03.03-03/10/95-02301

FINAL

# SAMPLE STRATEGY PLAN

# REMEDIAL INVESTIGATION/ FEASIBILITY STUDY PROJECT PLANS

## OPERABLE UNIT NO. 13 (SITE 63)

## MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0304

MARCH 10, 1995

*Prepared for:*

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

*Under the:*

**LANTDIV CLEAN Program**
**Contract N62470-89-D-4818**

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## 1.0 INTRODUCTION

This Sample Strategy Plan (SSP) presents an overview of the remedial scope of work for Site 63 (Verona Loop Dump) at Marine Corps Base (MCB), Camp Lejeune, North Carolina. Figure 1-1 shows the overall location of this site.

The purpose of the SSP is to provide LANTDIV, MCB Camp Lejeune, EPA Region IV, and the North Carolina Department of the Environment, Health, and Natural Resources (DEHNR), with a summary of the proposed field investigation that will be presented by Baker Environmental, Inc. (Baker) at an upcoming RI/FS scoping meeting. This document is meant to be used as a supplement to the scoping meeting, and is not intended for formal comment. Questions or comments on the proposed RI field investigations will be addressed by Baker at the upcoming meeting.

The format of the SSP is as follows. A brief description of the site location and setting, site history, and a summary of previous investigations are provided. Previously-obtained analytical results are also presented in tabular format in order to familiarize the reader with the levels and types of contaminants at the site. A proposed field investigation is described, including the objectives and sampling rationale. Figures depicting the sampling locations are also included.

## 2.0 SITE LOCATION AND SETTING

The study area is located along Verona Road south of the Marine Corps Air Station (MCAS), New River. A general site location of the study area is shown on Figure 2-1. Site 63 is approximately three to four acres in size. Verona Loop Dump is primarily wooded with the exception of a haul road formerly used to transport debris to the dump. The site is bordered by Verona Loop Road to the south, an intermittent stream to the east, and woods to the north and west. The site is relatively flat, although the eastern portion slopes toward the stream. There are no current site structures. There are no supply wells within a one mile radius of the site.

## 3.0 SITE HISTORY

Information regarding the history of Site 63 is scarce. It was reported that the area was used as a disposal site for wastes generated during military training exercises. The type of materials disposed are described only as bivouac wastes. No hazardous wastes were reported to be involved in the disposal operations. The years of operating the site as disposal grounds are unknown. The area is currently unrestricted with respect to site access and military maneuvers are still conducted in the area.

## 4.0 PREVIOUS INVESTIGATIONS

- A Site Inspection was conducted in 1991 by Baker Environmental, Inc.
- Final Site Inspection Report (Baker, January 31, 1994).

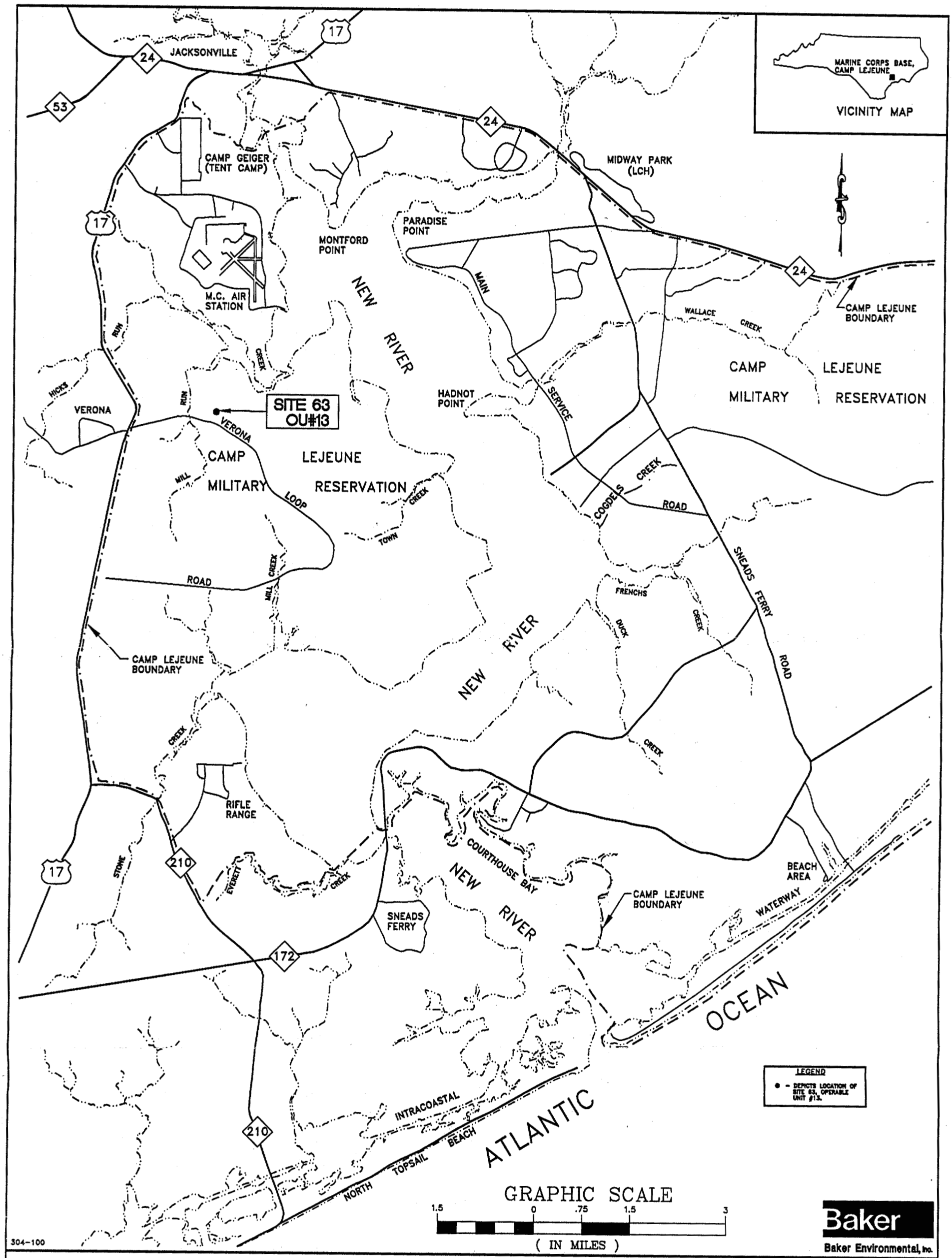


FIGURE 1-1
CAMP LEJEUNE AND SITE
LOCATION MAP
SITE 63, VERONA LOOP DUMP

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

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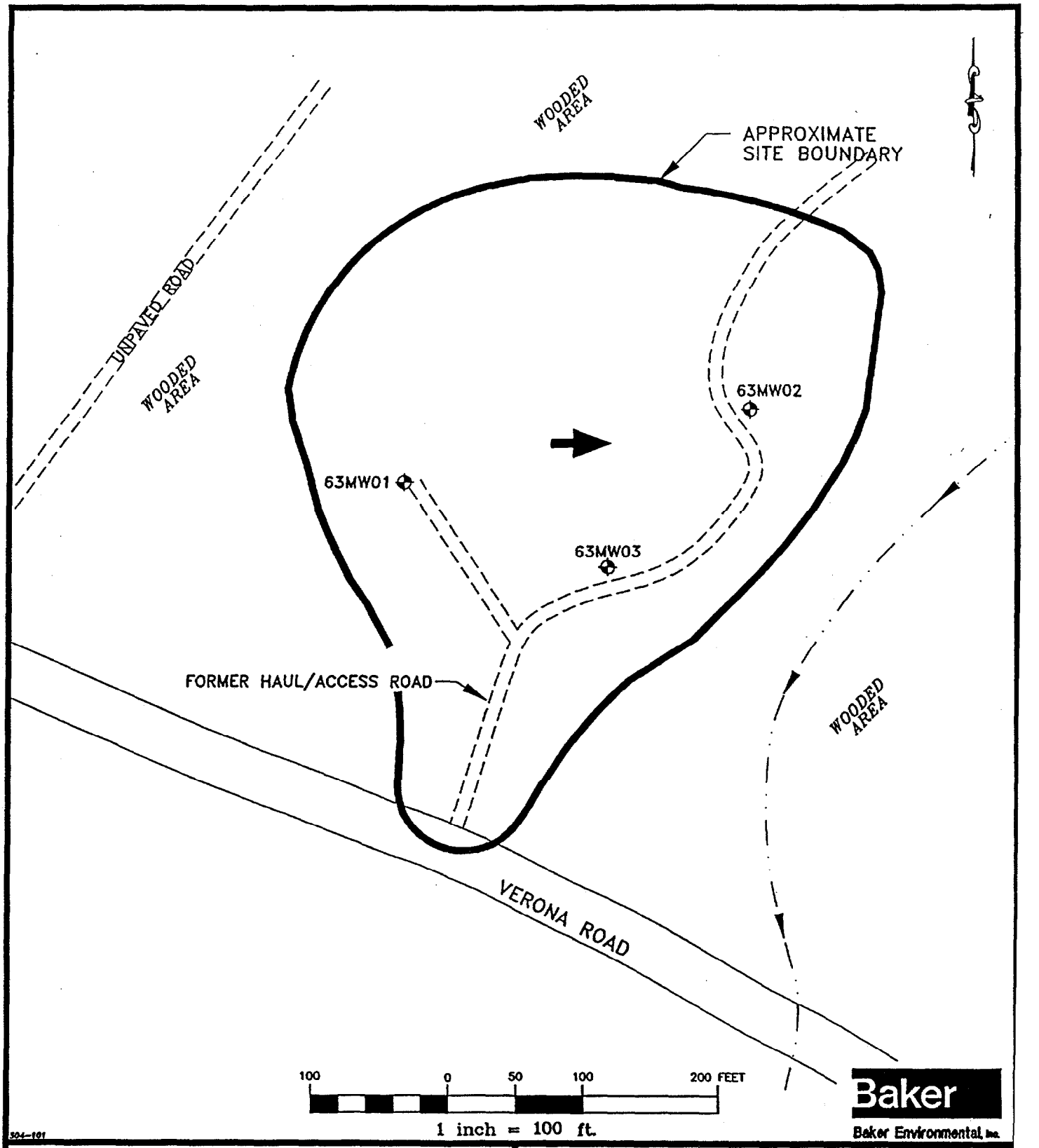



## LEGEND

- MONITORING WELL LOCATION
- APPROXIMATE INTERMITTENT STREAM LOCATION AND FLOW DIRECTION
- APPROXIMATE GROUNDWATER FLOW DIRECTION

FIGURE 2-1
GENERAL SITE LAYOUT
VERONA LOOP DUMP
SITE 63

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.1 Soil Investigation

Six (6) soil borings were drilled on site and advanced to the water table. Soil samples from two depths, zero to two feet below ground surface (bgs) and from just above the soil/groundwater interface, were collected from each borehole. Additionally, a total of six soil samples were taken during the drilling and installation of three groundwater monitoring wells. All soil samples were analyzed for full TCL organics and TAL metals. Analytical findings are summarized in Tables 4-1.

*Surface Soil*:

- Low levels of the volatile organics toluene (2 μg/kg) and total xylenes (3 μg/kg) were detected in the subsurface soil collected from soil boring 63SB03. The subsurface sample from this boring did not exhibit either contaminant.
- Low levels of phthalates were detected in three out of nine samples.
- Low levels of pesticide constituents, 4,4'-DDD, 4,4'-DDT, and 4,4'-DDE, were detected in sample 63SB04.
- Aroclor-1254 was detected at a level of 1,000 μg/kg in sample 63SB02.
- Inorganic concentrations in surface soil appeared to be consistent with base-specific inorganic levels with the exception of lead (36.3 mg/kg) in soil boring SB0400.

*Subsurface Soil*:

- Low levels of phthalates were detected in several samples.
- Various inorganics were detected in subsurface-soil samples, none of which appeared to be elevated substantially above base-specific levels.

## 4.2 Groundwater Investigation

Three (3) shallow monitoring wells were installed, and one round of groundwater samples were collected. Groundwater samples were analyzed for full TCL organics and TAL metals using CLP analytical protocols. Analytical findings are summarized in Table 4-2.

- Low levels of benzoic acid (3 μg/L) and bis(2-ethyhexyl)phthalate (9 μg/L) were detected in groundwater collected from monitoring well 63MW02.
- Trace levels of carbon disulfide (1 μg/L) in both wells 63MW01 and 63MW02.
- Maximum concentrations of aluminum (85,300 μg/L), barium (5,410 μg/L), chromium (134 μg/L), iron (100,000 μg/L), lead (369 μg/L), and manganese (1020 μg/L) exceeded federal and/or state groundwater standards. All maximum concentrations occurred in well 63MW02.

**TABLE 4-1**

**NATURE AND EXTENT OF SOIL CONTAMINATION**
**OU NO. 13 (SITE 63)**
**VERONA LOOP DUMP**
**MCB CAMP LEJEUNE, NORTH CAROLINA**

| Contaminant (Organic) | Surface Soil (0-2 feet) | | | Subsurface Soil (below 2 feet) | | |
|---|---|---|---|---|---|---|
| | No. of Positive Detections/No. of Samples | Range of Positive Detections (µg/kg) | Location of Maximum Concentration | No. of Positive Detections/No. of Samples | Range of Positive Detections (µg/kg) | Location of Maximum Concentration |
| Toluene | 1/9 | 2 | SB0300 | 0/9 | ND | NA |
| Total Xylenes | 1/9 | 3 | SB0300 | 0/9 | ND | NA |
| Benzoic Acid | 2/9 | 45-280 | MW0200 | 0/9 | ND | NA |
| Di-n-butylphthalate | 3/9 | 43-51 | MW0100 | 2/9 | 43-78 | MW0206 |
| bis(2-Ethyhexyl) phthalate | 3/9 | 44-72 | MW0200 | 1/9 | 62 | MW0105 |
| 4-4'-DDE | 1/9 | 58 | SB0400 | 0/9 | ND | NA |
| 4-4'-DDD | 1/9 | 53 | SB0400 | 0/9 | ND | NA |
| 4-4'-DDT | 1/9 | 39 | SB0400 | 0/9 | ND | NA |
| Aroclor-1254 | 1/9 | 1000 | SB0200 | 0/9 | ND | NA |
| Aluminum | 8/9 | 975-8,450 | SB0100 | 9/9 | 1,920-20,500 | SB0406 |
| Arsenic | 4/9 | 1.4-2.3 | SB0300 | 5/9 | 1.3-9.1 | SB06045 |
| Barium | 3/9 | 16.9-22.9 | SB0400 | 3/9 | 16.3-41.8 | SB0406 |
| Calcium | 0/9 | ND | NA | 3/9 | 79.7-377.0 | SB0406 |
| Chromium | 8/9 | 1.7-11.3 | SB0300 | 9/9 | 2.0-30.3 | SB0406 |
| Copper | 8/9 | 2.3-20.3 | SB0500 | 9/9 | 2.9-24.0 | SB0406 |
| Iron | 8/9 | 741-5980 | SB0300 | 9/9 | 682-16,100 | SB0107 |
| Lead | 8/9 | 2.2-36.3 | SB0400 | 9/9 | 2.1-8.5 | SB0406 |

**TABLE 4-1 (Continued)**

**NATURE AND EXTENT OF SOIL CONTAMINATION**
**OU NO. 13 (SITE 63)**
**VERONA LOOP DUMP**
**MCB CAMP LEJEUNE, NORTH CAROLINA**

| Contaminant (Organic) | Surface Soil (0-2 feet) | | | Subsurface Soil (below 2 feet) | | |
|---|---|---|---|---|---|---|
| | No. of Positive Detections/No. of Samples | Range of Positive Detections (µg/kg) | Location of Maximum Concentration | No. of Positive Detections/No. of Samples | Range of Positive Detections (µg/kg) | Location of Maximum Concentration |
| Magnesium | 7/9 | 32.2-324.0 | SB0100 | 9/9 | 40.9-1020.0 | SB0406 |
| Manganese | 7/9 | 6.6-22.8 | SB0400 | 8/9 | 4.9-57.1 | SB0406 |
| Nickel | 5/9 | 2.1-3.9 | SB0100 | 7/9 | 2.2-7.3 | SB0406 |
| Potassium | 4/9 | 373-697 | SB0300 | 7/9 | 290-2,000 | SB0406 |
| Vanadium | 8/9 | 2.2-13.8 | SB0300 | 9/9 | 1.6-36.9 | SB0406 |
| Zinc | 6/9 | 8.4-57.1 | SB0400 | 7/9 | 6.6-33.9 | SB0406 |

µg/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
ND - not detected
NA - not applicable
Reference: Baker, 1994

TABLE 4-2

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION
OU NO. 13 (SITE 63)
VERONA LOOP DUMP
MCB CAMP LEJEUNE, NORTH CAROLINA

| Contaminant | No. of Positive Detections/ No. of Samples | Range of Positive Detections (µg/L) | Location of Maximum Concentration |
|---|---|---|---|
| Carbon Disulfide | 2/3 | 1 | MW01, MW02 |
| Benzoic Acid | 1/3 | 3 | MW02 |
| bis(2-Ethylhexyl)phthalate | 1/3 | 9 | MW02 |
| Aluminum | 3/3 | 3,650-85,300 | MW02 |
| Barium | 3/3 | 56.1-5,410 | MW02 |
| Chromium | 3/3 | 4.4-134 | MW02 |
| Iron | 3/3 | 4,320-100,00 | MW02 |
| Lead | 3/3 | 4.3-369 | MW02 |
| Manganese | 3/3 | 50.3-1,020 | MW02 |

µg/L - microgram per liter
Reference: Baker, 1994

### 4.3 Surface Water/Sediment Investigation

Two surface water and two sediment samples were collected from the intermittent stream. No organic contaminants were detected in either the surface water or sediment samples.

- Iron was the only contaminant detected above North Carolina and Federal surface water quality standards.
- Concentration levels of aluminum, arsenic, barium, beryllium, chromium, copper, iron, lead, magnesium, manganese, nickel, vanadium, and zinc were less than the effective range-median (ER-M) in both sediment samples.

Analytical findings regarding surface water and sediment contaminant levels are summarized in Tables 4-3 and 4-4, respectively.

## 5.0 SITE VISIT OBSERVATIONS

Baker personnel conducted a site visit on February 2, 1995 to identify current site conditions. Figure 5-1 presents visual observations from the site visit. Some notable observations are discussed herein.

The site is mainly wooded, with young and very young conifers trees (saplings to ages of approximately 10 to 15 years old). A few older-growth conifers trees were observed. Undergrowth was minimal at the time of observation.

Bivouac wastes were observed on site, including MRE (meals ready-to-eat) packaging and ammunition containers. construction-type debris was also observed, including concrete, wood, and steel. A portion of waste disposal appears to have been surficial, as evident in the hummocky (i.e., many mounds) terrain.

An area of stressed vegetation was observed on the eastern portion of the site, between monitoring well 63MW02 and the stream channel. The area is characterized by dead and fallen trees.

Several small trenches and one large trench were observed on the site. The small trenches appeared to have been excavated for military training exercises. The use of the large trench was not discernable, but appeared to be approximately 10 feet wide by 50 feet length. Standing water was observed in this trench.

## 6.0 PROPOSED FIELD INVESTIGATION

The objectives of this investigation are to identify contaminants and media of potential concern; identify routes of exposure, and delineate suspected areas where prior practices may have impacted the soil, sediment, surface and/or groundwater. Table 6-1 provides a summary of the proposed field investigation.

### 6.1 Support Activities

All new soil boring locations, and sediment and surface water stations will be surveyed. The newly installed and existing monitoring wells will also be surveyed.

TABLE 4-3

NATURE AND EXTENT OF SURFACE WATER CONTAMINATION
OU NO. 13 (SITE 63)
VERONA LOOP DUMP
MCB CAMP LEJEUNE, NORTH CAROLINA

| Contaminant | From the Intermittent Stream | |
|---|---|---|
| | No. of Positive Detections/ No. of Samples | Range of Positive Detections (µg/L) |
| Aluminum | 2/2 | 1,030-1,170 |
| Barium | 2/2 | 26.9-34.8 |
| Calcium | 2/2 | 1,570-2,520 |
| Copper | 1/2 | 6.3 |
| Iron | 2/2 | 1,040-1,090 |
| Magnesium | 2/2 | 746-845 |
| Manganese | 2/2 | 10.4-13.6 |
| Nickel | 1/2 | 10.2 |
| Sodium | 2/2 | 4,150-4,780 |
| Thallium | 1/2 | 2.0 |

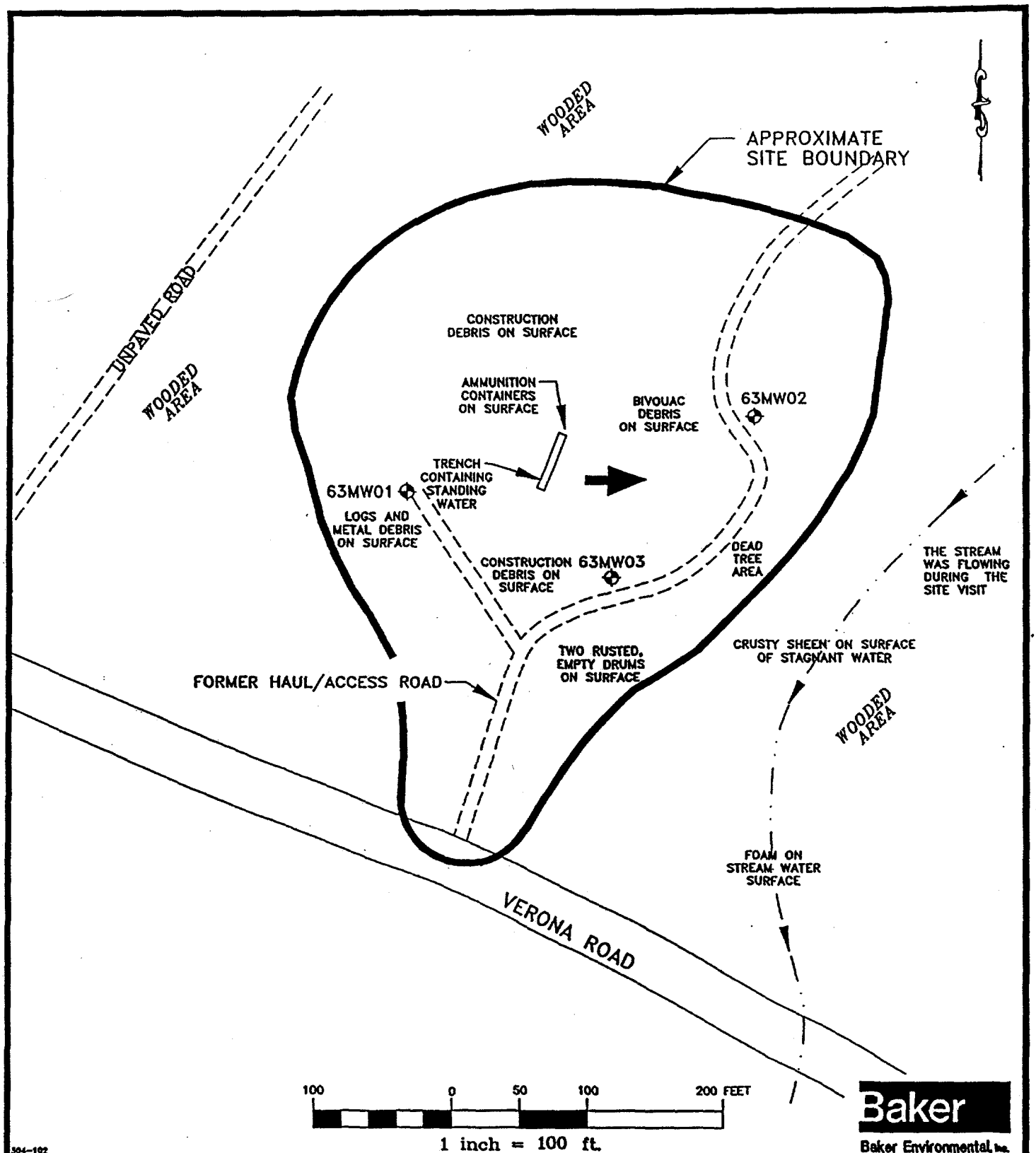
µg/L - micrograms per liter
Reference: Baker, 1994

TABLE 4-4

NATURE AND EXTENT OF SEDIMENT CONTAMINATION
OU NO. 13 (SITE 63)
VERONA LOOP DUMP
MCB CAMP LEJEUNE, NORTH CAROLINA

| Contaminant | From the Intermittent Stream | |
|---|---|---|
| | No. of Positive Detections/ No. of Samples | Range of Positive Detections (mg/kg) |
| Aluminum | 2/2 | 803-13,400 |
| Arsenic | 1/2 | 3.5 |
| Barium | 2/2 | 2.7-34.2 |
| Beryllium | 1/2 | 0.31 |
| Calcium | 1/2 | 160 |
| Chromium | 2/2 | 1.7-17.3 |
| Copper | 2/2 | 16.8-76.8 |
| Iron | 2/2 | 376-5750 |
| Lead | 2/2 | 3.4-90.0 |
| Magnesium | 2/2 | 36.5-525 |
| Manganese | 2/2 | 2.7-14.7 |
| Nickel | 2/2 | 3.5-8.2 |
| Potassium | 1/2 | 873 |
| Vanadium | 2/2 | 1.6-24.0 |
| Zinc | 2/2 | 3.5-19.0 |

mg/kg - milligrams per kilogram
Reference: Baker, 1994




## LEGEND

- MONITORING WELL LOCATION
- APPROXIMATE INTERMITTENT STREAM LOCATION AND FLOW DIRECTION
- APPROXIMATE GROUNDWATER FLOW DIRECTION

FIGURE 5-1
VISUAL OBSERVATIONS FROM SITE VISIT
VERONA LOOP DUMP
SITE 63

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

TABLE 6-1

SUMMARY OF SAMPLING AND ANALYTICAL OBJECTIVES
OU NO. 13 (SITE 63)
REMEDIAL INVESTIGATION/FEASIBILITY STUDY, CTO-0304
MCB CAMP LEJEUNE, NORTH CAROLINA

| Study Area | Investigation | Baseline No. of Sample | Analysis [1] | Turnaround |
|---|---|---|---|---|
| Site 63 - Verona Loop Road | Soil | 20 soil borings/2 samples per boring | TCL Organics<br>TAL Metals | Routine [2] |
| | | 10 soil borings/2 samples per boring | TCL Organics<br>TAL Metals | Quick [3] |
| | | 2 soil boring/1 composite sample per boring<br>2 soil borings/2 samples per boring | TOC [4]<br>CEC [5] | Routine |
| | | 1 monitoring well soil boring/2 samples per boring | TCL Organics<br>TAL Metals | Routine |
| | | 3 monitoring well soil borings/2 samples per boring | TCL Organics<br>TAL Metals | Quick |
| | Groundwater - One round of sampling | 7 (3 existing & 4 newly installed) shallow monitoring wells | TCL Organics<br>TAL Metals | Routine |
| | Surface Water/Sediment | 3 stations/1 sample per station | TCL Organics<br>TAL Metals<br>Grain size<br>TOC | Routine |
| | | 1 station/1 sample per station | TCL Organics<br>TAL Metals | Routine |

Notes:
(1) Analysis will include field measurements of pH and Eh
(2) Quick = 7 day turnaround time
(3) Routine = 35 day turnaround time
(4) TOC = Total Organic Carbon
(5) CEC = Cation Exchange Capacity
(6) TDS/TSS = Total Dissolved Solids/Total Suspended Solids

Static water level measurements will be collected from existing and newly installed monitoring wells. Additionally, slug tests will be conducted on each well.

All laboratory analyses will be performed in accordance with CLP methods. Analytical results will be submitted in a Data Quality Objective (DQO) Level III format.

## 6.2 Soil Investigation

Information obtained from the soil investigation will be used to delineate the horizontal and vertical extent of waste deposition.

The soil investigation will involve the following:

- A 100 by 100 foot sampling grid will be established over the site. Thirty-four (34) soil borings will be drilled at select nodes of the grid (Figure 6-1). One (1) additional soil boring will be located in the approximate middle of the dead tree area.

- Soil borings are expected to extend less than 10 feet below ground surface (bgs). Monitoring well borings are expected to extend approximately 13 feet bgs. Two soil samples will be collected from each boring, one at 0 to 1 foot bgs., and one immediately above the saturated zone. An additional sample will be collected as necessary, from any soils appearing to be visually contaminated, or if the depth to the saturated zone is greater than 10 feet. All samples will be submitted for laboratory analysis including Target Compound List (TCL) organics, Target Analyte List (TAL) metals.

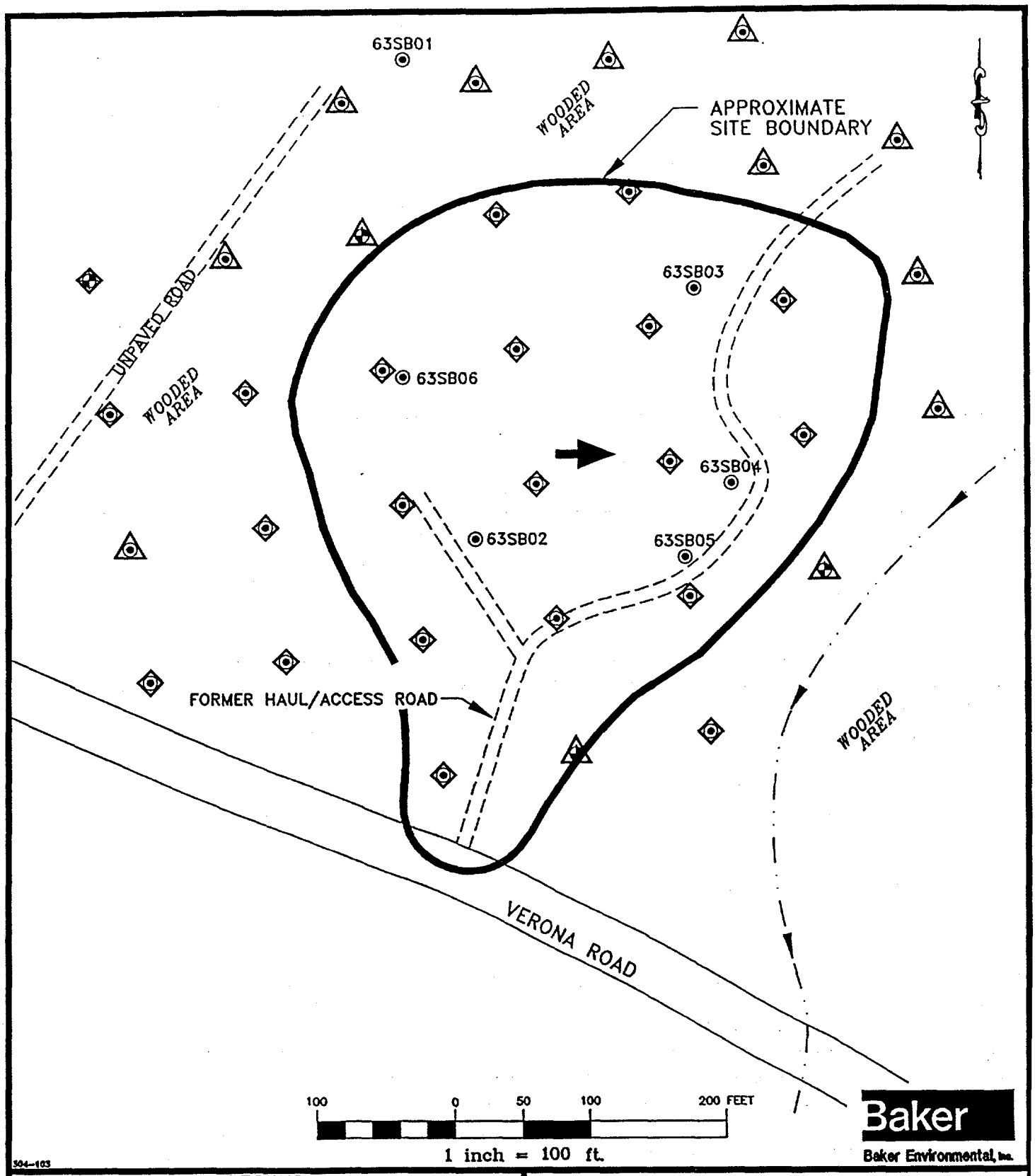
- Soil samples from 20 soil boring swill be analyzed on a routine turnaround time (28 days). These soil borings are shown on Figure 6-1 as a proposed soil boring symbol surrounded by a diamond.

- A composite sample from tow (2) soil boring locations will be analyzed for Total Organic Carbon (TOC). These soil sample locations will be selected during the field investigation.

- Soil samples from 10 soil borings be analyzed on a quick turnaround time (7 days). These borings are shown on Figure 6-1 as a proposed soil boring symbol surrounded by a triangle.

- Two (2) soil samples from two (2) select soil boring locations will be analyzed for cation exchange capacity (CEC) as well as the parameters referenced above. These soil sample locations will be selected during the field investigation.

- Soil samples from one (1) monitoring well boring will be analyzed on a routine turnaround time. This boring is shown on Figure 6-1 as the monitoring well boring symbol surrounded by a diamond.




LEGEND

- EXISTING SOIL BORING LOCATION
- PROPOSED SOIL BORING (ROUTINE TURNAROUND)
- PROPOSED SOIL BORING (QUICK TURNAROUND)
- PROPOSED MONITORING WELL BORING (ROUTINE TURNAROUND)
- PROPOSED MONITORING WELL BORING (QUICK TURNAROUND)
- APPROXIMATE INTERMITTENT STREAM LOCATION AND FLOW DIRECTION
- APPROXIMATE GROUNDWATER FLOW DIRECTION

FIGURE 6-1
PROPOSED SOIL INVESTIGATION
VERONA LOOP DUMP
SITE 63

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

- Soil samples from three (3) monitoring well borings will be analyzed on a quick turnaround time. These soil borings are shown on Figure 6-1 as a proposed monitoring well boring symbol surrounded by a triangle.

## 6.3 Groundwater Investigation

Four (4) shallow monitoring wells are proposed to supplement the three existing wells in characterization of groundwater conditions (Figure 6-2).

The groundwater investigation will involve the following:

- Four of the soil borings discussed in Section 6.2 will be converted to monitoring wells. The monitoring wells will be installed to a similar depth as the existing wells (approximately 13 feet bgs). One well, located west of the unpaved road will be used as a background location.

- The new and existing monitoring wells will be developed to insure proper hydraulic connection with the aquifer.

- The new and existing monitoring wells will be used to assess current groundwater flow direction.

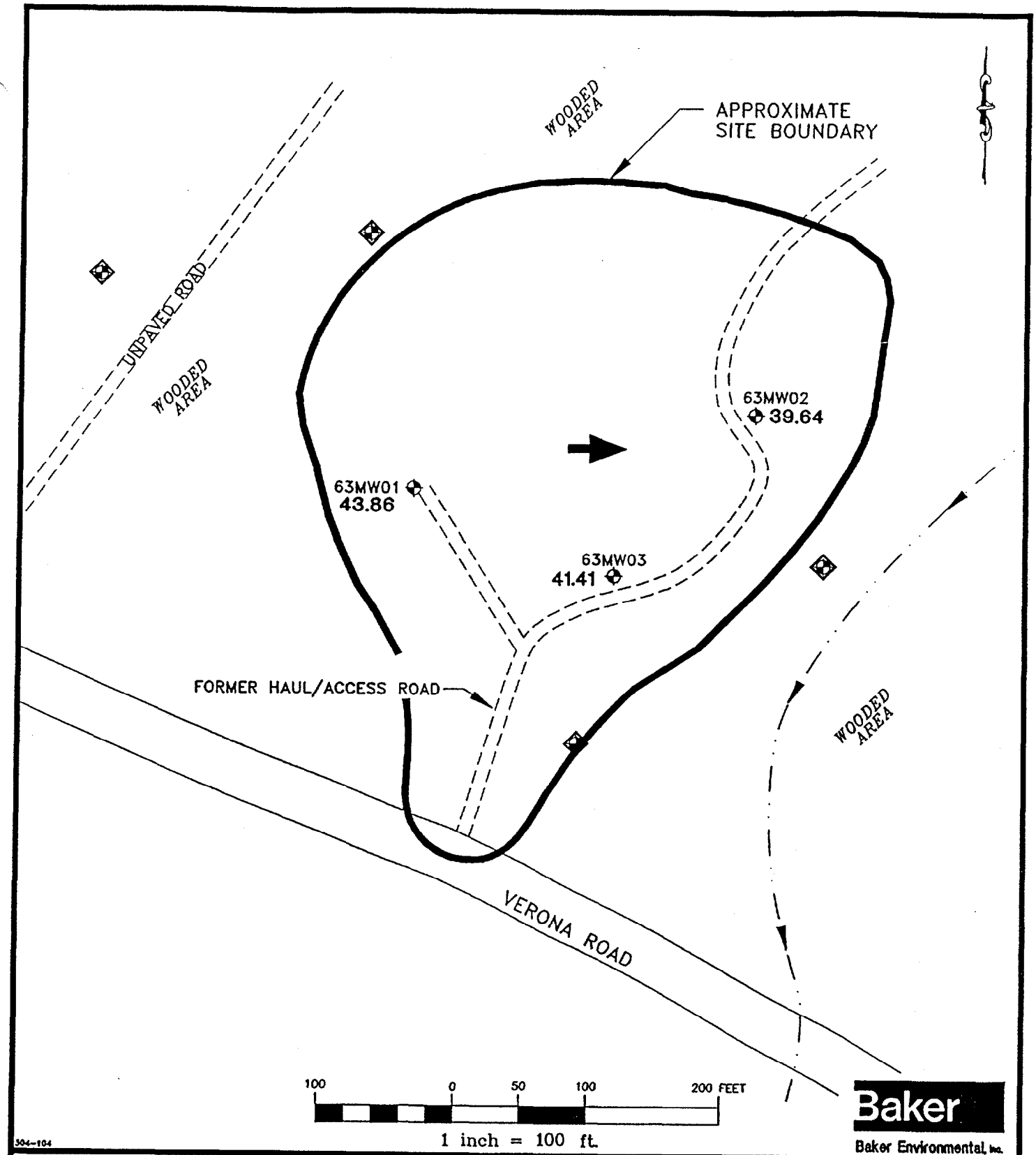
- One round of groundwater samples will be collected from new and existing monitoring wells. Low-flow purge and sampling techniques will be used in the collection of samples. All samples will be submitted for laboratory analysis (routine turnaround) including TCL organics, total TAL metals, and Total Dissolved Solids/Total Suspended Solids (TDS/TSS).

## 6.4 Surface Water/Sediment Investigation

The surface water/sediment investigation will be used to assess the current and historical impacts of the disposal area on the adjacent stream.

The surface water/sediment investigation will involve the following:

- One (1) surface water sample will be collected from each of three (3) stations in the adjacent stream (Figure 6-3). One station will be located upstream of the disposal area. Another station will be located adjacent to the disposal area. The remaining station will be located downstream of the disposal area. One (1) sediment sample will be collected at each of the same stations referenced above at a depth of 0 to 6 inches. Surface water and sediment samples will be submitted for laboratory analysis (routine turnaround) including TCL organics and TAL metals. Additionally, sediment samples will be analyzed for grain size and TOC. To determine if the groundwater and surface water are connected staff gauges will be installed.

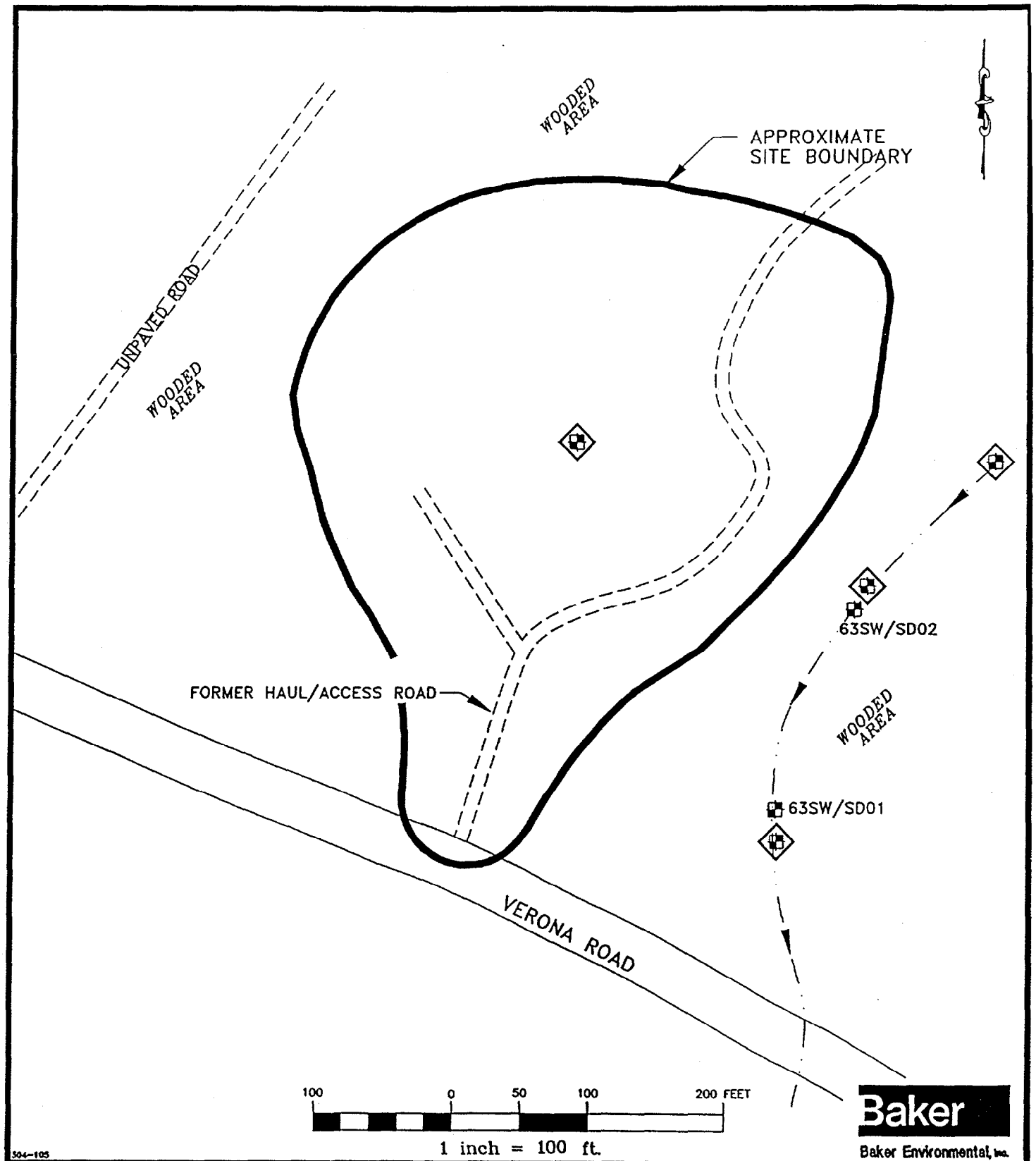



## LEGEND

- EXISTING MONITORING WELL LOCATION
- PROPOSED MONITORING WELL LOCATION
- 43.86 GROUNDWATER ELEVATION (FEET/MSL) IN 1995
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- APPROXIMATE INTERMITTENT STREAM LOCATION AND FLOW DIRECTION

FIGURE 6-2
PROPOSED GROUNDWATER INVESTIGATION
VERONA LOOP DUMP
SITE 63

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




LEGEND

- EXISTING SURFACE WATER/ SEDIMENT SAMPLE STATION
- PROPOSED SURFACE WATER/ SEDIMENT SAMPLE STATION
- APPROXIMATE INTERMITTENT STREAM LOCATION AND FLOW DIRECTION

FIGURE 6-3
PROPOSED SURFACE WATER/ SEDIMENT INVESTIGATION
VERONA LOOP DUMP
SITE 63
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

- If standing water is present, one (1) surface water sample will be collected from a station located in the trench near the center of the site (Figure 6-3). One (1) sediment sample will be collected at the same station at a depth of 0 to 6 inches, whether or not standing water is present. All samples will be submitted for laboratory analysis (routine turnaround) including TCL organics and TAL metals.