FINAL

PROPOSED REMEDIAL ACTION PLAN
OPERABLE UNIT NO. 5, SITE 2

MARINE CORPS BASE,
CAMP LEJEUNE, NORTH CAROLINA
CONTRACT TASK ORDER 0174

JUNE 23, 1994

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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TABLE OF CONTENTS

TABLES

FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
Baker	Baker Environmental, Inc.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	contaminants of concern
DON	Department of the Navy
FFA	Federal Facilities Agreement
FS	Feasibility Study
FSA	Former Storage Area
gpm	gallons per minute
HI	Hazard Index
IAS	Initial Assessment Study
ICR	Incremental Cancer Risk
IRP	Installation Restoration Program
LA	Lawn Area
MCB	Marine Corps Base
MPA	Mixing Pad Area
NC DEHNR	North Carolina Department of Environment, Health, and Natural Resources
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NPW	net present worth
O&M	operation and maintenance
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PRAP	Proposed Remedial Action Plan

RAA	remedial action alternative
RAO	remedial action objective
RGO	remediation goal option
RI	Remedial Investigation
RL	remediation level
ROD	Record of Decision
STP	sewage treatment plant
SVOC	semivolatile organic compound
TCE	trichloroethene
TCLP	Toxicity Characteristics Leaching Procedure
TCRA	Time Critical Removal Action
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

PROPOSED REMEDIAL ACTION PLAN

Introduction

This Proposed Remedial Action Plan (PRAP) is issued to describe the Marine Corps Base (MCB) Camp Lejeune and the Department of the Navy's (DoN's) preferred remedial action for Operable Unit No. 5 at MCB, Camp Lejeune, Onslow County, North Carolina. Operable Unit No. 5 is located at the intersection of Holcomb Boulevard and Brewster Boulevard, within MCB Camp Lejeune. Operable Unit No. 5 consists of one site, Site 2 (Former Nursery/Day Care Center).

MCB Camp Lejeune and the DoN are issuing this PRAP as part of the public participation responsibility established under Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and the Federal Facilities Agreement (FFA) between the DoN, United States Environmental Protection Agency (USEPA) Region IV, and the North Carolina Department of Environment, Health, and Natural Resources (NC DEHNR).

MCB Camp Lejeune and the DoN, with the assistance of USEPA Region IV and the NC DEHNR, will select a remedy for Site 2 only after the public comment period has ended and the information submitted during this time has been reviewed and considered. The Final Record of Decision (ROD) may recommend a different remedial action than is presented in this plan depending on new information or public comments.

This PRAP briefly summarizes information that can be found in greater detail in the Remedial Investigation (RI) Report, the Feasibility Study (FS), and other documents referenced in the RI and FS Reports prepared for Site 2. The DoN encourages the public to review these documents in order to gain a more comprehensive understanding of the site. The Administrative Record file, which contains information on which the selection of the remedial action will be based, is available for public review at the Onslow County Library in Jacksonville, North Carolina. The public is invited to review and comment on the Administrative Record and this PRAP.

Operable Unit Description

Camp Lejeune is a training base for the U.S. Marine Corps, located in Onslow County, North Carolina. The Base covers approximately 236 square miles and includes 14 miles of coastline. MCB Camp Lejeune is bounded to the southeast by the Atlantic Ocean, to the northeast by State Route 24, and to the west by U.S. Route 17. The town of Jacksonville, North Carolina is located north of the Base.

The study area, Operable Unit No. 5 (Site 2) is one of 13 operable units within MCB Camp Lejeune. An "operable unit" as defined by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) is a discrete action that comprises an incremental step toward comprehensively addressing site problems. The cleanup of a site can be divided into a number of operable units, depending on the complexity of the problems associated with the site. Operable units may address geographical portions of a site, specific site problems, or initial phases of an action. With respect to MCB Camp Lejeune, operable units were developed to combine one or more individual sites where Installation Restoration Program (IRP) activities are or will be implemented.

Operable Unit No. 5, which covers an area of approximately 5 acres, is made up solely of Site 2, which is located at the intersection of Holcomb Boulevard and Brewster Boulevard (see Figures 1 and 2). Within the site, there are two main areas of concern: the area around Building 712, including the Lawn Area (LA) and the Mixing Pad Area (MPA); and the Former Storage Area (FSA), which is located at the southern portion of the site (See Figure 2).

As shown on Figure 2, the site is bordered to the north by a wooded area that generally drains north toward Overs Creek; to the west by Holcomb Boulevard; and to the east by the Water Treatment Plant (Building No. 670). The land at Site 2 is primarily flat, but dips sharply at the drainage ditches which run parallel to the Lejeune Railroad. There is a drainage ditch on both the east and west side of the railroad tracks. Drainage along the eastern edge of the Building 712 area is toward these drainage ditches along the railroad, which run in a north-northwest direction toward Overs Creek. Drainage along the western edge of the Former Storage Area is also toward these drainage ditches. Another drainage ditch extends westward from the Building 712 area, underneath Holcomb Boulevard.

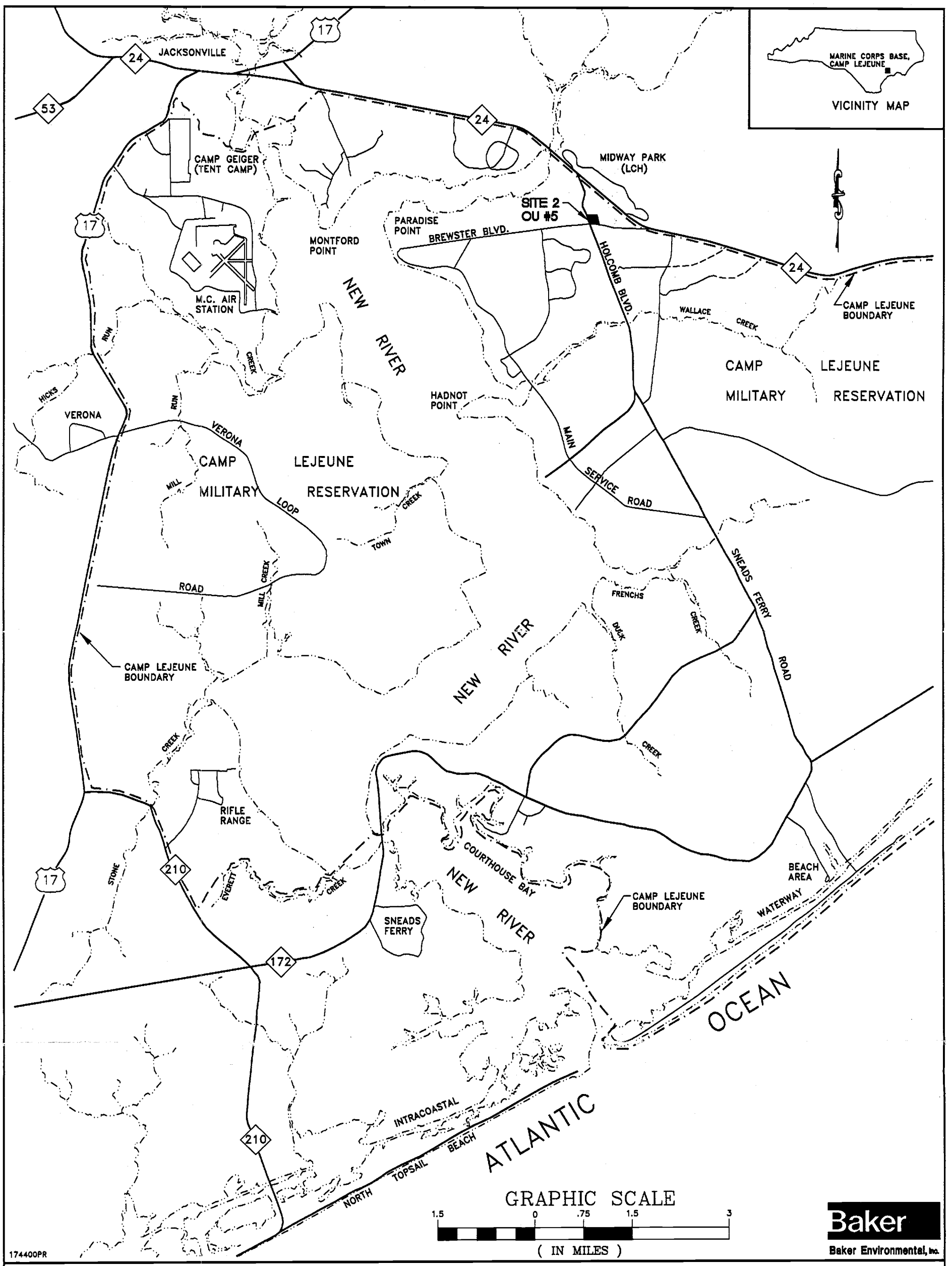

FIGURE 1
LOCATION MAP
OPERABLE UNIT No.5, SITE 2
PROPOSED REMEDIAL ACTION PLAN CTO-0174
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

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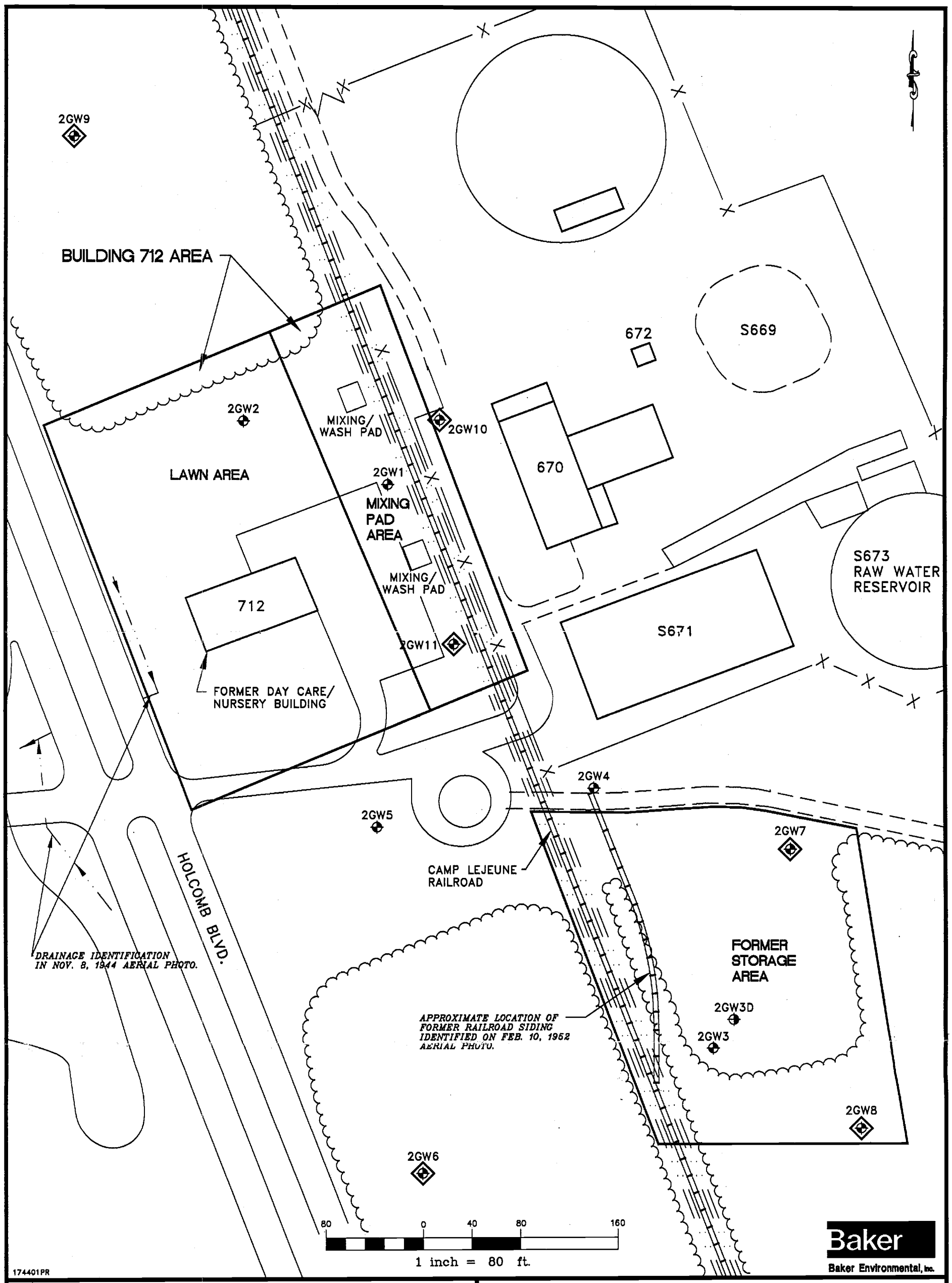


LEGEND

2GW1 EXISTING SHALLOW MONITORING WELL

2GW3D NEWLY INSTALLED SHALLOW MONITORING WELL

2GW3D NEWLY INSTALLED DEEP MONITORING WELL

SOURCE: LANTDIV, FEB. 1992

FIGURE 2
SITE PLAN OF
OPERABLE UNIT No.5, SITE 2
PROPOSED REMEDIAL ACTION PLAN CTO-0174

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

Operable Unit Background History

From 1945 to 1958, Building 712 was used for the storing, handling, and dispensing of pesticides. Building 712 was later used as a children's day care center. The building is currently used for administrative offices.

Chemicals known to have been used include: chlordane, DDT, diazinon, and 2,4-D. Chemicals known to have been stored on site include dieldrin, lindane, malathion, silvex, and 2,4,5-T. Areas of suspected contamination are the former fenced playground area, the mixing pad, the wash pad, and railroad drainage ditches. Aboveground horizontal storage tanks were detected near the MPA in a 1952 aerial photograph. These storage tanks may have stored pesticides. Contamination is believed to have occurred as a result of small spills, washout and excess product disposal. During the years of operation, it is reasonable to assume several gallons per year were involved; therefore, the estimated quantity involved is on the order of 100 to 500 gallons of liquids containing various concentrations of product. Solid residues in cracks and crevasses may total 1 to 5 pounds. Disposal to Overs Creek is undocumented.

There is little documentation regarding the operational history of the FSA. It was reportedly used to store bulk materials and vehicles. The following items, within the FSA, were identified in aerial photos of the site:

- A railroad siding, extending from the main line into the FSA.
- A crane, possibly located on the railroad siding, that was apparently used to unload materials from railroad cars.
- An area of possibly stained surface soil, present along the eastern border of this area.

Previous Investigations

Previous investigations of hazardous waste sites at MCB Camp Lejeune have been conducted under an Initial Assessment Study (IAS) and Confirmation Study. The following summarizes these and other previous investigations and their findings as they pertain to Site 2:

Initial Assessment Study

An IAS was conducted by Water and Air Research, Inc., in 1983. The IAS identified a number of sites at MCB Lejeune as potential sources of contamination, including Site 2. The IAS reviewed historical records and aerial photographs, as well as performed field inspections and personnel interviews to evaluate potential hazards at various sites on MCB Camp Lejeune. Based on review of historical records and general site reconnaissance, Site 2 was among the sites at MCB Camp Lejeune recommended for further study to evaluate the necessity of conducting mitigating actions or clean-up operations.

Confirmation Study

A Confirmation Study was conducted by Environmental Science and Engineering, Inc., beginning in 1986. Confirmation study activities were aimed at confirming the existence of contaminants potentially detrimental to human health and the environment at the site. The study included various phases based on the media of interest. A summary of constituents detected in the various media sampled is presented below:

- Soil sample results indicated that pesticides were present in soils surrounding the mixing/washing pad area.

- Analysis of pesticides in the shallow aquifer indicated the presence of trace amounts of pesticides in one well (2GW1). No detected compounds were reported for the supply wells. In December 1986, a second round of groundwater samples were collected. Trace amounts of pesticides were found in monitoring wells 2GW1 and 2GW3. In addition, ethylbenzene was detected in monitoring well 2GW3 above the North Carolina groundwater standard of 29 µg/L. In March 1987, a third round of groundwater samples from a select group of wells revealed trace amounts of pesticides in monitoring well 2GW3. Ethylbenzene was again detected above the applicable water quality standard in well 2GW2.

- In 1986, two surface water/sediment samples were collected from the drainage ditch along the eastern boundary of the site. One surface water/sediment sample revealed low levels of pesticides present.

Pre-Remedial Investigation Activities

In July 1992, a geophysical investigation was performed at Site 2 to determine the source of groundwater contamination near monitoring well 2GW3. No anomalies that could serve as sources (i.e., tanks or drums) of groundwater contamination were identified during this investigation. However, an anomalous subsurface feature was detected near monitoring well 2GW3. The data from this anomaly was not conclusive to ascertain whether or not it was a tank, large diameter utility line or other buried structure.

In January 1994, additional geophysical investigation activities were conducted in the vicinity of this anomalous subsurface feature. This focused reinvestigation determined that there were no subsurface features in this area. The fixture that was apparently detected in July 1992 may have been an echo or interference from monitoring well 2GW3 (Baker 1994).

Also in 1992 a limited groundwater sampling program was implemented to obtain preliminary data to scope RI activities.

Remedial Investigation

Baker Environmental, Inc. initiated an RI field program at Site 2 to characterize potential environmental impacts and threats to human health resulting from previous storage, operational, and disposal activities. Investigation activities commenced in April 1993 and continued through June 1993. The field program consisted of a preliminary site survey; a geophysical survey; a soil gas survey; a soil investigation including drilling and sampling; a groundwater investigation including monitoring well installation (shallow and deep wells) and sampling (two rounds); a surface water and sediment investigation; and an aquatic and ecological survey.

Table 1 presents a listing of contaminants detected at Site 2.

A summary of the nature and extent of contamination at Site 2 is presented below.

- Soil in the vicinity of the MPA has been impacted by pesticide contamination. This is apparently the result of releases associated with pesticide mixing and washing of pesticide and herbicide spraying equipment. The soil in this area has also been impacted by SVOC contamination. This is apparently the result of petroleum-based

TABLE 1

CONTAMINANTS DETECTED WITHIN OPERABLE UNIT NO. 5
PROPOSED REMEDIAL ACTION PLAN - CTO-0174
MCB CAMP LEJEUNE, NORTH CAROLINA

Pesticides	Volatile Organic Compounds	Semivolatile Organic Compounds
4,4'-DDD	Acetone	2,4-Dimethylphenol
4,4'-DDE	Dichloroethene	Acenaphthlene
4,4'-DDT	Benzene	Anthracene
alpha-Chlordane	Bromomethane	Benzo(a)anthracene
Dieldrin	Dichloromethane	Benzo(a)pyrene
Endrin	Ethylbenzene	Benzo(b)fluoranthene
Endosulfan II	Trichloroethene	Benzo(k)fluoranthene
gamma-Chlordane	Toluene	Chrysene
Heptachlor	Xylenes (total)	Fluoranthene
	trans-1,2-Dichloroethene	Fluorene
	Trichloroethene	Naphthalene
Inorganics	Vinyl Chloride	n-Nitrosodiphenylamine
Aluminum	2-Butanone	Phenanthrane
Arsenic	4-Methyl-2-Pentanone	Phenol
Barium	Methylene Chloride	Pyrene
Beryllium		2-Methylnaphthalene
Chromium		Di-n-butyl Phthalate
Copper		Bis(2-ethylhexyl)phthalate
Iron		
Lead		
Manganese		
Mercury		
Selenium		
Silver		
Vanadium		

solvents or fuels (possibly diesel fuel) being used as a carrying agent for herbicide mixtures and to operate and clean spraying equipment.

- Sediment in the railroad track drainage ditches in the vicinity of the MPA has been impacted by pesticide contamination. SVOCs have also been detected in sediment samples collected in this area. This is apparently the result of releases associated with herbicide mixing and the cleaning (possibly with diesel fuel) of pesticide and herbicide spraying equipment.

- Soil throughout Site 2 (i.e., outside of the MPA) has been impacted by pesticide contamination that resulted from the former practice of general base-wide spraying of pesticides. The pesticide concentrations in soil in the LA and FSA are several orders of magnitude lower than the pesticide contaminant concentrations detected in the vicinity of the MPA.

- Shallow groundwater in the FSA has been impacted by VOC contamination. Ethylbenzene and xylene (total) were detected in groundwater samples collected from shallow monitoring wells in the FSA. The area of highest VOC concentration is at monitoring well 2GW3. VOCs have been detected in this monitoring well during previous investigations. The extent of VOC contamination appears to be limited to the shallow groundwater in the vicinity of the FSA.

  The source of the shallow groundwater contamination in the FSA has not been determined. Similar contaminants were detected in low levels in one soil boring in the vicinity of monitoring well 2GW3, indicating that the source may have been at or near the surface in this area (e.g., surface spill, etc.).

- Inorganics were detected in groundwater samples collected from shallow monitoring wells at the site. Several of these analytes exceeded Federal and/or North Carolina groundwater quality standards. The distribution of detected inorganics in shallow groundwater followed no discernible pattern that would indicate a likely source. Many of the highest concentrations of inorganics were detected in background monitoring wells (2GW9, 2GW8). The concentrations of detected inorganics is much greater in the unfiltered (total) samples than in the filtered (dissolved) samples. This indicates that the inorganics detected in groundwater samples at Site 2 may be due predominantly to the presence of soil particles entrained in the groundwater samples

and may not be attributable to site operations. Some inorganics (arsenic, lead, barium, beryllium, and vanadium) were nonetheless retained as chemicals of concern in the baseline risk assessment.

- Trichloroethene (TCE) was detected at a low concentration (5 µg/L) in deep monitoring well 2GW3D. There is no evidence (documentation, soil samples, shallow groundwater samples) to indicate that this is related to operation activities at Site 2. TCE and other chlorinated hydrocarbons have been detected in deep groundwater in other areas at MCB Camp Lejeune (Geophex, 1991). TCE was not detected in this monitoring well during the second round of groundwater sampling.

- Trace levels of pesticides were detected in surface water samples collected in the railroad drainage ditches. This may be the result of Site 2 operations or general base-wide spraying. Copper was detected above applicable Freshwater Water Quality Screening Value (FWQSV), North Carolina Water Quality Standards (NCWQS), and Federal Ambient Water Quality Criteria (AWQC) applicable to Overs Creek.

Time Critical Removal Action

Based on the RI findings and human health and ecological risk assessments, a Time-Critical Removal Action (TCRA) for the removal and disposal of contaminated surface and subsurface soil and sediment, identified in the area of the two mixing/wash pads and the former storage area, has been proposed. Implementation of the TCRA will mitigate potential human health and ecological risks associated with contaminated soil and sediment. The TCRA is currently in the design phase.

The proposed TCRA includes:

- Excavation of 500 cubic yards of soil, sediment, and debris from the mixing pad area and FSA

- Confirmation soil sampling and analysis, and additional excavation of material contaminated in excess of the removal action endpoints

- Transportation and disposal of contaminated soil and sediment at a RCRA-permitted hazardous waste landfill

- Site restoration

Upon completion of the TCRA, the primary sources of contamination at Site 2 will be removed. The only remaining COC will be organic and inorganic contaminants in groundwater. The selected remedial alternative will only address the groundwater.

Scope and Role of Action

The proposed remedial action identified in this PRAP is the overall strategy for the entire operable unit in that it addresses the media of concern, which is groundwater. Implementation of this remedial action will insure, through monitoring and ***deed*** restrictions, that exposure to contaminated groundwater will not occur. This, in turn, will insure that there is no risk to human health and to the environment.

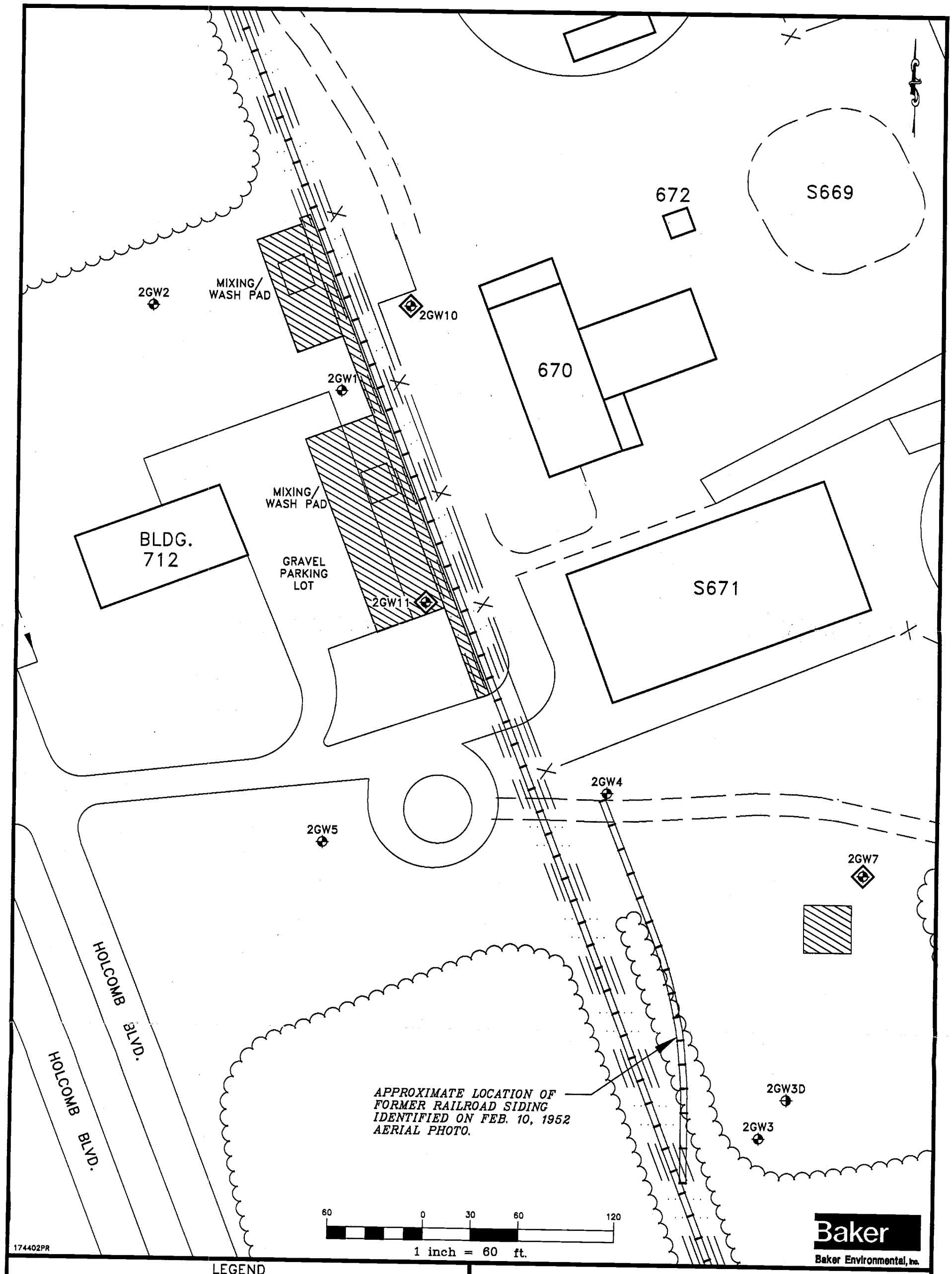
In addition, the RI identified pesticide contaminated soil in the Mixing Pad Area, and sediment along the railroad tracks that may pose a threat to human health and the environment. This material will be removed from Site 2 through a TCRA, which will be conducted prior to implementing the groundwater remedial alternative at the site. The location of the contaminated soil and sediment to be addressed in the TCRA are shown on Figure 3.

Surface water and sediment outside of the areas to be included in the TCRA will not be addressed under this action for the following reasons:

- The overall risk to human health posed by contaminants in the Railroad Track Drainage Ditches and Overs Creek are acceptable.

- Based on a comparison of surface water and sediment data to EPA Region IV, NOAA, Surface Water and Sediment Screening Values, adverse impacts to the benthic or fish communities are low.

- The groundwater remedial alternative and the removal of contaminated soil and sediment at the site will prevent future potential contamination of Overs Creek.



LEGEND

- 2GW1 – NEWLY INSTALLED SHALLOW MONITORING WELL
- 2GW3D – EXISTING DEEP MONITORING WELL
- 2GW7 – EXISTING SHALLOW MONITORING WELL
- – PROPOSED AREAS (APPROXIMATE) TO BE INCLUDED IN TIME CRITICAL REMOVAL ACTION

SOURCE: LANTDIV, FEB. 1992

FIGURE 3
APPROXIMATE AREAS TO BE INCLUDED IN
TIME CRITICAL REMOVAL ACTION
SITE 2
PROPOSED REMEDIAL ACTION PLAN CTO-0174
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

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Summary of Site Risks

As part of the RI, a Human Health Risk Assessment and an Ecological Risk Assessment were conducted to evaluate the current and future potential risks to human health and the environment resulting from the presence of contaminants identified at Site 2. A summary of the key findings from both of these studies is presented below.

Human Health Risk Assessment

The risk assessment was conducted for several environmental media including surface soil, subsurface soil, groundwater, surface water, and sediment. Contaminants of potential concern (COPCs) for each of these media were selected based on site history, chemical concentration, prevalence, toxicity, and comparison to standards.

Table 2 lists the COPCs which were identified and assessed for each media. For soil and groundwater, COPC included VOCs, SVOCs, pesticides, and inorganics. Surface water COPCs included pesticides and inorganics, and sediment COPCs included VOCs, pesticides, and inorganics.

The receptors evaluated for the baseline RA assessment included current exposure for civilian base personnel, and future exposure for construction workers, and resident children and adults for both the Lawn and Mixing Pad Areas and the Former Storage Area. Soil, groundwater, surface water, and sediment were quantitatively evaluated. Note that a "future residential exposure" has been evaluated in the RA in accordance with EPA Region IV guidelines; however, future land use of this area is nonresidential based on the five-year Master Plan for MCB, Camp Lejeune.

The human health RA conducted under two scenarios:

- Site risks without (before) the TCRA
- Site risks with (after) the TCRA

The results of the RA are summarized on Table 3. There will be no risks in the unacceptable range associated with soil, sediment, or surface water at the site after the TCRA is implemented. Remaining site risks are associated with contaminants present in the shallow groundwater.

TABLE 2

SUMMARY TABLE OF CHEMICALS OF POTENTIAL CONCERN FOR OPERABLE UNIT NO. 5, SITE 2
PROPOSED REMEDIAL ACTION PLAN - CTO-0174
MCB CAMP LEJEUNE, NORTH CAROLINA

Chemical of Potential Concern	Lawn and Mixing Pad Areas		Lawn and Mixing Pad Areas Time-Critical Removal Action		Former Storage Area		Former Storage Area Time-Critical Removal Action	
	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil
Volatile Organics								
Ethylbenzene						X		X
Toluene					X	X	X	X
Xylene (total)	X	X	X	X	X	X	X	X
Semivolatile Organics								
Accnaphthene		X						
Anthracene		X						
Fluoranthene		X						
Fluorene		X						
2-Methylnaphthalene		X						
Naphthalene		X						
N-Nitrosodiphenylamine		X						
Phenanthrene		X						
Pyrene		X						
Pesticides								
alpha-Chlordane	X	X	X	X				
gamma-Chlordane	X	X	X	X				
4,4'-DDD	X	X	X	X	X	X	X	X
4,4'-DDE	X	X	X	X	X	X	X	X
4,4'-DDT	X	X	X	X	X	X	X	X
Dieldrin	X							
Heptachlor	X	X						
Inorganics								
Arsenic	X	X	X			X		X

TABLE 2 (Continued)

SUMMARY TABLE OF CHEMICALS OF POTENTIAL CONCERN FOR OPERABLE UNIT NO. 5, SITE 2
PROPOSED REMEDIAL ACTION PLAN - CTO-0174
MCB CAMP LEJEUNE, NORTH CAROLINA

Chemical of Potential Concern	Groundwater	Surface Water Drainage Ditches	Sediment Railroad Drainage Ditches	Sediment Time-Critical Removal Action Railroad Drainage Ditches	Sediment Overs Creek
Volatile Organics					
Ethylbenzene	X		X		
Trichloroethene	X				
Xylene (total)	X		X		
Semivolatile Organics					
Acenaphthene	X				
2-Methylnapthalene	X		X		
2,4-Dimethylphenol	X				
Naphthalene	X		X		
Phenol	X				
Pesticides					
alpha-Chlordane			X	X	
gamma-Chlordane			X	X	
4,4'-DDD	X	X	X	X	X
4,4'-DDE			X	X	X
4,4'-DDT	X	X	X	X	X
Dieldrin			X	X	
Endofulfan II			X		
Inorganics					
Arsenic	X	X	X		X
Barium	X				
Beryllium	X	X			
Lead	X				
Vanadium	X				

Note: X = denotes chemical was retained as a chemical of potential concern

TABLE 3

TOTAL SITE INCREMENTAL LIFETIME CANCER RISK AND HAZARD INDICES
OPERABLE UNIT NO. 5 - SITE 2
PROPOSED REMEDIAL ACTION PLAN - CTO-0174
MCB CAMP LEJEUNE, NORTH CAROLINA

Receptors	Lawn and Mixing Pad Areas		Lawn and Mixing Pad Areas - Time Critical Removal Action		Former Storage Area		Former Storage Area - Time Critical Removal Action		Overs Creek	
	ICR	HI	ICR	HI	ICR	HI	ICR	HI	ICR	HI
Civilian Base Personnel	1E-4	1.3	5E-7	0.008	3E-7	0.004	3E-8	3E-4	--	--
Construction Worker	6E-7	0.1	1E-10	6E-5	4E-8	.005	4E-8	.005	--	--
Child Resident	2E-3	111	3E-4	11	3E-4	12	3E-4	11	--	--
Adult Resident	2E-3	23	7E-4	5	7E-4	5	7E-4	5	--	--
Trespassing Child	--	--	--	--	--	--	--	--	1E-7	1E-3
Trespassing Adult	--	--	--	--	--	--	--	--	9E-8	3E-4

Notes: ICR = Incremental Lifetime Cancer Risk
HI = Hazard Index

Shading indicates that risk level is not within or fell above acceptable levels.

Currently there are no receptors who are exposed to the shallow groundwater in this area. All groundwater used at MCB, Camp Lejeune is supplied by the deeper Castle Hayne aquifer from uncontaminated supply wells. Future development of the shallow aquifer for potable use is unlikely because of the general poor water quality in the shallow zone, poor flow rates, and the unlikely future development of the site for residential housing. The potential risk that could be due to groundwater exposure at this site was evaluated as a conservative estimation exposure.

Ecological Risk Assessment

An Ecological Risk Assessment was conducted at Site 2 in conjunction with the RI. The objective of this risk assessment was to determine if past reported disposal activities are adversely impacting the ecological integrity of the terrestrial and aquatic habitats on, or adjacent to, the site.

The results of the ecological risk assessment indicate the following:

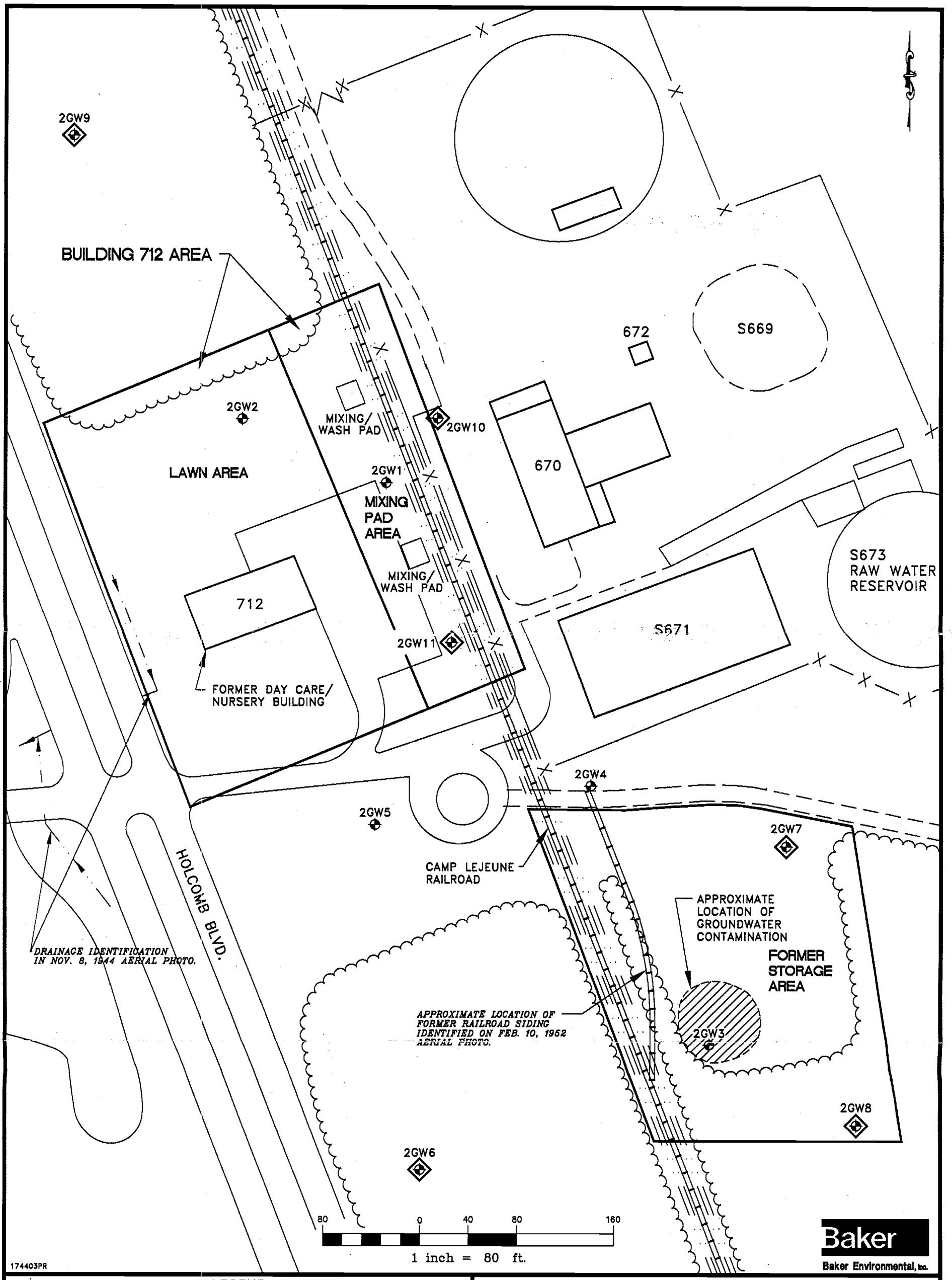
- Pesticides in sediments along the drainage ditch and Overs Creek result in a potential decrease in the viability of aquatic receptors under both the no TCRA and the TCRA scenarios.

- Pesticides in the soil in the MPA result in a potential decrease in the viability of terrestrial receptors under the no TCRA scenario. Under the TCRA scenario, there is no decrease in the viability of terrestrial receptors.

- There is no decrease in viability of aquatic or terrestrial receptors in the FSA under either the no TCRA scenario or the TCRA scenario.

Summary of Alternatives

The Remedial Action Alternatives (RAAs) were developed to address contaminated groundwater at Site 2. Groundwater contamination is restricted to shallow groundwater in the FSA, near monitoring well 2GW3, where elevated levels of ethylbenzene (190 µg/L) and total xylenes (1800 µg/L) were detected. Figure 4 shows the general location of shallow groundwater contamination.



LEGEND

2GW1 EXISTING SHALLOW MONITORING WELL

2GW3D NEWLY INSTALLED SHALLOW MONITORING WELL

SOURCE: LANTDIV, FEB. 1992

FIGURE 4
APPROXIMATE LOCATION OF
SHALLOW GROUNDWATER CONTAMINATION
OPERABLE UNIT No.5, SITE 2
PROPOSED REMEDIAL ACTION PLAN CTO-0174
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

01253 BB02Z

Soil and sediment in the vicinity of the MPA exhibit elevated concentrations of pesticide contaminants. However, these are being addressed in the TCRA. After the contaminated soils are removed, the potential human health risks will be reduced to an acceptable level, as indicated by an ICR value between 1.0E-4 to 1.0E-6. Since the TCRA will be conducted prior to implementing any RAA considered in this PRAP, the LA and MPAs will not be considered further in this PRAP.

Based on the above, six groundwater RAAs were developed and evaluated in the FS. A brief overview of each of the RAAs is included below. All costs and implementation times are estimated.

Groundwater RAAs

The following groundwater RAAs were developed and evaluated for Site 2:

- RAA No. 1 No Action
- RAA No. 2 Institutional Controls with Long-term Monitoring
- RAA No. 3 Collection/Treatment/Discharge to a Sewage Treatment Plant
- RAA No. 4 Collection/Discharge to a Sewage Treatment Plant
- RAA No. 5 Collection/Discharge to Site 82 (Operable Unit No. 2)
- RAA No. 6 In-Situ Treatment

Common Elements - Except for the "No Action" RAA, all of the Groundwater RAAs include a the following common components:

- RAAs 2 through 6 will include institutional controls such as a long-term groundwater monitoring, aquifer-use restrictions, and on placement of potable water supply wells restrictions. The monitoring activities will be conducted to gauge the effectiveness of the selected remedy. Restrictions will be placed on the operable unit to prohibit the installation of any new potable water supply wells. Aquifer-use restrictions will be implemented to control the installation of new potable water supply wells in this area.

- RAAs 3 through 5 include the extraction of contaminated groundwater followed by on-site or off site treatment and discharge.

A description of each alternative as well as the estimated capital costs, annual operation and maintenance (O & M) costs, the Net Present Worth (NPW) and timeframe to implement the alternative follows. The NPW is calculated over a period of 30 years, at a 5 percent interest rate:

- **RAA No. 1: No Action**

  Capital Cost: $0
  Annual O&M Costs: $0
  NPW: $0
  Months to Implement: None

  The No Action RAA is required under CERCLA to establish a baseline for comparison. Under this RAA, no further action at the operable unit will be implemented.

- **RAA No. 2: Institutional Controls with Long-Term Monitoring**

  Capital Cost: $0
  Annual O&M Costs: $57,100 for Years 1 and 2, $28,550 for Years 3 through 5, and $15,475 for Years 6 through 30
  NPW: $350,000
  Months to Implement: 3

  RAA No. 2 will include the institutional controls that are common with RAA Nos. 2 through 6, as mentioned previously. The long-term monitoring program will consist of quarterly sampling and analysis of the groundwater from 12 existing monitoring wells and 3 operational water supply wells (616, 646, and 647) for years one and two, and semiannual sampling for years three through five. Restrictions will be implemented which will restrict the installation of any new potable water supply wells within the vicinity of Site 2. After five years, the site will be reviewed, and the long-term monitoring program could be adjusted to annual sampling.

- **RAA No. 3: Collection/Treatment/Discharge to a Sewage Treatment Plant**

  Capital Cost: $303,000
  Annual O&M Costs: $162,760 for Years 1 and 2, $134,210 for Years 3 through 5, and $119,935 for Years 6 through 30
  NPW: $1.89 million
  Months to Implement: 15

  Under RAA No. 3, the contaminated groundwater plume originating in the FSA near monitoring well 2GW3 will be extracted and treated on-site. A network of three

shallow extraction wells will be placed along the boundary of the plume. Each extraction well will be installed to a depth of 35 feet and pumped at a rate of approximately 5 gallons per minute (gpm). The extracted groundwater will be treated on site via a combination of applicable treatment options (or treatment train), and then discharged through a force main to a sanitary sewer which discharges to the Hadnot Point Sewage Treatment Plant (STP). The treatment train may consist, but not be limited to, filtration, neutralization, precipitation, air stripping, and activated carbon adsorption.

The overall objective of this RAA is to reduce the COPCs in the groundwater to drinking water standards for Class I aquifers and to mitigate the potential for further migration of the existing groundwater plume. The cone of influence created by extraction wells are expected to reach the downgradient boundary of the plume. Groundwater extraction and treatment will be employed until the remediation goals of the aquifer are met. In addition, this RAA includes the same institutional controls as Groundwater RAA No. 2.

- **RAA No. 4: Collection/Discharge to a Sewage Treatment Plant**

Capital Cost: $210,000
Annual O&M Costs: $106,220 for Years 1 and 2, $77,670 for Years 3 through 5, and $63,395 for Years 6 through 30
NPW: $1.30 million
Months to Implement: 15

Under RAA No. 4, the contaminated groundwater plume originating in the FSA near monitoring well 2GW3 will be extracted via an extraction well system as in RAA No.3, and discharged untreated through a force main to a sanitary sewer, which discharges to the Hadnot Point STP.

The overall objective of this RAA is to reduce the COPCs in the groundwater to drinking water standards for Class I aquifers and to mitigate the potential for further migration of the existing groundwater plume. The cone of influence created by extraction wells are expected to reach the downgradient boundary of the plume. Groundwater extraction and treatment will be employed until the remediation goals of the aquifer are met. In addition, this RAA includes the same institutional controls as Groundwater RAA Nos. 2 and 3.

- **RAA No. 5: Collection/Discharge to Site 82 (O.U. No.2)**

  Capital Cost: $323,000
  Annual O&M Costs: $108,220 for Years 1 and 2, $79,670 for Years 3 through 5, and $65,395 for Years 6 through 30
  NPW: $1.44 million
  Months to Implement: 15

  Under RAA No. 5, the contaminated groundwater plume originating in the FSA near monitoring well 2GW3 will be extracted via an extraction well system as in RAA No.3, and discharged untreated through a force main to a groundwater treatment system to be constructed at Site 82. At Site 82, the extracted groundwater will be treated via a treatment train similar to the one mentioned in RAA No. 3 (with the exception of size). Treated groundwater will be discharged to Wallace Creek.

  The overall objective of this RAA is to reduce the COPCs in the groundwater to drinking water standards for Class I aquifers and to mitigate the potential for further migration of the existing groundwater plume. In addition, this RAA includes the same institutional controls as Groundwater RAA Nos. 2, 3, and 4.

- **RAA No. 6: In-Situ Treatment**

  Capital Cost: $124,000
  Annual O&M Costs: $113,440 for Years 1 and 2, $84,890 for Years 3 through 5, and $70,615 for Years 6 through 30
  NPW: $1.26 million
  Months to Implement: 15

  Under RAA No. 6, the contaminated groundwater plume originating in the FSA near monitoring well 2GW3 will be remediated via an air sparging and soil vapor extraction system. In this method, air will be injected into the groundwater through air sparging wells. The air acts to strip and remove the VOC contaminants from the groundwater. Soil venting wells will be placed to control air flow and to collect vapors within the vadose zone. The collected vapors would be treated to remove the contaminants prior to the air being vented to the atmosphere. No groundwater is removed in this alternative, therefore, groundwater does not have to be discharged to a STP or a watercourse.

  The objective of this RAA is to reduce the COPCs in the groundwater to levels that meet drinking water standards for Class I aquifers, and to reduce the potential for

further migration of the existing groundwater plume at Site 2. In addition, this RAA includes the same institutional controls as Groundwater RAA Nos. 2, 3, 4, and 5.

Evaluation of Alternatives and the Preferred Alternative

The preferred RAA for Site 2 is Groundwater RAA No. 2, Institutional Controls with Long-Term Monitoring. The principal components of this RAA include institutional controls such as long-term groundwater monitoring, aquifer use restrictions, and land use restrictions. Based on available information, this alternative appears to provide the best balance with respect to the nine CERCLA evaluation criteria used to evaluate alternatives. Based on new information or public comments, MCB Camp Lejeune/DoN, in consultation with USEPA and the State of North Carolina, may later modify the preferred alternative or select another treatment alternative presented in this PRAP and the RI/FS. The public, therefore, is encouraged to review and comment on all of the information on these RAAs identified in this plan.

A profile of the performance of six alternatives with respect to seven of the nine criteria is presented on Table 4. The remaining criteria for Community Acceptance will be assessed in the Responsiveness Summary following a review of the public comments on the RI/FS Reports and this PRAP. A glossary of the evaluation criteria is presented on Table 5.

Summary of the Preferred Alternative

This section of the PRAP focuses on the selected remedy for Site 2. The major treatment components, engineering controls, and institutional controls of the remedy will be discussed along with the estimated costs to implement the remedial action. In addition, the remediation objectives to be attained at the conclusion of the remedial action will be discussed.

The selected remedy for Site 2 is RAA No. 2, Institutional Controls/Long-Term Groundwater Monitoring. The major components of the selected remedy include:

- Implementing a long-term groundwater monitoring program to monitor on-site wells and nearby potable water supply wells. Under this program, groundwater from 12 existing monitoring wells and 3 nearby operational water supply wells will be collected and analyzed for the following parameters:

TABLE 4

SUMMARY OF DETAILED ANALYSIS - GROUNDWATER RAAs
PROPOSED REMEDIAL ACTION PLAN - CTO-0174
MCB CAMP LEJEUNE, NORTH CAROLINA

Evaluation Criteria	RAA No. 1 No Action	RAA No. 2 Institutional Controls/Long-Term Groundwater Monitoring	RAA No. 3 Collection/Treatment/ Discharge to a STP	RAA No. 4 Collection/Discharge to a STP	RAA No. 5 Collection/Discharge to Site 82	RAA No. 6 In-Situ Treatment
OVERALL PROTECTIVENESS						
• Human Health Protection	No reduction in risk.	Institutional controls provide protection against risk from groundwater ingestion.	Groundwater plume treated. Pump and treat provides protection against future potential risk from groundwater ingestion.	Groundwater plume treated. Pump and treat provides protection against future potential risk from groundwater ingestion.	Groundwater plume treated. Pump and treat provides protection against future potential risk from groundwater ingestion.	Groundwater plume treated. In-situ treatment provides protection against future potential risk from ingestion.
• Environmental Protection	Allows continued contamination of the groundwater.	Allows continued contamination of the groundwater. Potential natural attenuation of organic contaminants over time.	Migration of contaminated groundwater is reduced by pump and treat.	Migration of contaminated groundwater is reduced by pump and treat.	Migration of contaminated groundwater is reduced by pump and treat.	Level of groundwater contamination is reduced by in situ treatment.
COMPLIANCE WITH ARARs						
• Chemical-Specific ARARs	Will exceed Federal and/or NC groundwater quality ARARs.	Will exceed Federal and/or NC groundwater quality ARARs.	Should meet Federal and NC groundwater quality ARARs in time.	Should meet Federal and NC groundwater quality ARARs in time.	Should meet Federal and NC groundwater quality ARARs in time.	Should meet Federal and NC groundwater quality ARARs in time.
• Location-Specific ARARs	Not applicable.	Not applicable.	Will meet location-specific ARARs.	Will meet location-specific ARARs.	Will meet location-specific ARARs.	Will meet location-specific ARARs.
• Action-Specific ARARs	Not applicable.	Not applicable.	Will meet action-specific ARARs.	Will meet action-specific ARARs.	Will meet action-specific ARARs.	Will meet action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE						
• Magnitude of Residual Risk	As migration of groundwater continues, potential risks may increase.	Risk reduced to human health since the use of the groundwater aquifer is restricted.	Risk reduced by extracting contaminated groundwater.	Risk reduced by extracting contaminated groundwater.	Risk reduced by extracting contaminated groundwater.	Risk reduced by in-situ treatment of contaminated groundwater.
• Adequacy and Reliability of Controls	Not applicable - no controls.	Institutional controls are reliable if strictly enforced.	Groundwater pump and treat is reliable.	Groundwater pump and treat is reliable.	Groundwater pump and treat is reliable.	In-situ treatment demonstrated for COCs
• Need for 5-year Review	Review would be required to ensure adequate protection of human health and the environment is maintained.	Review would be required to ensure adequate protection of human health and the environment is maintained.	Review not needed once remediation goals are met.	Review not needed once remediation goals are met.	Review not needed once remediation goals are met.	Review not needed once remediation goals are met.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT						
• Treatment Process Used	None.	None.	Treatment train for metals removal, air stripping, and activated carbon.	Physical and biological treatment at STP.	Treatment train at Site 82 for metals removal, air stripping, and activated carbon.	In-situ air sparging and soil venting for VOC removal.
• Amount Destroyed or Treated	None.	None.	Majority of contaminants in groundwater.	Majority of contaminants in groundwater.	Majority of contaminant in groundwater plumes.	Majority of contaminant in groundwater plumes.

TABLE 4 (Continued)

SUMMARY OF DETAILED ANALYSIS - GROUNDWATER RAAs
PROPOSED REMEDIAL ACTION PLAN - CTO-0174
MCB CAMP LEJEUNE, NORTH CAROLINA

Evaluation Criteria	RAA No. 1 No Action	RAA No. 2 Institutional Controls/Long-Term Groundwater Monitoring	RAA No. 3 Collection/Treatment/ Discharge to a STP	RAA No. 4 Collection/Discharge to a STP	RAA No. 5 Collection/Discharge to Site 82	RAA No. 6 In-Situ Treatment
• Reduction of Toxicity, Mobility or Volume	None.	None.	Reduced volume and toxicity of contaminated groundwater.	Reduced volume and toxicity of contaminated groundwater.	Reduced volume and toxicity of contaminated groundwater.	Reduced volume and toxicity of contaminated groundwater.
• Residuals Remaining After Treatment	Not applicable - no treatment.	Not applicable - no treatment.	Minimal residuals after goals are met.	Minimal residuals after goals are met.	Minimal residuals after goals are met.	Minimal residuals after goals are met.
• Statutory Preference for Treatment	Not satisfied.	Not satisfied.	Satisfied.	Satisfied.	Satisfied.	Satisfied.
SHORT-TERM EFFECTIVENESS						
• Community Protection	Risks to community not increased by remedy implementation.	Risks to community not increased by remedy implementation.	Potential risks to public health and environment during extraction and treatment due to equipment failure.	Potential risks to public health and environment during extraction and treatment due to equipment failure.	Potential risks to public health and environment during extraction and treatment due to equipment failure.	Potential risks to public health and environment during extraction and treatment due to equipment failure.
• Worker Protection	No significant risk to workers.	No significant risk to workers.	Protection required during treatment.	Protection required during treatment.	Protection required during treatment.	Protection required during treatment.
• Environmental Impacts	None	None	None	None	None	None
• Time Until Action is Complete	Not applicable.	Risks from potential groundwater ingestion reduced within 3 to 6 months due to institutional controls.	Thirty years used to determine NPW costs. Time for completion of remediation is unknown.	Thirty years used to determine NPW costs. Time for completion of remediation is unknown.	Thirty years used to determine NPW costs. Time for completion of remediation is unknown.	Thirty years used to determine NPW costs. Time for completion of remediation is unknown.
IMPLEMENTABILITY						
• Ability to Construct and Operate	No construction or operation activities.	No construction or operation activities.	Installation and treatment technologies proven.	Installation and treatment technologies proven.	Installation and treatment technologies proven.	Installation and treatment technologies proven.
• Ability to Monitor Effectiveness	No monitoring. Failure to detect contamination will result in potential ingestion of contaminated groundwater.	Proposed monitoring will give notice of failure before significant exposure occurs.	Adequate system monitoring.	Adequate system monitoring.	Adequate system monitoring.	Requires indirect monitoring of system performance.
• Availability of Services and Capacities; Equipment	None required.	None required.	Groundwater extraction and treatment equipment is readily available.	Groundwater extraction equipment is readily available.	Groundwater extraction equipment is readily available.	System components readily available.
COSTS Net Present Worth	$0	$350,000	$1.89 million	$1.3 million	$1.44 million	$1.32 million

RAA = Remedial Action Alternative STP = Sewage Treatment Plant ARARs = Applicable or Relevant and Appropriate Requirements

TABLE 5
GLOSSARY OF EVALUATION CRITERIA

- **Overall Protection of Human Health and Environment** - addresses whether or not an alternative provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment engineering controls or institutional controls.

- **Compliance with ARARs** - addresses whether or not an alternative will meet all of the applicable or relevant and appropriate requirements (ARARs) or other Federal and State environmental statutes.

- **Long-term Effectiveness and Permanence** - refers to the magnitude of residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

- **Reduction of Toxicity, Mobility, or Volume through Treatment** - is the anticipated performance of the treatment options that may be employed in an alternative.

- **Short-term Effectiveness** - refers to the speed with which the alternative achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.

- **Implementability** - is the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the chosen solution.

- **Cost** - includes capital and operation and maintenance costs. For comparative purposes, presents present worth values.

- **USEPA/State Acceptance** - indicates whether, based on review of the RI and FS reports and the PRAP, the USEPA and State concur with, oppose, or have no comments on the preferred alternative.

- **Community Acceptance** - will be assessed in the Record of Decision (ROD) following a review of the public comments received on the RI and FS reports and the PRAP.

- VOCs
- Barium (total and filtered)
- Beryllium (total and filtered)
- Cadmium (total and filtered)
- Chromium (total and filtered)
- Lead (total and filtered)
- Manganese (total and filtered)
- Total suspended solids
- Total dissolved solids

- Restricting the installation of new potable water supply wells in the vicinity of Site 2.

The estimated capital cost associated with the selected remedy is $0. Annual O&M costs of approximately $57,100 are projected for administration of institutional controls and the quarterly sampling of the monitoring wells and supply wells for years 1 and 2. Approximately $28,550 are projected for the semiannual sampling in years 3 through 5 and $15,475 for the annual sampling in years 6 through 30. This annual cost is for 30 years. Assuming an annual percentage rate of 5 percent, these costs equate to a NPW of approximately $350,000. A summary of this cost estimate for the major components of the selected remedy is included in Appendix C.

In summary, the preferred alternative, Groundwater RAA No. 2 will achieve risk reduction by limiting the use of the groundwater at the operable unit. This RAA is believed to provide the best balance of trade-offs among the RAAs with respect to the pertinent evaluation criteria. Based on the available information, MCB Camp Lejeune/DoN believe the preferred RAA will be protective of human health and the environment, and is the most cost effective alternative. Although the contaminated groundwater will not be treated under this RAA, the isolated nature of the contamination area and land-use restrictions to be implemented, will minimize the risk of groundwater ingestion. Therefore, this alternative will provide for overall human health protection.

COMMUNITY PARTICIPATION

A critical part of the selection of a remedial action alternative is community involvement. The following information is provided to the community in order to obtain input that addresses the selection of remedial action alternative for Site 2.

Public Comment Period

The public comment period will begin on _____, 1994 and end on _____, 1994 for the Proposed Remedial Action Plan for Operable Unit No. 5 (Site 2). Written comments should be sent to the following address:

Commander
Atlantic Division Naval Facilities Engineering Command
1510 Gilbert Street (Bldg. N-26)
Norfolk, Virginia 23511-2699
Attention: Ms. Linda Berry, P.E., Code 1823

Administrative Record

The Administrative Record is available to the community at the following location:

Onslow County Library
58 Doris Avenue East
Jacksonville, NC 28540
(919) 455-7350

Hours:
M-Th: 9:00 a.m.- 9:00 p.m.
F-Sa: 9:00 a.m.- 6:00 p.m.
Closed Sunday

IF YOU HAVE ANY QUESTIONS ABOUT OPERABLE UNIT NO. 5 (SITE 2), PLEASE CONTACT ONE OF THE FOLLOWING:

Commanding General
AC/S EMD (IRD)
Marine Corps Base
PSC Box 20004
Camp Lejeune, North Carolina 28452-0004
Attention: Mr. Neal Paul
(919) 451-5063

Commander
Atlantic Division
Naval Facilities Engineering Command
1510 Gilbert Street (Bldg. N-26)
Norfolk, Virginia 23511-2699
Attention: Ms. Linda Berry, P.E., Code 1823
(804) 322-4793

MAILING LIST

If you are not on the mailing list and would like to receive future publications pertaining to Operable Unit No. 5 (Site 2) please fill out, detach, and mail this form to:

Commanding General
AC/S EMD (IRD)
Marine Corps Base
PSC Box 20004
Building 67
Camp Lejeune, North Carolina 28452-0004
Attn: Mr. Neal Paul
(919) 451-5063

Name _____

Address _____

Affiliation _____

Phone ( ) _____