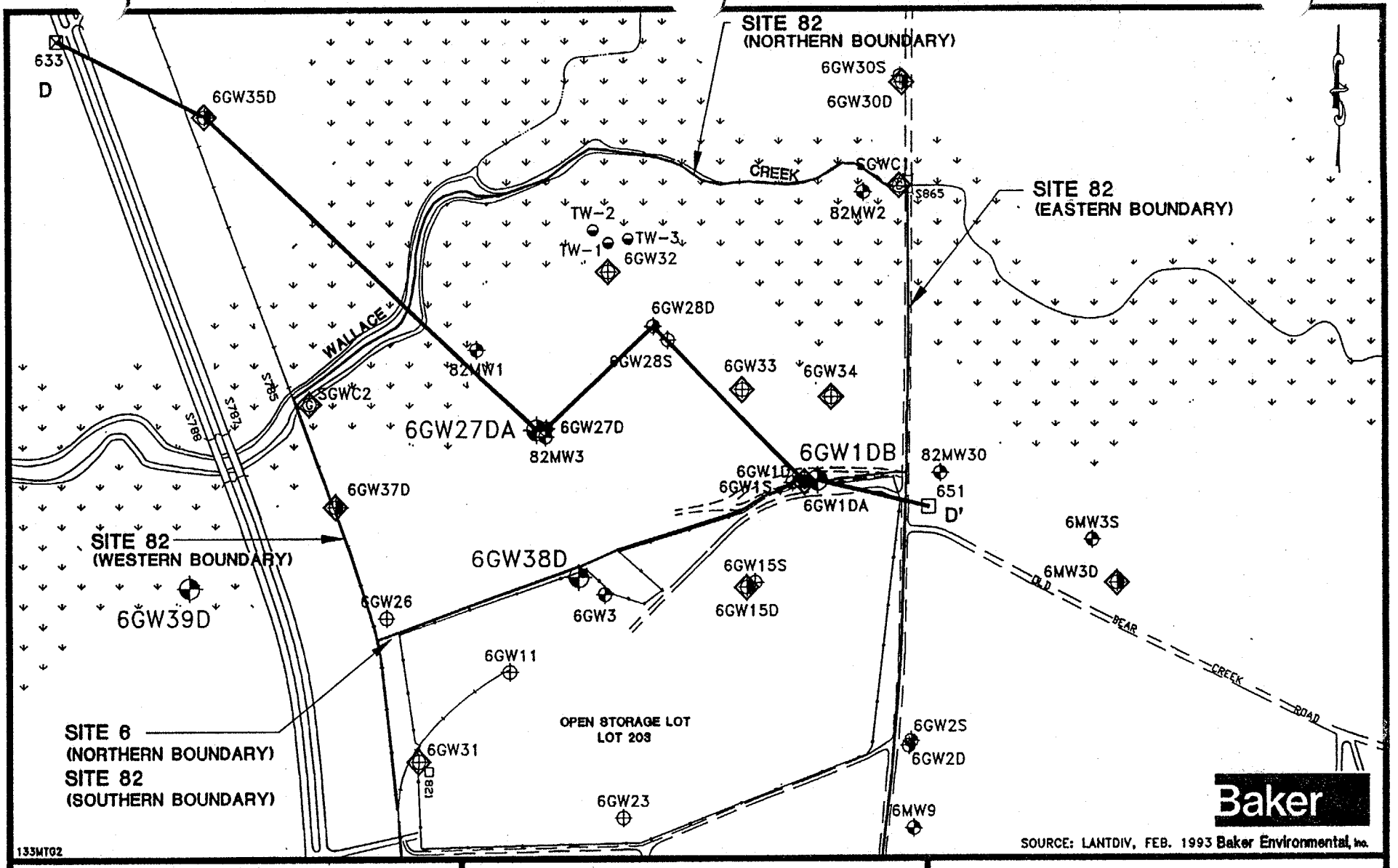
- 6GW1S EXISTING SHALLOW MONITORING WELL
- 6GW9 PHASE I SHALLOW MONITORING WELL INSTALLED BY BAKER ENVIRONMENTAL, Inc., SEPT.– OCT. 1992
- 6GW1D PHASE I DEEP MONITORING WELL INSTALLED BY BAKER ENVIRONMENTAL, Inc., SEPT.– NOV. 1992
- SHSG1 PHASE I STAFF GAUGE INSTALLED BY BAKER ENVIRONMENTAL, Inc., OCT. 1992
- 6GW31 PHASE II SHALLOW MONITORING WELL INSTALLED BY BAKER ENVIRONMENTAL, Inc., MARCH–APRIL 1993
- 6GW1DA PHASE II DEEP MONITORING WELL INSTALLED BY BAKER ENVIRONMENTAL, Inc., MARCH–APRIL 1993
- SGWC1 PHASE II STAFF GAUGE INSTALLED BY BAKER ENVIRONMENTAL, Inc., DEC. 1992
- TW-1 TEMPORARY WELL INSTALLED BY BAKER ENVIRONMENTAL, Inc., MARCH 1993

500 0 250 500 1000

1 inch = 500 ft.

FIGURE 1
DEEP MONITORING WELL LOCATIONS
PRE-DESIGN STUDY CTO-0133

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



LEGEND

- EXISTING SHALLOW MONITORING WELL
- PHASE I SHALLOW MONITORING WELL INSTALLED BY BAKER ENVIRONMENTAL, Inc., SEPT.– OCT. 1992
- PHASE I DEEP MONITORING WELL INSTALLED BY BAKER ENVIRONMENTAL, Inc., SEPT.– NOV. 1992
- PHASE I STAFF GAUGE INSTALLED BY BAKER ENVIRONMENTAL, Inc., OCT. 1992
- PHASE II SHALLOW MONITORING WELL INSTALLED BY BAKER ENVIRONMENTAL, Inc., MARCH–APRIL 1993
- PHASE II DEEP MONITORING WELL INSTALLED BY BAKER ENVIRONMENTAL, Inc., MARCH–APRIL 1993
- PHASE II STAFF GAUGE INSTALLED BY BAKER ENVIRONMENTAL, Inc., DEC. 1992
- TEMPORARY WELL INSTALLED BY BAKER ENVIRONMENTAL, Inc., MARCH 1993
- D — GEOLOGIC TRAVERSE LINE

500 0 250 500 1000

1 inch = 500 ft.

FIGURE 2
DEEP GEOLOGIC CROSS-SECTION LOCATION MAP
PRE-DESIGN STUDY CTO-0133

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

FIGURE 4
WALLACE CREEK WATER LEVEL DATA
CTO-0133 MCB CAMP LEJEUNE, NC

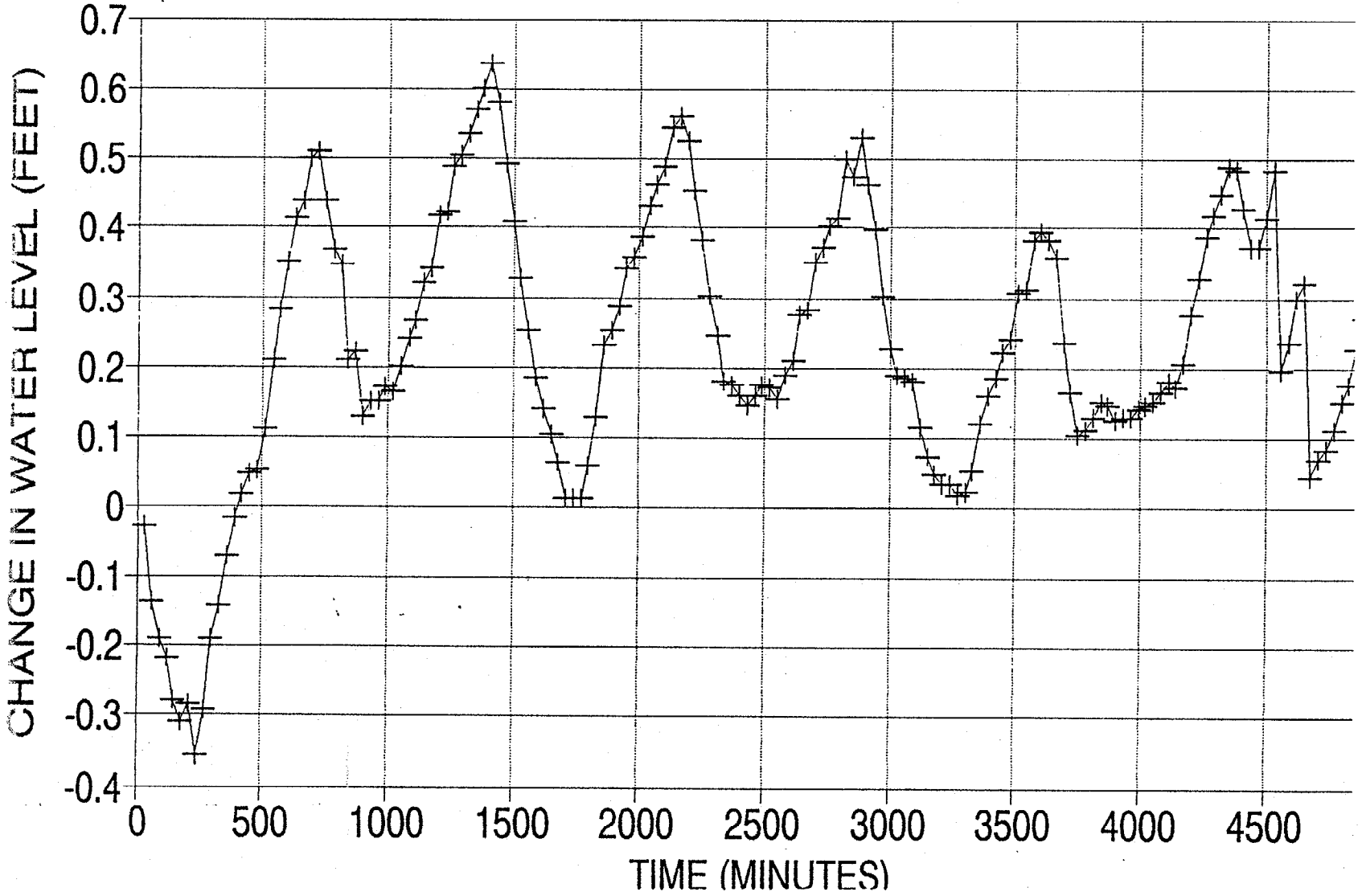
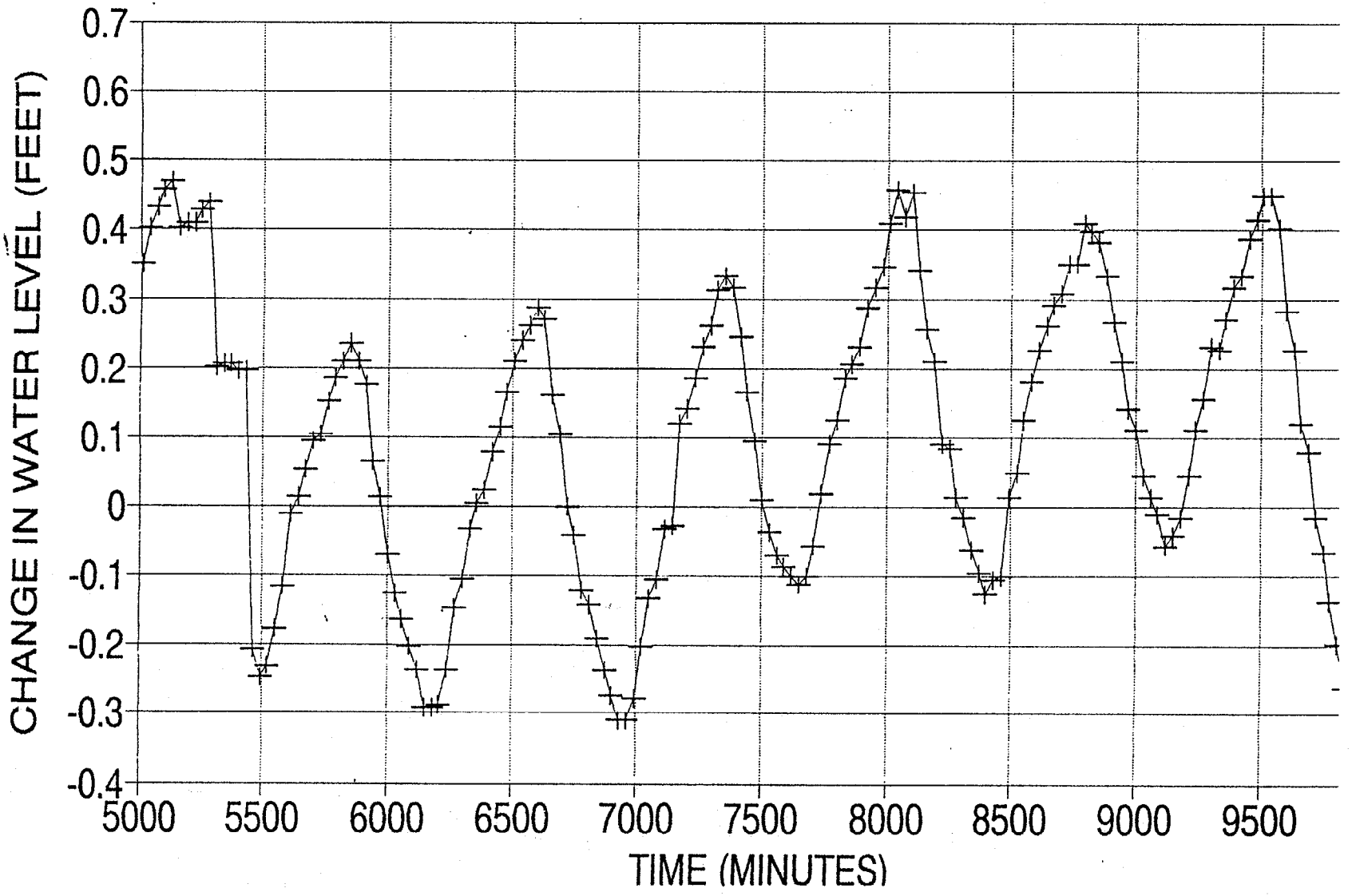
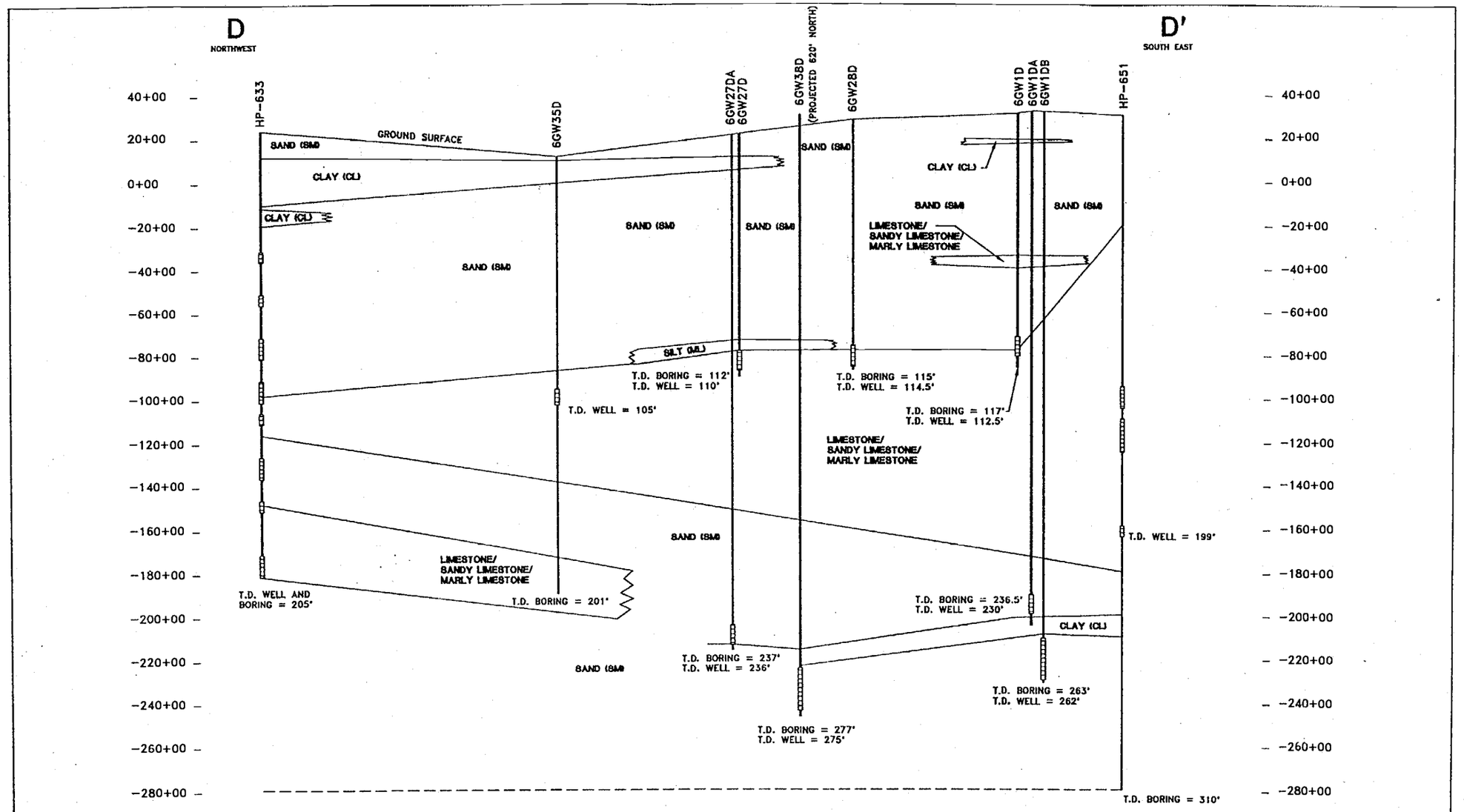


FIGURE 4
WALLACE CREEK WATER LEVEL DATA
CTO-0133 MCB CAMP LEJEUNE, NC





NOTES: -HADNOT POINT SUPPLY WELL LITHOLOGY INFORMATION OBTAINED FROM HARNED, et al, 1989.
-THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

HORIZONTAL SCALE

VERTICAL SCALE

LEGEND
HP-633 HADNOT POINT SUPPLY WELL
6GW1D DEEP MONITORING WELL AND SOIL BORING
APPROXIMATE DEPTH AND LENGTH OF SCREEN INTERVAL
T.D. TOTAL DEPTH OF SOIL BORING OR WELL
ESTIMATED
PROJECTED

DATE NOVEMBER 1993
SCALE GRAPHIC
DRAWN REL
REVIEWED DLB
P.O.# 18133-22-SRN
CADD# 133MT03

NORTH

PRE-DESIGN STUDY CTO-0133
MARINE CORP BASE, CAMP LEJEUNE
NORTH CAROLINA

BAKER ENVIRONMENTAL, Inc.
Coraopolis, Pennsylvania

Baker
Baker Environmental, Inc.

GEOLOGIC CROSS-SECTION D-D'
DEPICTING DEEP SOIL CONDITIONS

SCALE GRAPHIC

DATE NOVEMBER 1993

FIGURE No.
3