ENFORCEMENT
RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

CAROLAWN SITE
FORT LAWN, CHESTER COUNTY
SOUTH CAROLINA

PREPARED BY:

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ATLANTA, GEORGIA

DECLARATION FOR THE RECORD OF DECISION

SITE NAME and LOCATION

Carolawn
Fort Lawn, Chester County, South Carolina

STATEMENT OF BASIS AND PURPOSE

This decision document represents the selected remedial action for the Carolawn site in Fort Lawn, South Carolina chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the National Contingency Plan. This decision is based upon the administrative record for the Carolawn Site.

The State of South Carolina has concurred on the selected Remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Carolawn site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

MIGRATION CONTROL (Remediation of Contaminated Groundwater)

Installation of a groundwater interception and extraction system at the site. The level and degree of treatment of the extracted groundwater will depend on 1) the ultimate discharge point of this water and 2) the level of contaminants in the extracted groundwater. Three water discharge alternatives for the treated groundwater are 1) the local sewer system, (i.e., Publicly Owned Treatment Works), 2) Fishing Creek via a National Pollution Discharge Elimination System permit or, 3) on-site irrigation. A fourth discharge possibility is groundwater injection. The range of treatment for the extracted groundwater includes air stripping, biodegradation, filtration through activated carbon filter and metal removal. The most cost effective combination for the point of discharge and the degree of treatment will be determined in the Remedial Design stage. The discharged water will meet all ARAR's. Concurrence on the final design will be requested from the State of South Carolina. Comments will also be solicited from the public on the final design.

Review the existing groundwater monitoring system to insure proper monitoring of groundwater. If deemed necessary, additional monitor wells will be installed to mitigate any deficiencies in the existing groundwater monitoring system.

Appropriate institutional controls (deed restrictions) will be implemented.

Upon the condemnation of the adjacent contaminated private, potable wells by the County of Chester, these wells will be plugged in accordance to South Carolina Department of Health and Environmental Control regulations.

SOURCE CONTROL (Remediation of Contaminated Soils)

Due to the effectiveness of the removal actions, no source of contamination remains within the fenced area of the site. However, additional field work is required in the disposal area north of the fenced area. This field work will consist of the installation of confirmatory soil borings to verify the presence or absence of contamination in this area. If no contamination is found, there will no source control remediation required at the Carolawn site, however, if contaminated soil is found, a second Record of Decision will be necessary to address this source of contamination.

GENERAL SITE CLEANUP ACTIVITIES

The two inactive incinerators will be inspected and any remaining residue will be sampled and analyzed. Also, wipe samples will be collected and analyzed. The results of the analyses will determine the method of disposition for the incinerators. The two remaining drums will also be sampled and analyzed to determine how they will be disposed. In addition, site cleanup will include closing of the equipment decontamination area used during Phase I RI activities.

DECLARATION

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Since this remedy may result in hazardous substances remaining on-site above health-based levels, the five-year review will apply to this action.

SEP 27 1989
Date

Lee A. DeHihns III, for
Greer C. Tidwell
Regional Administrator

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CAROLAWN SITE
FORT LAWN, CHESTER COUNTY, SOUTH CAROLINA

1.0 INTRODUCTION

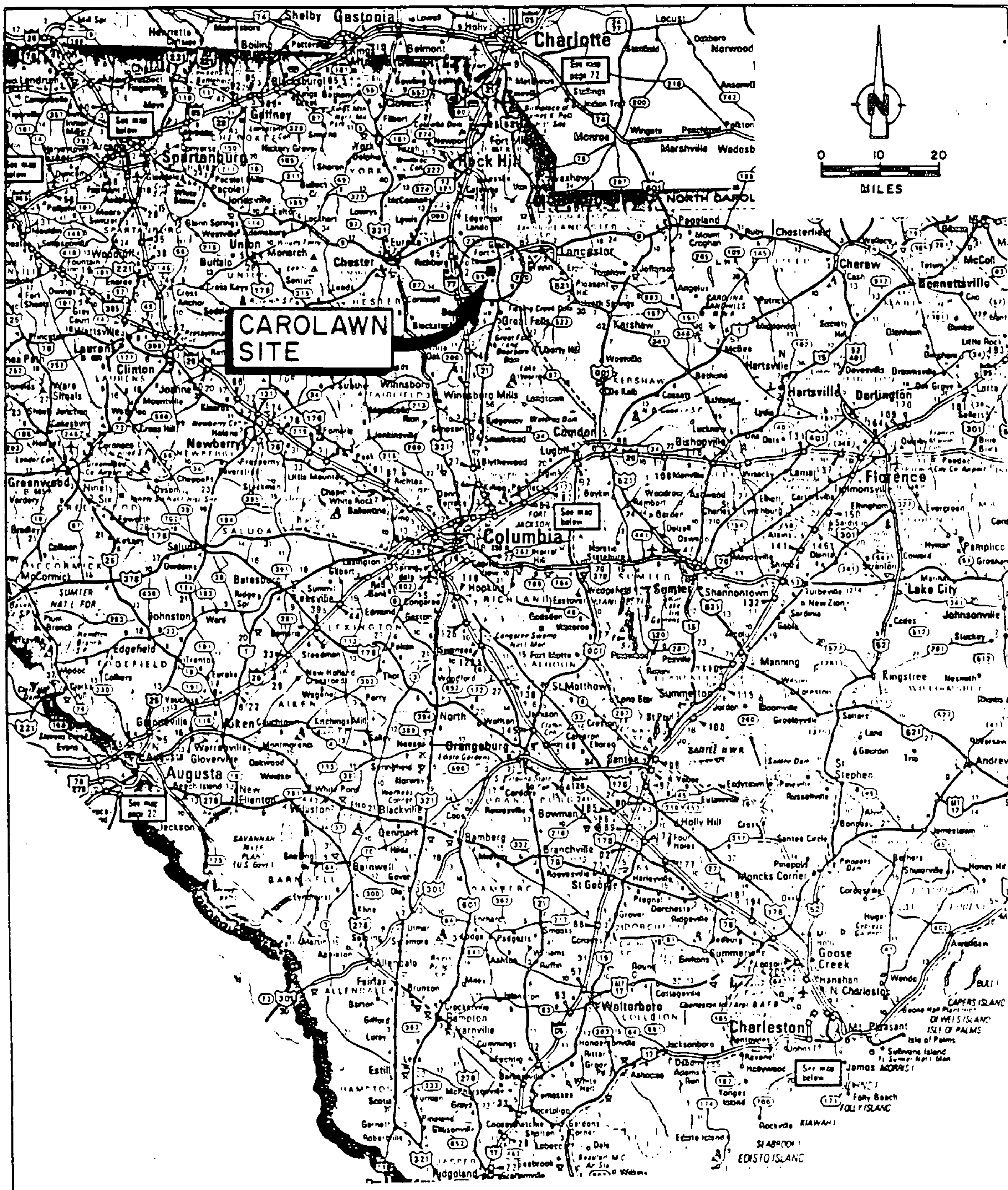
The Carolawn site, also known as the Fort Lawn site, was proposed for inclusion on the National Priorities List (NPL) in December 1982 and was finalized on the NPL, ranking 699, in September 1983. The Carolawn site has been the subject of two Remedial Investigation and Feasibility Study (RI/FS) undertakings by the Potentially Responsible Parties (PRPs). The first RI/FS, which has subsequently been referred to as Phase I, was conducted from September 1985 to March 1987. The second RI/FS, Phase II, began in the fall of 1987 and was completed in September 1989. Phase II was deemed necessary by the Agency after reviewing the Phase I RI/FS document. The review found this document lacking sufficient data and information to support the selection of a remedial alternative, consequently, Phase II was initiated in September 1987.

The Phase II RI report, which is supplemented by the Phase I RI/FS report, examined air, groundwater, soil, surface water, and sediment contamination at the Site and the routes of exposure of these contaminants to the public and environment. The Phase II RI report was completed in September 1989. The Phase II FS document, which is also supplemented by the Phase I RI/FS report, developed, examined and evaluated five (5) remedial alternatives. The draft RI and FS reports were issued to the public in August 1989.

This Record of Decision (ROD) has been prepared to summarize the remedial alternative selection process and to present the selected remedial alternative.

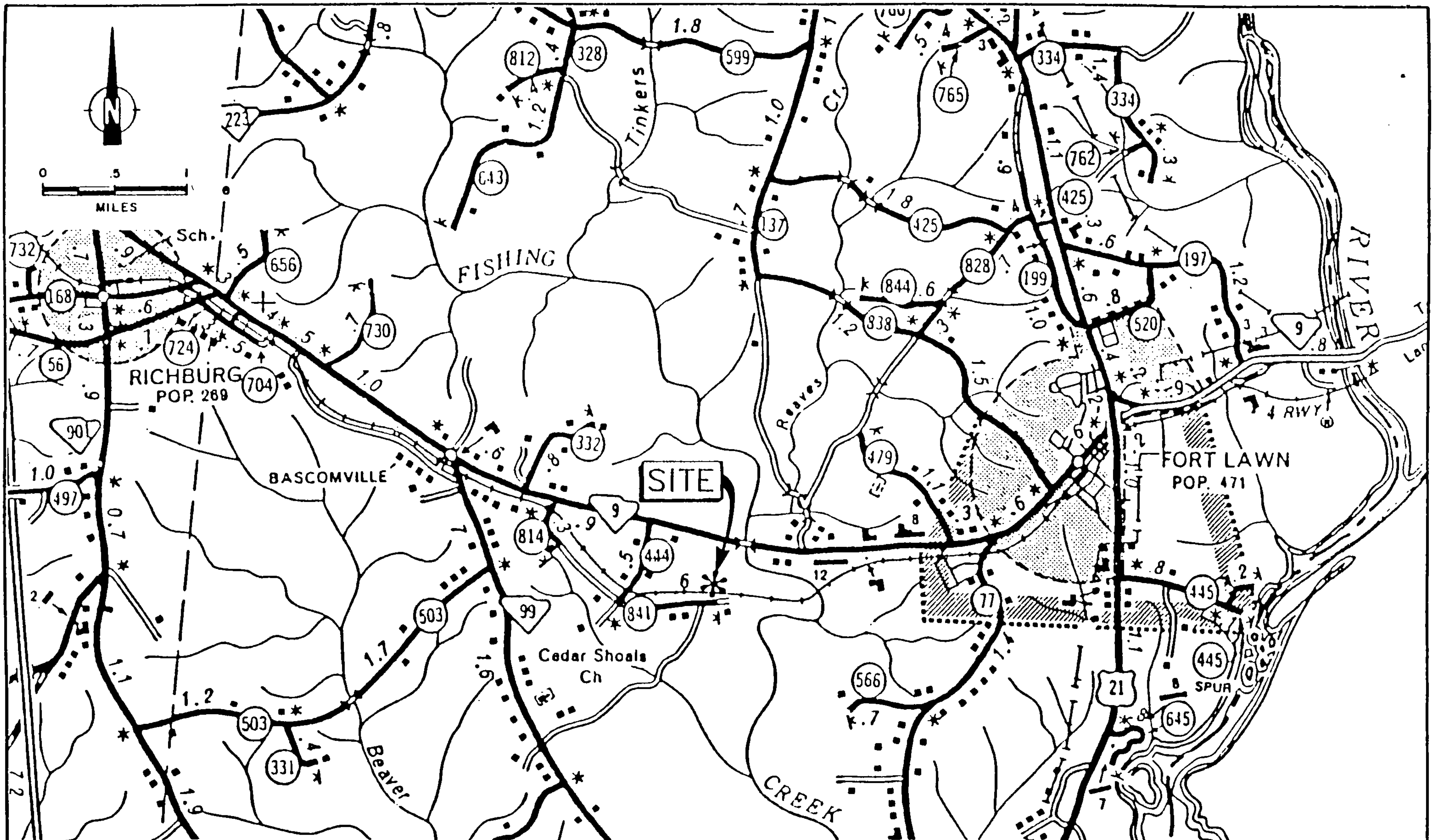
1.1 SITE LOCATION AND DESCRIPTION

The Carolawn Site is an approximate 60-acre abandoned waste storage and disposal facility located in Fort Lawn, Chester County, South Carolina (Figure 1). The site, shown in Figure 2, is situated less than three miles west of Fort Lawn, the closest population center to the site, and approximately one-half mile south of South Carolina Highway 9 at latitude 34°41'10" north and longitude 80°56'35" west. Rural and agricultural areas surround much of the site. The Lancaster & Chester Railroad and County Road 841 borders the site to the south and Fishing Creek borders the site to the east. Fishing Creek is a tributary to the Catawba River. Wooded areas and cultivated fields lie to the west and north of the site. Soybeans have been historically planted in these fields. Fort Lawn had a population of 471 according to the 1980 U.S. Census.



SOURCE: RAND McNALLY
ROAD ATLAS, 1986

FIGURE 1 SITE LOCATION



SOURCE: S.C. DEPT. OF HIGHWAYS AND TRANSPORTATION, GENERAL HIGHWAY MAP, CHESTER COUNTY, SOUTH CAROLINA, 1968

FIGURE 2 SITE VICINITY MAP

Approximately five acres of the site were affected by the hazardous waste storage and disposal activities, three of which have been enclosed in a chain-linked fence. Disposal activities at the site began in 1970 and ended in 1980, when the site was abandoned. Both Phase I and Phase II focused on the fenced area.

Located within a two-mile radius of the site are approximately thirty (30) permanent, single family residences; most of which are along South Carolina Highway 9 (Figure 2). There are four residences located within 300 yards of the fenced area with a fifth residence located approximately 1,000 yards to the west of the site. One of these dwellings is located between the site and Fishing Creek (Figure 3).

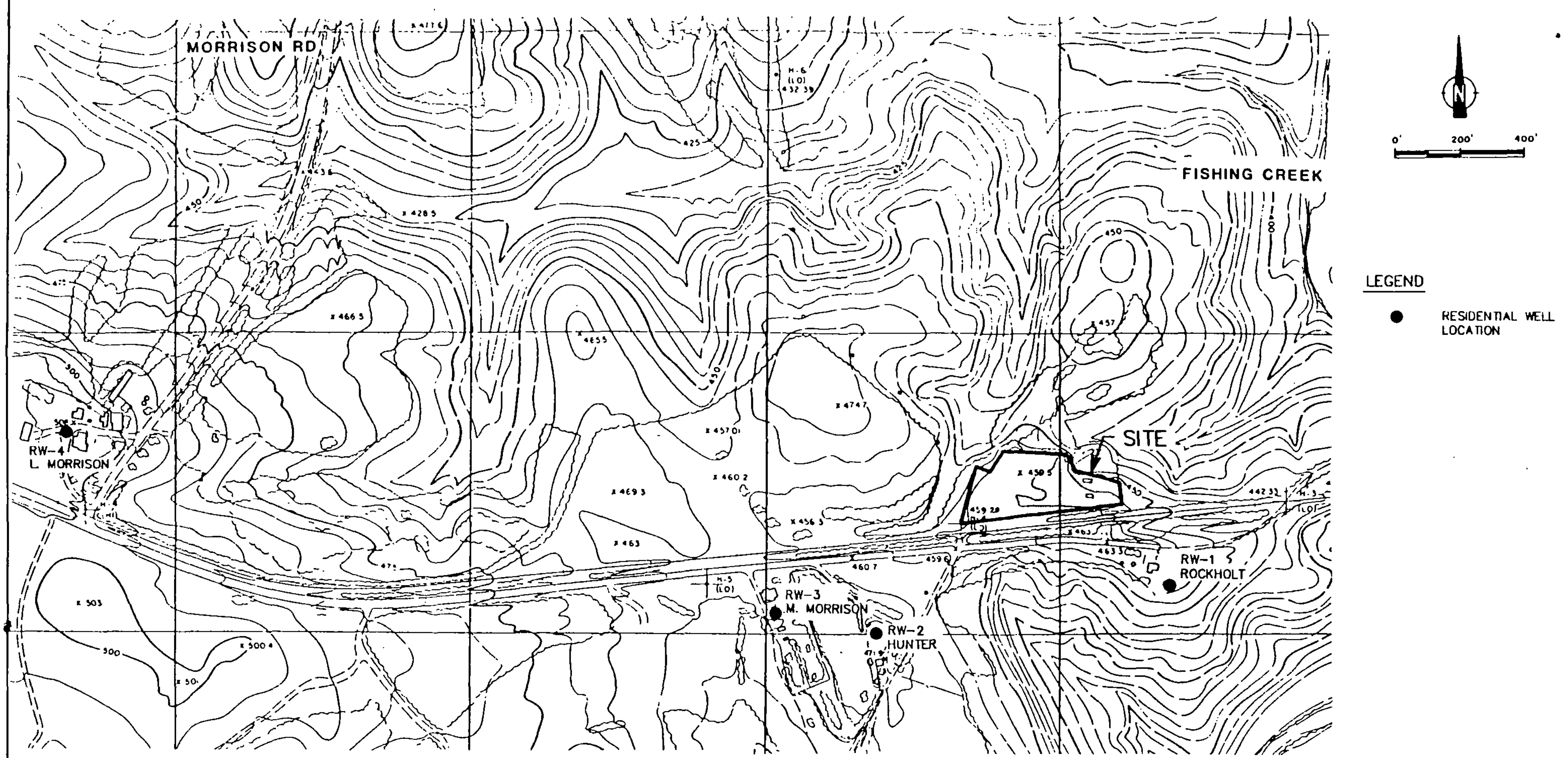
Natural resources in the area of the site include water, soils, flora, and fauna. The waters of Fishing Creek are occasionally used for fishing and other recreational activities but topography and poor accessibility limit the use of the creek in the vicinity of the site. Fishing Creek flows southward past the site and eventually empties into the Catawba River, eight miles south of the site and above Great Falls, South Carolina, where approximately 2,500 people receive their water supply from the Catawba River.

The residential, commercial and industrial establishments within the City of Fort Lawn receive their water supply from the Chester Metropolitan Sanitary District (MSD), whose water intake on the Catawba River is approximately four miles east of the site and above the confluence of Fishing Creek and Catawba River. Three of the four residents adjacent to the site who used private wells were provided an alternative water source in 1985 and connected to the Chester MSD. The fourth resident declined the opportunity to be connected to the Chester MSD system and elected to continue to use their private well. To date, no contaminants have been found in this private well.

1.2 SITE HISTORY

The Carolawn site was originally owned by the Southeastern Pollution Control Company (SEPCo) of Charlotte, North Carolina. Beginning in 1970, SEPCo used the site as a storage facility for a solvent recovery plant located in Clover, South Carolina. SEPCo went bankrupt in 1974 and abandoned the Site leaving approximately 2,500 drums of solvents on site. SEPCo had been storing the drummed solvents in anticipation of incinerating the waste. Neither an incineration permit nor a storage/disposal permit were issued to SEPCo by South Carolina Department of Health and Environmental Control (SCDHEC). The drums were stacked one-or-two high on wooden pallets or directly on the ground. No dikes or containment barriers were constructed.

In January 1975, Columbia Organic Chemical Company was contracted to clean up the SEPCo Plant in Clover, South Carolina. As part of this clean up effort, Columbia Organic transported and stored the waste at the Carolawn site. Columbia Organics brought an additional 2,000 drums to the site. As payment for services rendered during the cleanup of the plant in Clover, Columbia Organics received the Carolawn property.



SOURCE: SOIL AND MATERIAL ENGINEERS INC.
COLUMBIA, SOUTH CAROLINA

FIGURE 3 LOCATION OF ADJACENT RESIDENTS AND RESIDENTIAL POTABLE WELLS

South Carolina Recycling and Disposal, Inc. (SCRDI), a subsidiary of Columbia Organics, controlled the site. In 1978, SCRDI obtained a permit from SCDHEC for a one-time disposal of 300-400 drums containing inert waste. In October 1978, SCRDI was given approval to dispose of empty drums on the 3-acre fenced portion of the property. Also in 1978, SCRDI sold the 3-acre fenced area of the site to the Carolawn Company.

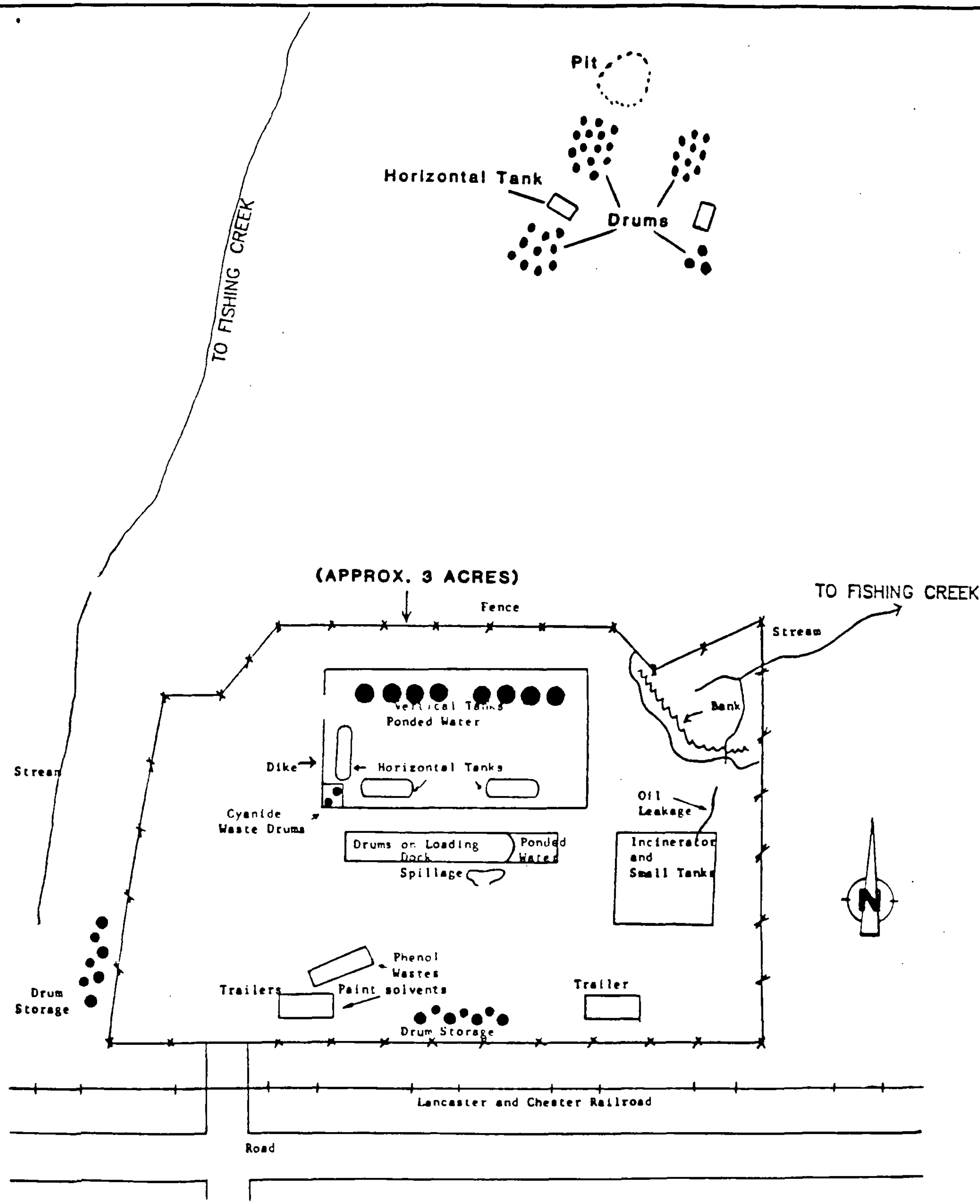
The Carolawn Company began the construction of two incinerators on the site. With conditional approval of SCDHEC, a test burn was conducted with one incinerator. Full scale incineration never developed. At the time of abandonment of the site by the Carolawn Company, the fenced area contained a concrete loading dock, a diked area for storage of tanks and drums, two incinerators, two storage trailers, 14 storage tanks, and as many as 480 drums containing liquid and solid wastes. An additional 660 drums and 11 storage tanks were located outside the fenced area to the north (Figure 4). SCRDI was notified by SCDHEC in 1979 that they would have to clean up the Carolawn site.

Both SCDHEC and the Agency conducted site investigations at the Carolawn site. These investigations included collecting environmental samples for analysis as well as pulling samples from nearby private residential wells. Due to the elevated levels of contamination found and the potential threat for imminent damage to public health and/or the environment, EPA initiated cleanup activities at the site on December 1, 1981. Cleanup activities included removing the drums, waste and contaminated soils. Cleanup activities ended in February 1982. As part of the cleanup all nearby residences were provided with an alternative water source; they were connected to MSD.

When Phase I of the RI was initiated, there were 17 storage tanks on site. Some of the tanks contained waste. The Carolawn Generators Steering Committee, under an Administrative Order of Consent, took it upon themselves to remove these tanks in May-June 1986. The tanks were cleaned, cut up and sold as scrap metal, the waste was incinerated off-site, the water from decontamination activities was treated and sent to the local publicly owne treatment works (POTW), and contaminated soils were excavated and sent to GSX, Pine wood, South Carolina for disposal. Presently, the only structures on site are the concrete base of the tank farm, two inoperable incinerators and miscellaneous debris such as drum lids and pallets.

1.3 DEMOGRAPHICS

The Site is located in a primarily rural area of Chester County (Figure 2). Five households are located adjacent to the Site. Approximately 2,000 people live within a four-mile radius of the Site, with an estimated 100 people within a one-mile radius. Fort Lawn (population 471) is located 2.5 miles east of the Site and Richburg (population 269) is located three (3) miles west of the Site. The population estimations are based on the 1980 U.S. census.



SOURCE: USEPA, 1982

FIGURE 4 LOCATION OF FORMER WASTE STRUCTURES

2.0 ENFORCEMENT ANALYSIS

The Carolawn site was proposed for inclusion on the first NPL in December 1982. The site was finalized on the NPL in September 1983 and ranked 699. EPA assumed lead responsibility for the Site at this time.

Initial Notice Letters were sent to the identified PRPs in November 1981. Additional notice letters were sent to additional PRPs, the transporters, in September 1983

A Partial Consent Decree was entered into by the following PRPs with the Agency and the Department of Justice in August 1985 to conduct the RI/FS. The Settling Defendants were Aeroquip Corporation; Black & Decker, Inc.; Burlington Industries, Inc.; Carolawn Company, Inc.; Cellu-Craft, Inc.; Clarke Floor Equipment Company; Columbia Organic Chemical Company, Inc.; Cone Mills Corporation; Cumberland County Hospital System, Inc.; Dart Industries, Inc.; Eaton Corporation; General Electric Company; Georgia-Pacific Corporation; Max G. Gergel; Inmont Corporation; Kerr Glass Manufacturing Corporation; The Knight Publishing Company; James Q.A. McCigre; National Health Laboratories, Inc.; National Starch & Chemical Corporation; Measurements Group, Inc.; Melvin Ernest Nunnery; Mobil Chemical Company; David M. Neill; Robert Riggs; South Carolina Recycling and Disposal, Inc.; Stickhausen, Inc.; Technographics Printworld, Inc.; Henry M. Tischler; and Bruce A. Whitten. The Partial Consent Decree required the PRPs to conduct the RI/FS.

An Administrative Order of Consent was entered into by the PRPs in September 1985. The Administrative Order required the PRPs to remove the remaining onsite tanks and their contents. The tanks and their contents were disposed of in compliance to all applicable laws, including Resource Conservation & Recovery Act (RCRA). The work conducted under this Administrative Order was completed to the satisfaction of the Agency.

3.0 CURRENT SITE STATUS

This section summarizes the Site's characteristics.

The site was abandoned by the Carolawn Company in 1980. Following the two removals, the first sponsored by EPA and the second by the PRPs, the site lies vacant. A chain linked fence encompasses three of the five acres that were affected by the storage and disposal activities. The fence is in generally good condition. The other area affected by the storage and disposal activities lies several hundred feet to the north of the fenced area. This area was also cleaned up by EPA during the Agency's removal action.

Due to the limited analytical soil data collected from the area north of the fenced area, additional confirmatory samples needs to be done in this area to confirm the presence or absence of residual soil contamination in this area.

3.1 HYDROGEOLOGIC SETTING

The Carolawn site is located in the eastern Charlotte Belt of the Piedmont Physiographic Province of South Carolina. This belt is characterized by granitoid gneisses with strong compositional layering, probably derived from sediments. The bedrock in the vicinity of the Site consists of Lower Metadiorite and Metagabbros. This complex is cut by pegmatite, granite and mafic dikes.

The stratigraphic units encountered at the site were:

i) Alluvial deposits;
ii) Residual and Coluvial clays;
iii) Residuum and Saprolite; and
iv) Bedrock.

The upper regions of the bedrock have been altered by in-situ weathering. This weathering has produced a partially to highly decomposed mixture of rock and soil which is referred to as saprolite. Saprolite retains the vestigial mineralogy and structure of the original rock.

The bedrock beneath the Site has undergone several episodes of deformation. These events have created joints and fractures. These structural features influence groundwater flow within the crystalline bedrock. The major structural features noted at the Carolawn site were joints and dikes. Joint measurements revealed the presence of three joint sets with primary sets striking N45°W and N5°W and a minor set striking at N35°W. All joint sets had vertical to subvertical dips. The mafic dike identified strikes at approximately N45°W and is moderately well fractured. Figure 5 provides the orientation and profile lines as well as the data generated in the magnetometer survey of the site and the orientation of the mafic dike that runs through the site.

The major hydrostratigraphic unit beneath the Site is the granodiorite bedrock, saturated conditions were not encountered in the Residuum/Saprolite unit. It may be possible that the Residuum/Saprolite unit may usually be saturated but the RI was conducted during an extended drought and only unsaturated conditions were encountered in this unit. The groundwater in the bedrock is associated with the joints and fractures.

All groundwater in South Carolina is classified as Class GB Waters (South Carolina Regulation 61-68). This classification means that all groundwater meeting the definition of underground sources of drinking water (USDW) meet quality standards set forth in the State Primary Drinking Water Regulations (R.61-58.5). An USDW is defined as an aquifer or portion of an aquifer which supplies, or contains, sufficient quantity of water to supply a public supply system.

According to USEPA Groundwater Classification Guidelines of December 1986, the bedrock aquifer beneath the site is classified as Class IIA. It is classified as Class IIA since the aquifer was used as a source of drinking water when the site was in operation. It is also anticipated that there are

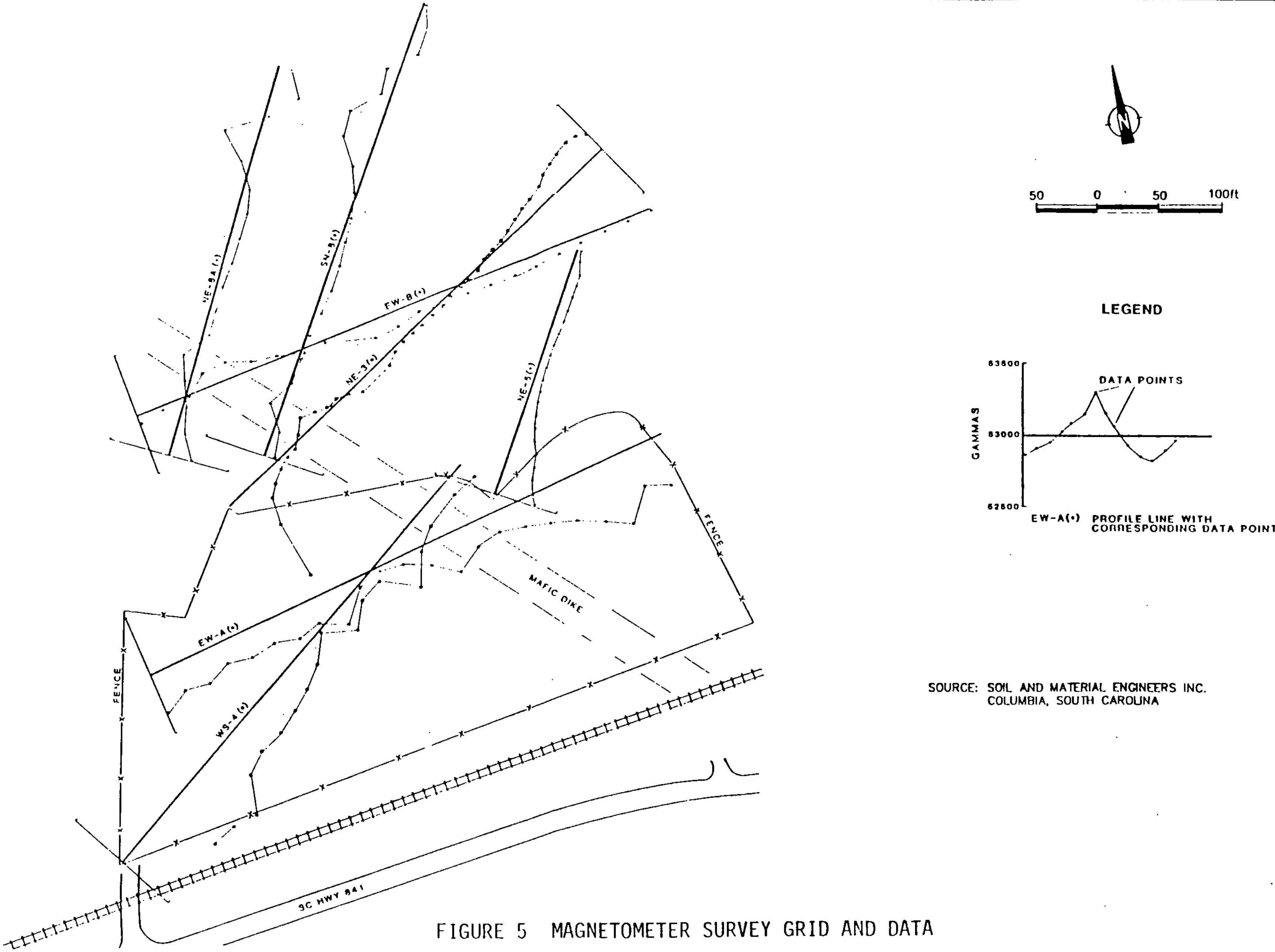


FIGURE 5 MAGNETOMETER SURVEY GRID AND DATA

SOURCE: SOIL AND MATERIAL ENGINEERS INC.
COLUMBIA, SOUTH CAROLINA

several private wells within the two-mile radius that are currently using this aquifer as a source of potable water. Therefore, the groundwater should be remediated to levels protective of public health and the environment.

The actual direction of groundwater flow through the bedrock is dependent upon the orientation of the joints and fractures. The groundwater contours (Figures 6, 7, and 8) indicate that the preferred direction of groundwater flow is to the north-east and south-east. Figure 6 presents groundwater contours based on groundwater levels measured in August 1988. Figures 7 and 8 also show groundwater contours based on groundwater level measurements collected in October 1988 and December 1988, respectively.

Hydraulic data collected during the RI indicates that Fishing Creek is the primary receptor of the groundwater flowing underneath the Site. This data also indicates that the mafic dike identified in Figure 5 does not influence, to any great degree, the hydrology of the site.

The estimated groundwater flow velocity is 1.96×10^{-4} centimeters/second (cm/sec). This is equivalent to 0.56 feet/day. Based on this velocity, it would take approximately six years for groundwater originating in the fenced area to reach Fishing Creek.

3.2 SITE CONTAMINATION

Due to the effectiveness of the removal actions, no source contamination remains within the fenced area of the site. However, some uncertainty exists with respect to the area north of the fenced area that was used for storage. Although this area was addressed during the Agency's removal action, insufficient confirmatory data has been generated to substantiate the absence or presence of soil contamination.

The analytical groundwater data indicates that contamination is entering Fishing Creek via discharge of groundwater to the creek.

3.3 AIR CONTAMINATION

The most common sources of air contamination at hazardous waste sites are the volatilization of toxic organic chemicals and the spread of airborne contaminated dust particles. Due to the removal actions all contamination at the surface has been eliminated. Therefore, as anticipated, no airborne problems were encountered during either Phase of the RI. This statement is supported by the fact that only background readings were recorded by site personnel using the HNu photoionization analyzer while performing designated RI tasks. The HNu was employed to monitor the air as a safety measure called for by the Health and Safety Plan.

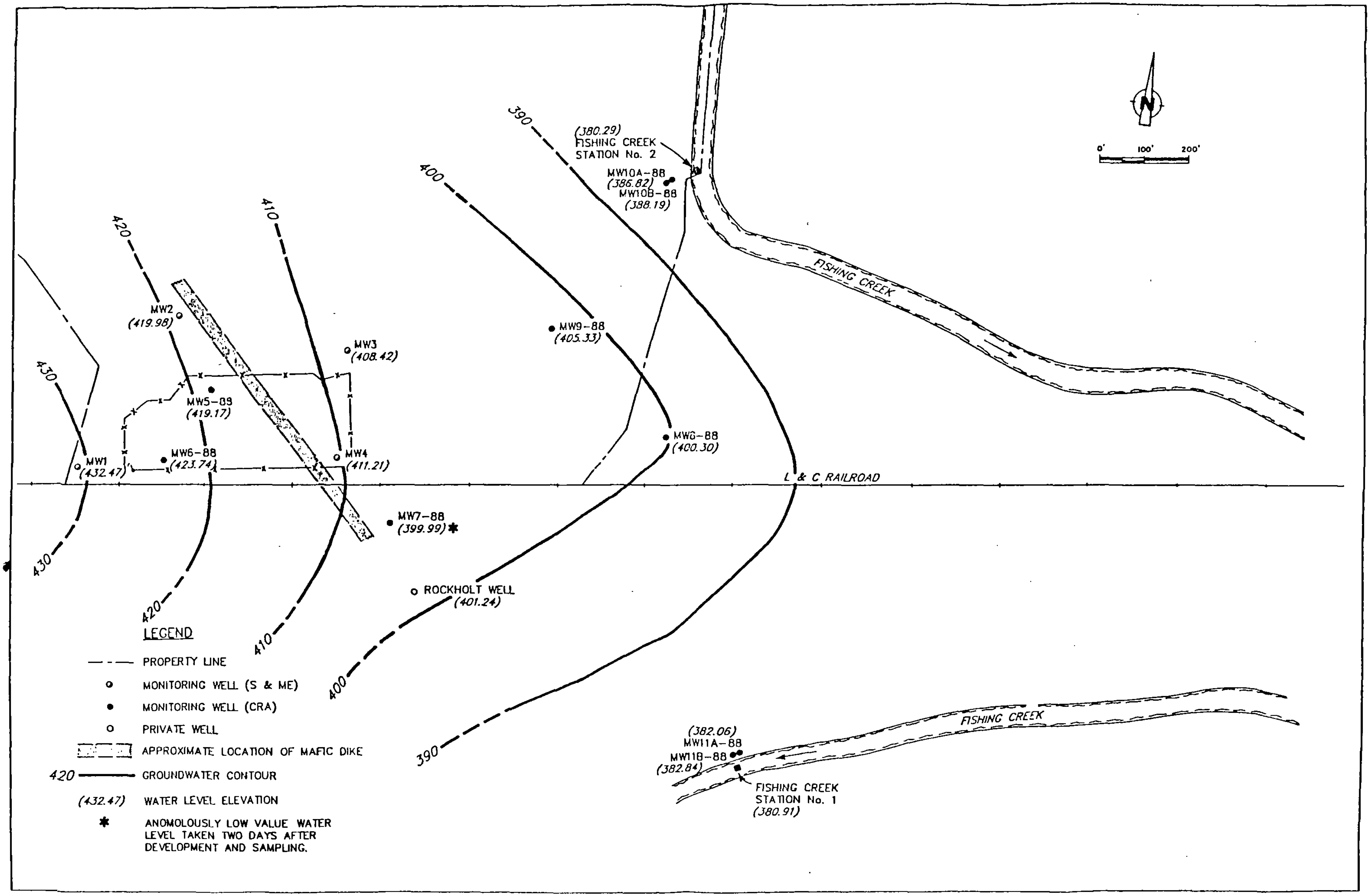


FIGURE 6 GROUNDWATER LEVEL CONTOURS BASED ON AUGUST 31, 1989 MEASUREMENTS

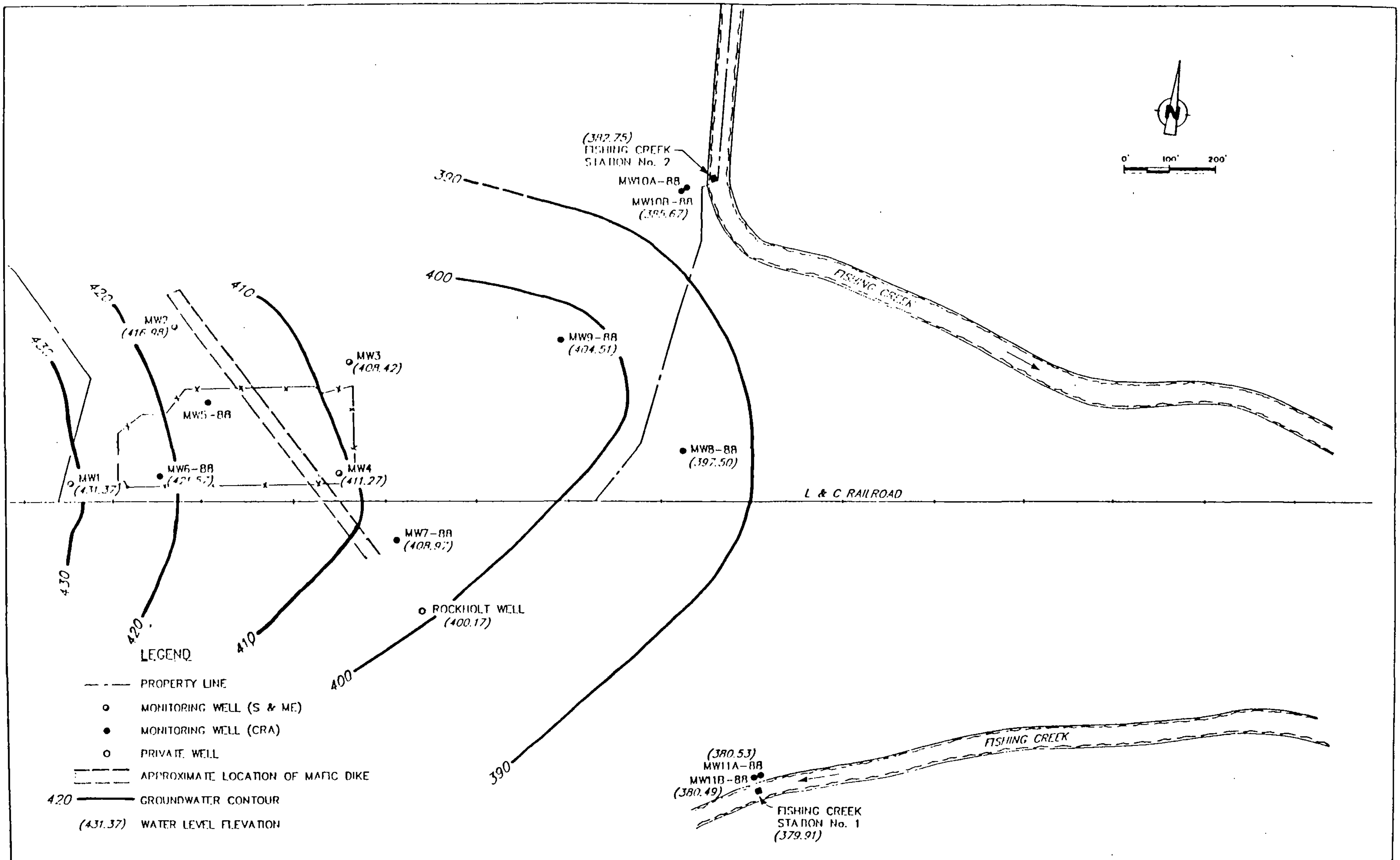


FIGURE 7 GROUNDWATER LEVEL CONTOURS BASED ON OCTOBER 17, 1988 MEASUREMENTS

Source: Conestoga-Rovers & Associates

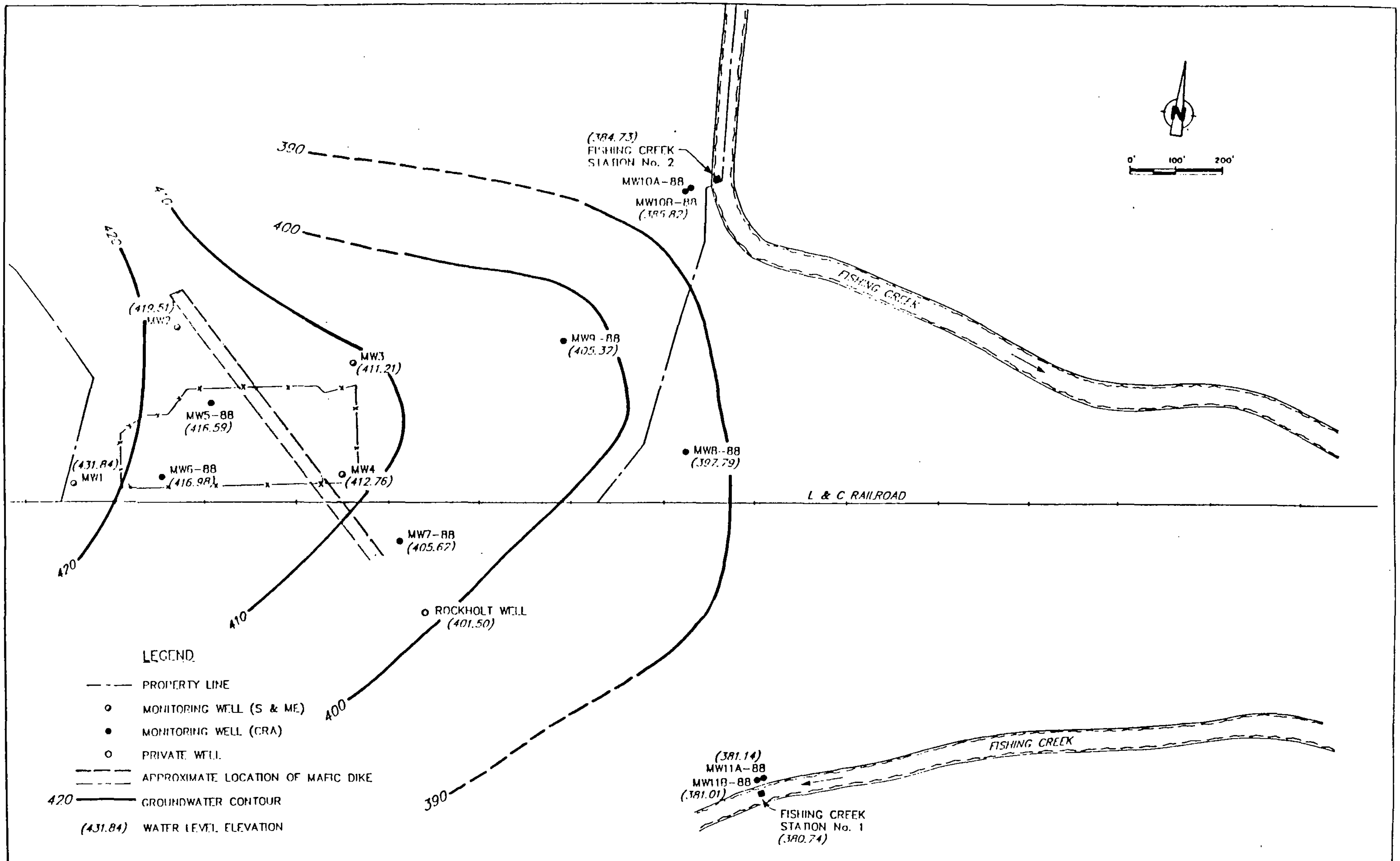


FIGURE 8 GROUNDWATER LEVEL CONTOURS BASED ON DECEMBER 14, 1988 MEASUREMENTS Source: Conestoga-Rovers & Associates

3.4 SOIL CONTAMINATION

Surficial and subsurface soil samples were collected and analyzed during Phase I of the RI. Figure 9 provides the location of the sampling points and the contaminants detected in the sample(s) collected from these points. All soil samples were analyzed for the Priority Pollutant List compounds. A summary of the detected compounds in the surface and sub-surface soil samples is presented in Tables 1 and 2, respectively. Examination of Table 1 indicates that methylene chloride and acetone were detected in all surface soil samples, however, these compounds were also detected in the laboratory blanks. Therefore, these contaminants are likely the result of laboratory contamination. The only base neutral extractable detected was bis(2-ethyl hexyl)phthalate. There is good evidence that this too may have been a contaminant introduced into the sample. It is the Agency's opinion that these contaminants are not present in the soils of the site as the analytical data would lead a person to believe but the result of cross-contamination.

Several metals were detected in the surficial soil samples. The highest concentrations were for lead, chromium and barium. Without representative background data, it is the Agency's contention that the elevated levels of lead and chromium are the result of past activities at the site.

Table 3 presents the general range and typical medium concentrations of various metals in soils. A comparison of the levels of metals collected at the site with the average metal concentrations typically found in soil is presented in Table 4.

In light of the above information, it is the Agency's opinion that the removal actions have eliminated future sources of contamination at the site within the fenced area. Some additional environmental sampling needs to be performed in the storage area north of the fenced area (Figure 4) to confirm the absence or presence of contamination. Although no source remediation is required within the fenced area of the site, there is some question as to the presence of residual soil contamination in this storage area north of the fenced area. If contamination is found, then this ROD will need to be amended.

3.5 GROUNDWATER CONTAMINATION

Two rounds of groundwater samples were collected during Phase I. The first round was analyzed for USEPA Priority Pollutants and the second round was analyzed for VOCs and selected inorganics. The wells sampled in Phase I were monitor wells MW-1, MW-2, MW-3, MW-4 and private wells RW1 (Rockholt), RW2 (Hunter), RW3 (M. Morrison), and RW4 (M. Morrison). The location of these wells can be found in Figures 3 and 10. The analytical data is presented in Table 5.

As part of Phase II activities, nine (9) additional monitor wells were installed at seven (7) locations. The locations are shown on Figure 11. Three rounds of samples were collected as part of Phase II activities. During the first round of sampling wells MW5-88 and MW6-88 were analyzed for

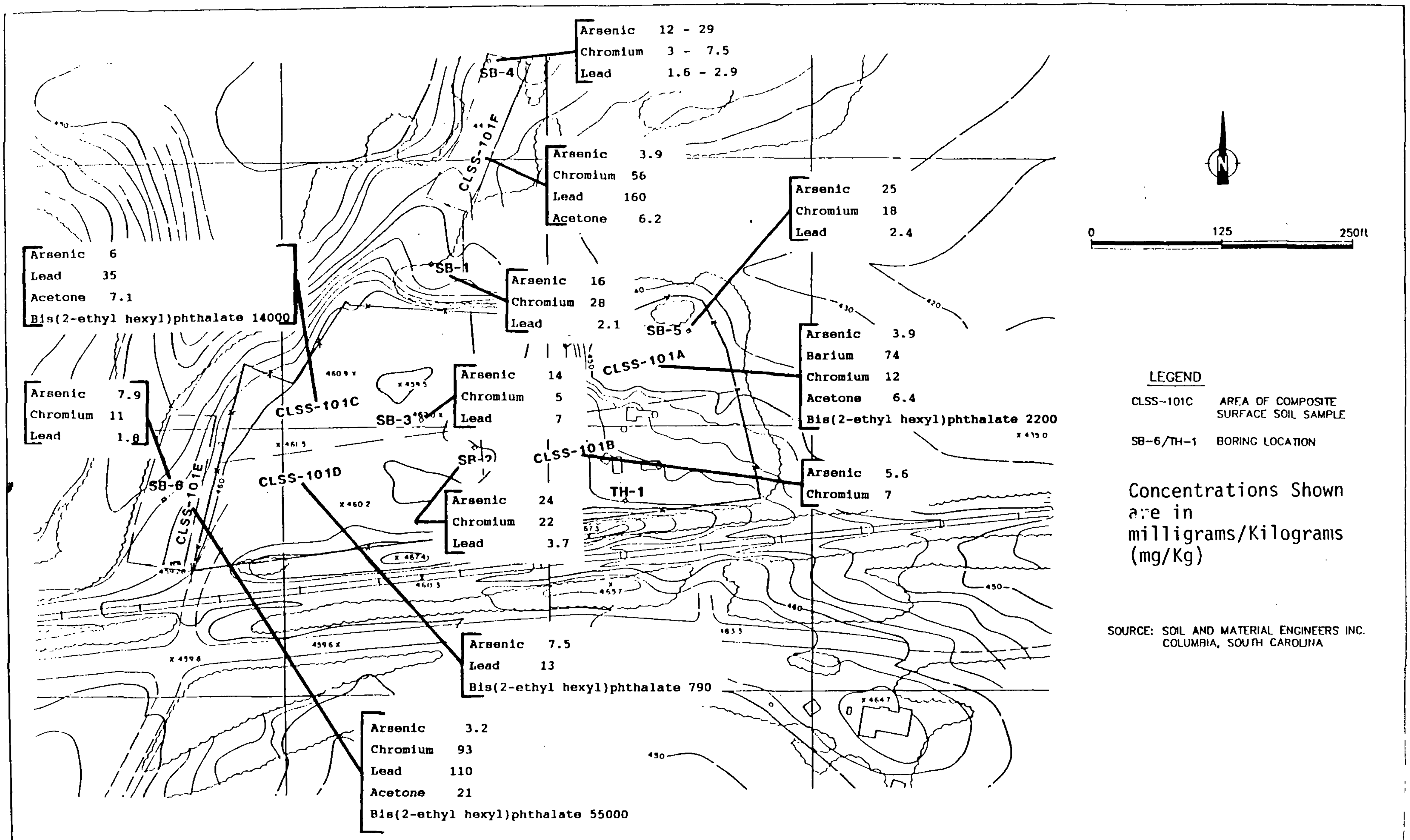


FIGURE 9 SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS

TABLE 1

SUMMARY OF DETECTED COMPOUND-SURFACE SOIL SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

Parameter	Detection Limit (mg/kg)	Sample Location CLSS-101A	CLSS-101B	CLSS-101C	CLSS-101D	CLSS-101E	CLSS-101F
Metals (Total)							
Antinom	0.05	U	U	U	U	U	1.2
Arsenic	0.05	3.9	5.6	6.0	7.5	3.2	3.9
Barium	10.0	74	70	U	U	320	40
Beryllium	0.20	U	U	U	U	U	U
Cadmium	0.10	U	U	0.47	U	0.77	0.40
Chromium	0.50	12	7.0	U	U	93	56
Copper	1.0	34	11	U	U	190	75
Lead	0.50	U	U	35	13	110	160
Mercury	0.002	U	0.0069	0.0055	0.008	0.12	0.019
Nickel	1.0	112	7.0	U	U	11	U
Selenium	0.10	U	U	U	U	U	U
Silver	0.50	U	U	U	U	U	U
Thallium	0.50	U	U	U	U	U	U
Zinc	0.20	24	15	U	U	57	U
VOLATILES (µg/kg)							
Methylene Chloride	D	11 B	8.0 B	22 B	19 B	51 B	12 B
Acetone		6.4 B	U	7.1 B	U	21 B	6.2 B
SEMI-VOLATILES (µg/kg)							
Bis(2-ethyl hexyl) phthalate	D	2200	U	14000	790	55000	U

Notes:
Samples were composited from samples collected in designated areas.
Samples collected on May 19-20, 1985. Analyzed by CompuChem Laboratories.

U - Not detected within minimum, attainable detection limit of sample. Detection limit as indicated.
B - Analyte found in blank as well as sample. Possible/probable blank contamination.
D - Detection limit varies.

TABLE 1

SUMMARY - SURFACE SOIL SAMPLING
WITHIN FENCED AREA (PHASE I)
CAROLAWN SITE
FORT LAWN, SOUTH CAROLINA

Parameter	*Detection Limit (mg/kg)*	*Maximum Detected (mg/kg)*	*Minimum Detected (mg/kg)*	*Number of Detections Above Analytical Background (of 4 samples)*[1]	*Mean Soil Concentrations (mg/kg)*	
					ND = 0	*ND = DL*
<u>Metals</u>						
Antimony	0.05	U	U	0	0	0.05
Arsenic	0.05	7.5	3.9	4	5.75	5.75
Barium	10.0	74	70	2	36	41
Beryllium	0.20	U	U	0	0	0.20
Cadmium	0.10	0.47	U	1	0.12	0.19
Chromium	0.50	12	7.0	2	4.75	5.0
Copper	1.0	34	11	2	11.25	11.75
Lead	0.50	35	13	2	12	12.25
Mercury	0.002	0.008	0.0055	3	0.0051	0.0056
Nickel	1.0	112	7.0	2	29.75	30.25
Selenium	0.10	U	U	0	0	0.1
Silver	0.50	U	U	0	0	0.5
Thallium	0.50	U	U	0	0	0.5
Zinc	0.20	24	15	2	19.5	19.85

TABLE 1

SUMMARY - SUB-SURFACE SOIL SAMPLING
WITHIN AND OUTSIDE FENCED AREA (PHASE I)
CAROLAWN SITE
FORT LAWN, SOUTH CAROLINA

Parameter	*Detection Limit (mg/kg)*	*Maximum Detected (mg/kg)*	*Minimum Detected (mg/kg)*	*Number of Detections Above Analytical Background (of 8 total)[1]*	*Mean of Detections Above Analytical Background (mg/kg)*
Metals					
Arsenic	0.25	29	7.9	8	25.7
Chromium	1.50	28	3.0	8	16.4
Copper	1.0	100	10	8	50.0
Cyanide	1.0	U	U	0	1.0
Lead	0.25	7.0	1.6	8	2.95
Volatiles (µg/kg)					
Methylene chloride	10	10	U	1	10
Semi-Volatiles (µg/kg)					
Bis (2-ethylhexyl) phthalate	330	330	U	1	330

Notes:

Samples collected on June 5-12, 1985. Analyzed by CompuChem Laboratories.

U - Not detected within minimum, attainable detection limit of sample. Detection limit as indicated.

(1) As shown on Figure 17. Based on Table 1.

TABLE I

SUMMARY - SURFACE SOIL SAMPLING
WITHIN FENCED AREA (PHASE I)
CAROLAWN SITE
FORT LAWN, SOUTH CAROLINA

Parameter	*Detection Limit (mg/kg)*	*Maximum Detected (mg/kg)*	*Minimum Detected (mg/kg)*	*Number of Detections Above Analytical Background (of 4 samples)*[1]	*Mean Soil Concentrations (mg/kg) ND = 0*	*Mean Soil Concentrations (mg/kg) ND = DL*
Volatiles (µg/kg)						
Methylene chloride	D	22B	8.0B	0	0	D
Acetone	D	7.1B	6.4B	0	0	D
Semi-Volatiles (µg/kg)						
Bis (2-ethylhexyl) phthalate	D	14,000	790	3	4247.5	D

Notes:

Samples were composited from samples collected in designated areas.
Samples collected on May 19-20, 1985. Analyzed by CompuChem Laboratories.

U - Not detected within minimum, attainable detection limit of sample. Detection limit as indicated.
B - Analyte found in blanks as well as sample. Possible/probable blank contamination.
D - Detection limit varies.
(1) Four soil sample locations; CLSS 101A to CLSS 101D, as shown in Figure 17. Based on Table I.

TABLE 2

SUMMARY OF SUB-SURFACE
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

Boring Location' / Sample Depth	Detection Limit	SB-1 3.0-4.4 ft.	SB-2 3.0-5.9 ft.	SB-3 3.0-4.40 ft.	SB-4 2.8-6.8 ft.	SB-4 6.8-10.8 ft.	SB-4 10.8-14.8 ft.	SB-5 3.0-6.3 ft.	SB-6 3.0-4.8 ft.	*Equipment Rinse Deionized Water (µg/L)*
Parameter										
Metals (mg/kg)										
Arsenic	0.25	16	24	14.0	29	26	12	25	7.9	0.5.0
Chromium	1.50	28	22.0	5.0	7.5	4.0	3.0	18	11	0.3
Copper	1.0	34	100	10	21	22	14	77	22	
Cyanide	1.0	U			U	U	U		U	0.2
Lead	0.25	2.1	3.7	7.0	2.9	2.1	1.6	2.4	1.8	.5.0
Volatiles (µg/kg)										
Methylene Chloride	10		10							
Semi-Volatiles (µg/kg)										
Bis (2-Ethyl hexyl) phthalate	330							330		
Pentachlorophenol	50	U	U	U	U	U	U	U	U	66

NOTES:

Samples collected June 5 - 12, 1986. Analyzed by CompuChem Laboratories.

U - Not detected within minimum, attainable detection limit of sample.

TABLE 3

TYPICAL ELEMENTAL COMPOSITION OF SOIL
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	Concentration in Soils mg/kg (ppm)		
Element	Range	Typical Medium	Source
Antimony	0.2 - 150	6	1,2,3, & 4
Arsenic	0.1 - 194	11	5
Barium	100 - 3,000	500	1
Beryllium	0.01 - 40	0.3	1
Cadmium	0.01 - 7	0.5	6
Chromium	5 - 3,000	100	6
Copper	2 - 250	30	1
Iron	100 - 550,000	40,000	1 and 5
Lead	LT1 - 888	29	5
Nickel	0.1 - 1,530	50	1 and 5
Selenium	0.1 - 38	0.4	1 and 6
Silver	0.01 - 0.8	0.4	5
Thallium	0.1 - 0.8	0.2	1
Zinc	1 - 2,000	90	1 and 5

1. BOWEN, M.J.M., "Environmental Chemistry of the Elements. Academic Press, New York, 1979.

2. RAGAINI, R.C., et al, "Environmental Trace Contamination in Kellog Idaho near Lead Smelting Complex," Envir SCI and Technol 11 773-780 1977.

3. LISK, D.J., "Trace Metals in Soils, Plant and Animals," Adv Agron 24 267-311, 1972.

4. "Geochemistry of Some Rocks, Soil Plant and Vegetables in the Conterminous United States", Geological Survey Professional Paper 574 F 1975.

5. URE, A.M., et al "Elemental Constituents of Soils" Environmental Chemistry, Vol 2, pp 94-204 ed H.J.M. BOWEN, Royal Society of Chemistry, Burlington, London, U.K., 1983.

6. PARR, JAMES F., MARSH, PAUL B., ELA, JOANNE M., Land Treatment of Hazardous Wastes, Agricultural Environmental Quality Institute, Agricultural Research Service, USDA, Beltsville, Maryland, Moyes Data Coroporation

TABLE 4

SUMMARY OF METALS IN SOILS (MG/KG)
CAROLAWN SITE - FORT LAWN, SOUH CAROLINA

Parameter	*Typical (1) Medium*	*Surface Soil*		*Subsurface Soil*		*Range*
		Average	*(% ND)*	*Average*	*(% ND)*	
Antimony	6	1.2	(83)	NA		1.2
Arsenic	11	5	(0)	19	(0)	3.2 - 2.9
Barium	500	126	(33)	NA		40 - 320
Beryllium	0.3	--	(100)	NA		--
Cadmium	0.5	0.6	(50)	NA		0.40 - 0.77
Chromium	100	42	(33)	12	(0)	3 - 93
Copper	30	78	(33)	38	(0)	11 - 190
Lead	29	80	(33)	3	(0)	1.6 - 160
Mercury	0.098	0.03	(17)	NA		0.0055 - 0.12
Nickel	50	10	(50)	NA		7 - 12
Selenium	0.4	--	(100)	NA		--
Silver	0.4	--	(100)	NA		--
Titanium	0.2	--	(100)	NA		--
Zinc	90	32	(50)	NA		15 - 57

Notes:

(% ND) - percent of samples not included in the average because below detection limit
NA - not analyzed
(1) - from Table 5.3

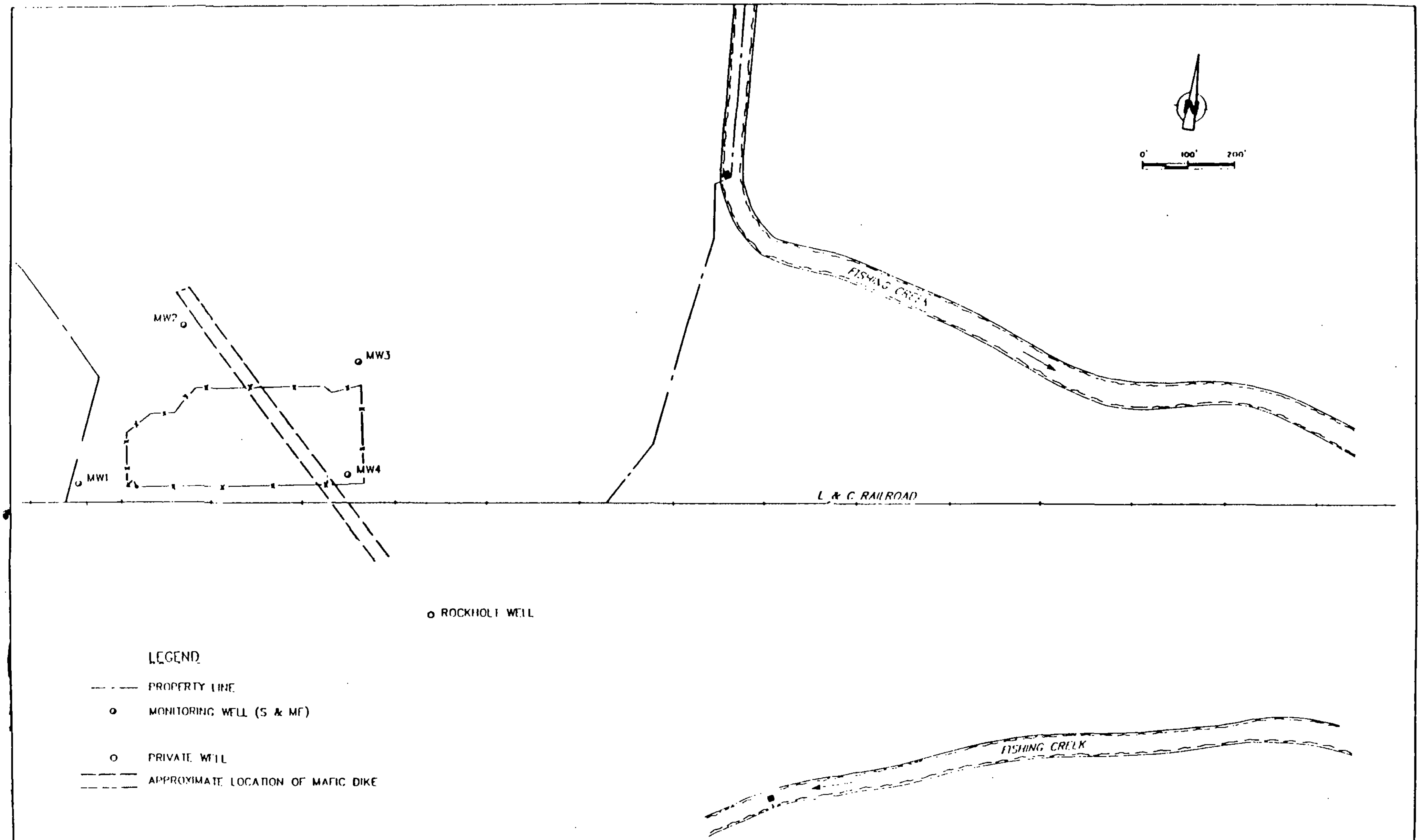


FIGURE 10 LOCATION OF MONITOR WELLS INSTALLED DURING PHASE I

Source: Conestoga-Rovers & Associates

TABLE 5

SUMMARY OF DETECTED COMPOUNDS - PHASE I GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

Location	*Detection*	*WELL MW1*		*WELL MW2*			*WELL MW3*		*WELL MW4*			*WELL RW1*		*WELL RW2*		*WELL RW3*	*WELL RW4*
												Rockholt		*Hunter*		*M.Morrison*	*M.Morrison*
Date	*Limit*	*7/86*	*12/86*	*7/86*	*7/86*	*12/86*	*7/86*	*12/86*	*7/86*	*12/86*	*12/86*	*7/86*	*12/86*	*7/86*	*12/86*	*7/86*	*7/86*
Parameter	*(µg/L)*																
pH(field)		7.04	7.24	7.00	7.00	6.95	7.13	6.86	7.81	7.04		7.01	6.9-	6.23	6.5.	6.5	5.95
pH(lab)		7.3	6.9	7.0	7.0	6.5	7.3	6.6	7.7	6.-		7.3	6.9	6.4	6.1	7	6.2
Spec. Cond(2) (field)		279	220	700	700	400	620	392	680	382		520	430	138	150-	1128	242
Spec. Cond (lab)		310	260	540	540	600	560	550	460	500		580	650	150	5-Jan	160	260
TDS mg/L		210	224	370	390	417	370	350	320	304		460	420	150	152	140	280
TOC mg/L	0.5 mg/L	U		4.5	3.5		18		5.8			3.8		3		0.8	3.4
Sulfate mg/L		14		43	43		30		26			43	19	25		8.5	3
Chloride mg/L		9.7	10.7	62	62	71.5	49	50.0	35	40.8		65.0	60.2	11	13.4	11	8
Phenols mg/L	0.1	U		0.6	U		U		U			U		U		U	U
Aluminum	200	U		333	297		203		1,400			3700		U		U	U
Arsenic	10	U		U	U		U		U			U		U		U	U
Barium	200	U		220	214		294		U			U		U		U	394
Beryllium	5	S		U	U		11		U			U		U		U	U
Cadmium	5	U		6.6	6.6		6.6		U			U		U		U	U
Calcium	5000	30,500		42,200	41,900		46,300		46,100			59,100		10,100		8,400	17,200
Chromium	10	U		120	10		U		U			16		U		U	U
Cobalt	50	U		U	U		U		U			U		U		U	U
Copper	25	U		U	U		U		32			184		45		U	UU
Iron	100	167		435	452		856		2,091			32,600		2,100		165	3490
Lead	5	23	U	27	28	10	26	U	26			20	U	U	14	U	2.6
Magnesium	5000	11,400		24,400	24,200		25,400		22,500			33,900		4,830		5,360	8
Manganese	15	120		17	17		58		151			1010		U		U	46
Mercury	0.2	U		U	U		U		U			U		U		U	U
Nickel	70	U		U	U		U		U			61		U		U	U
Potassium	5000	U		6,600	6,700		7,400		5700			5500		U		U	U
Sodium	5000	17,900		24,300	24,400		25,600		13900			14,800		10,500		16,800	14,600
Vanadium	50			U	U		U		U			62		U		U	U
Zinc	20	68		192	50		73		2,160			382		1,059		100	95

TABLE 5
(continued)

SUMMARY OF DETECTED COMPOUNDS - PHASE I GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

Location	Detection	WELL MW1		WELL MW2			WELL MW3		WELL MW4			WELL RW1 Rockholt		WELL RW2 Hunter		WELL RW3 M.Morrison	WELL RW4 M.Morrison
Date	Limit	7/86	12/86	7/86	7/86	12/86	7/86	12/86	7/86	12/86	12/86	7/86	12/86	7/86	12/86	7/86	7/86
Parameter	(ug/l)																
Volatile Organics																	
Methylene Chloride	5.0	U	5 B	U	5	U	17 U	9 B	U	5 B	6 B	U	7 B	U	5 B	U	U
Acetone	10	U	705 B	12 B	33 B	126 B	U	81 B	23 B	U	8 B	U	15 B	U	24 B	U	U
Trans 1,2-Dichloroethene	5.0	U	U	7.2	7.8	U	U	24	210	483	467	76	84	U	16 C	U	U
Trichloroethene	5.0	U	U	7.9	7.9	U	460	362	220	411	439	230	171	U	21 C	U	U
1,1 Dichloroethene	5.0	U	U	U	U	U	71	108	U	21	22	U	5	U	U	U	U
1,1 Dichloroethene	5.0	U	U	U	U	U	U	12	U	8	8	U	U	U	U	U	U
1,1,1 Trichloroethane	5.0	U	U	U	U	U	120	128	9.2	26	30	U	U	U	U	U	U
Total Xylenes	5.0	U	U	U	U	U	U	U	13	U	U	U	U	U	U	U	U
Chloroform	5.0	U	U	U	U	U	U	U	U	5	5	U	U	U	U	U	U
Semi-Volatiles																	
bis(2-ethylhexyl) phalate	10	U		U	U		U		350			U		U		U	U

Notes:

(1) Concentrations in µg/L unless otherwise noted. Samples collected July 9 through July 11, 1986; analyzed by CompuChem Laboratories.
Samples collected December 17, 1986; analyzed by Davis & Floyd Inc. All metals analyses were performed on unfiltered samples.

(2) Specific conductance in umhos/cm

(3) Detection limit for reported volatile analyses for sample from MW-3 collected on 7/9/86 was 17 µg/L because of dilution factor.

U - Not detected within minimum attainable detection limit of sample.
B - Analyte found in blank as well as sample. Possible/probably blank contamination.
C - Possible carryover contamination from previous laboratory sample run, as indicated by low matrix spike recoveries for compounds as flagged

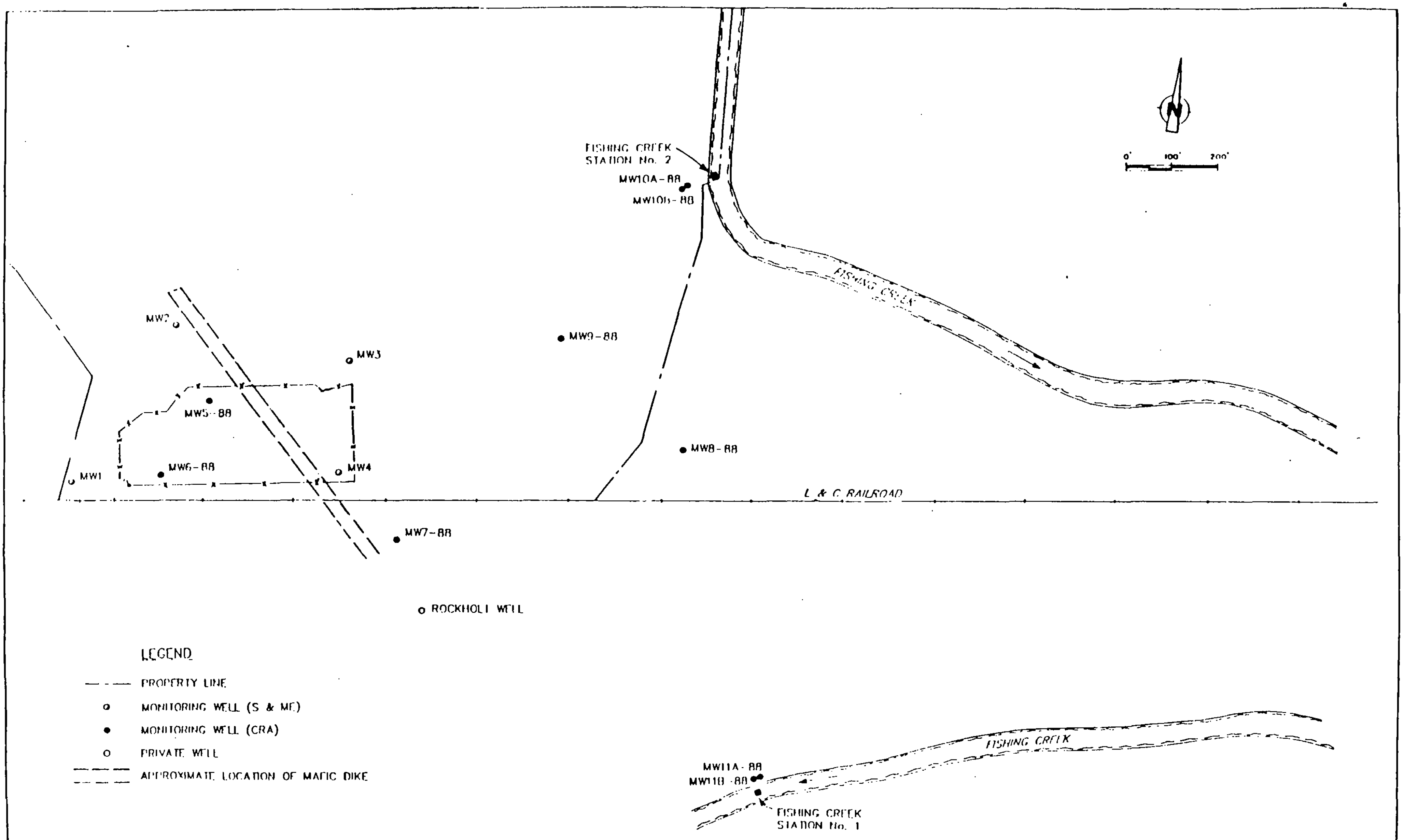


FIGURE 11 LOCATION OF MONITOR WELLS INSTALLED DURING PHASE II

Source: Conestoga-Rovers & Associates

the USEPA Target Compound List (TCL). The USEPA TCL is equivalent to the USEPA Priority Pollutant List. All the rest of the groundwater samples were analyzed for TCL Volatile Organic Compounds (VOCs). A summary of the results of the analyses are presented in Tables 6 and 7.

Below are brief descriptions of the findings of the groundwater investigation.

For VOCs: Several TCL VOCs were detected in the monitor wells and domestic wells sampled during both phases. The compounds found in the highest concentrations included acetone and trichloroethylene (TCE). Other VOCs were detected in a fewer number of wells. After reviewing the QA/QC data, it is the Agency's opinion that the methylene chloride found in some of the groundwater samples was due to laboratory cross-contamination and not a constituent of the groundwater. This conclusion is supported by the fact that methylene chloride was found in the laboratory blanks.

Figures 12 and 13 provide a visual presentation of groundwater contamination detected in the two sampling rounds conducted during Phase I. Figure 12 depicts the distribution of organics in the groundwater and Figure 13, the distribution of the inorganic contaminants. Figures 14 and 15 provide a visual distribution of acetone and TCE contamination of groundwater found during Phase II. Examination of these figures indicate that the contaminants are being transported through the fractures and joints in the bedrock along with the groundwater. As stated previously, the mafic dike has little effect on groundwater flow and therefore, the distribution of the contaminants in the groundwater.

For Base Neutral/Acid Extractables (BNAs): The only BNA detected in either Phase I or II was in well MW-4. Bis(2-ethyl hexyl)phthalate, a common cross-contaminant in monitor wells, was found in the first round of samples collected during Phase I.

For Polychlorinated Biphenyls (PCBs)/Pesticides: Neither PCBs nor pesticides were detected in any groundwater samples collected during the RI.

For Metals: A number of TCL metals were detected in the Phase I samples and in the groundwater samples pulled from MW5-88 and MW6-88 during Phase II. Lead was detected at concentrations from 2.6 to 28.0 ug/l in various monitor wells in Phase I. Lead was also detected in round 1 sampling of Phase II in MW5-88 and MW6-88 at concentrations of 8.2 micrograms per liter (ug/l) and 80 ug/l, respectively. This data is presented in Tables 5 and 7. The present Maximum Concentration Limit (MCL) for lead is 50 ug/l but in August, 1988, EPA proposed a MCL of 5 ug/l (Federal Register: Volume 53, No. 160). In addition, chromium was also detected in MW6 at a concentration of 80 ug/l (Table 7) which exceeds the present MCL of 50 ug/l.

TABLE 6

SUMMARY OF DETECTED COMPOUNDS - PHASE II GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

VOLATILE ORGANIC COMPOUNDS	MW1	MW2	MW3	MW4	MW5	MW5-D	MW6	MW6-S	MW7	MW8	MW9	M10A	M10B	M11A	M11B	RW-4	RW-4 (DUP)
ROUND 1																	
Acetone	11,000	29,000	6,200	9,000	31,000	16,000	ND (350)	ND (500)	9,200	64	6,300	100	240	ND (50)	530	ND (50)	ND (50)
Chloroform	ND (250)	ND (1000)	ND (170)	ND (170)	ND (830)	ND (830)	ND (35)	ND (50)	ND (330)	ND (5)	ND (50)	ND (8)	ND (12)	8	ND (17)	ND (12)	ND (12)
1,1-Dichloroethane	ND (250)	ND (1000)	ND (170)	ND (170)	ND (830)	ND (830)	ND (35)	ND (50)	ND (330)	ND (5)	ND (50)	ND (8)	ND (12)	ND (5)	ND (17)	ND (12)	ND (12)
1,1-Dichloroethene	10	ND (1000)	ND (170)	ND (170)	ND (830)	ND (830)	70	70	ND (330)	ND (5)	ND (50)	10	14	ND (5)	ND (17)	ND (12)	ND (12)
1,2-Dichloroethene (Total)	ND (250)	ND (1000)	ND (170)	470	ND (830)	ND (830)	400	440	370	ND (5)	81	80	110	ND (5)	ND (17)	120	120
1,1,1-Trichloroethane	ND (250)	ND (1000)	ND (170)	ND (170)	ND (830)	ND (830)	40	XX	ND (330)	ND (5)	ND (50)	10	19	ND (5)	ND (17)	ND (12)	ND (12)
Trichloroethene	ND (250)	ND (1000)	440	560	ND (830)	ND (830)	1200	1,100	510	ND (5)	XX	50	64	13	XX	320	240
ROUND 2																	
Acetone	ND (50)	ND (50)	ND (250)	ND (130)	620	130	ND (50)	1,400	ND (250)	ND (50)	ND (250)	NA	2,500	72	1,700	ND (100)	NA
1,1-Dichloroethane	ND (31)	ND (5)	ND (25)	ND (13)	ND (25)	6	ND (50)	ND (50)	ND (25)	ND (5)	ND (25)	NA	ND (50)	ND (5)	ND (50)	ND (10)	NA
1,1-Dichloroethene	ND (31)	ND (5)	77	ND (13)	18	14	170	120	16	ND (5)	ND (25)	NA	ND (50)	ND (5)	ND (50)	ND (10)	NA
1,2-Dichloroethene (Total)	ND (31)	XX	ND (5)	280	230	210	450	420	470	ND (5)	67	NA	100	ND (5)	ND (50)	150	NA
1,1,1-Trichloroethane	ND (31)	ND (5)	63	ND (13)	ND (25)	14	64	66	ND (25)	ND (5)	ND (25)	NA	ND (50)	ND (5)	ND (50)	ND (10)	NA
Trichloroethene	ND (31)	XX	420	230	180	160	880	820	620	ND (5)	45	NA	50	ND (5)	ND (50)	270	NA

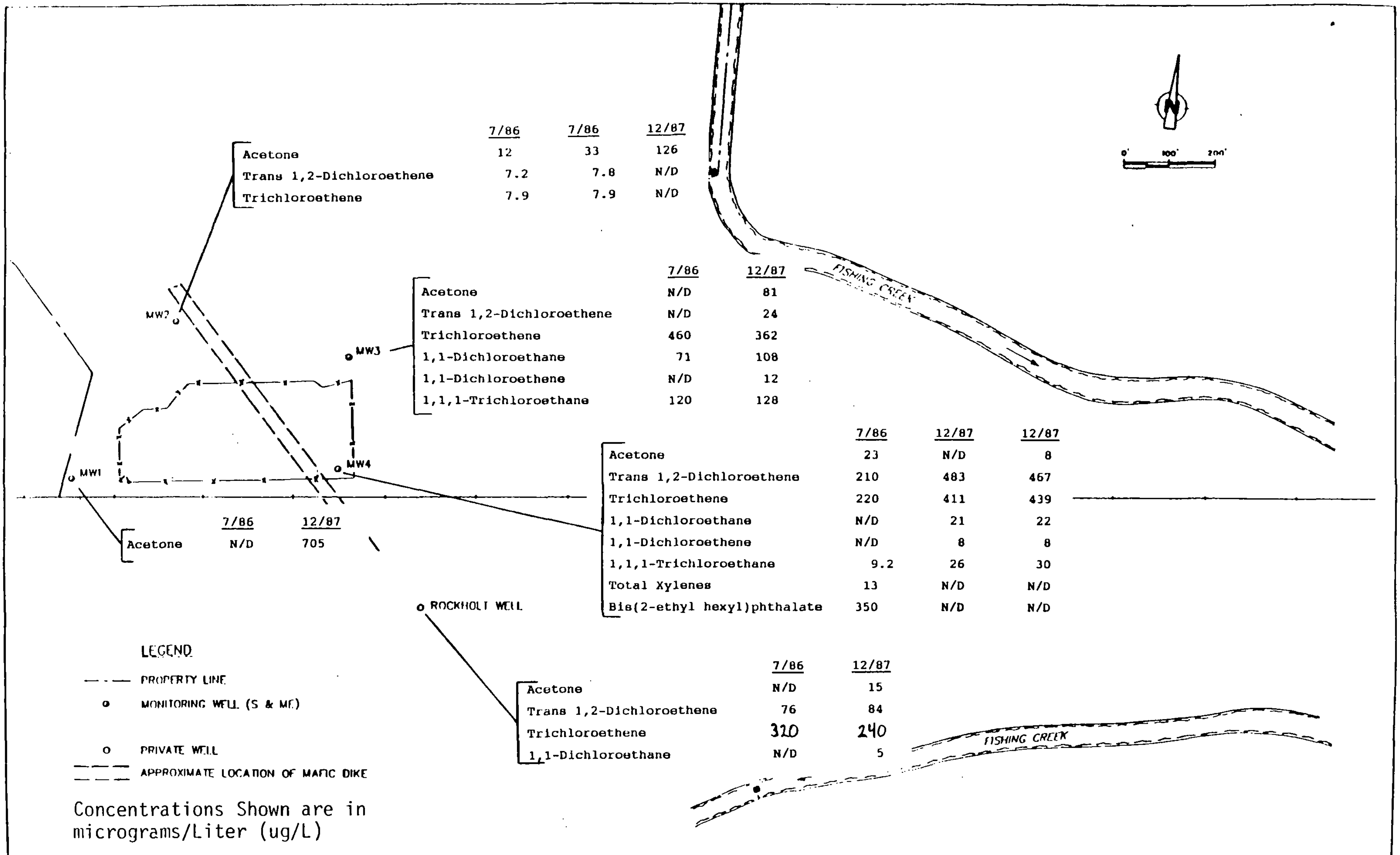
NOTES: ND - Not detected at stated detection limit
units µg/L
XX - Compound detected, but below quantitation limit
NA - Not analyzed

TABLE 7

SUMMARY OF DETECTED COMPOUNDS - PHASE II GROUNDWATER
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	MW5		MW5-DUPLICATE		MW6		MW6-SPIKE	
METALS	ROUND 1	ROUND 2	ROUND 1	ROUND 2	ROUND 1	ROUND 2	ROUND 1	ROUND 2
Aluminum	6,700	4,600	7,400	4,600	6,500	1,000	12,000	200
Barium	220	190	240	190	960	140	390	170
Calcium	50,000	51,000	48,000	51,000	100,000	54,000	52,000	59,000
Chromium	50	ND (20)	50	ND (20)	80	ND (20)	20	ND (20)
Cobalt	ND (50)	ND (50)	ND (50)	ND (50)	60	ND (50)	ND (50)	ND (50)
Copper	40	ND (10)	30	ND (10)	270	ND (10)	30	ND (10)
Iron	8,500	12,000	10,000	1,200	87,000	1,400	18,000	3,400
Lead	7.3	ND (50)	8.2	ND (50)	80.0	ND (50)	53.0	ND (50)
Magnesium	25,000	24,000	25,000	24,000	59,000	19,000	25,000	20,000
Maganese	140	230	150	230	1,400	210	460	260
Nickel	ND (40)	ND (40)	ND (40)	ND (40)	120	ND (40)	ND (40)	ND (40)
Potassium	7,100	6,700	7,400	6,800	30,000	6,200	12,000	7,200
Silver	20	10	20	ND (10)	ND (10)	ND (10)	ND (10)	10
Sodium	19,000	24,000	19,000	24,000	30,000	25,000	22,000	26,000
Vanadium	ND (50)	170	ND (50)	170	270	ND (50)	ND (50)	ND (50)
Zinc	20	80	20	80	170	30	70	90

NOTES: ND - Not detected at stated detection limit
units µg/L



MW2:

	7/86	7/86	12/87
Acetone	12	33	126
Trans 1,2-Dichloroethene	7.2	7.8	N/D
Trichloroethene	7.9	7.9	N/D

MW3:

	7/86	12/87
Acetone	N/D	81
Trans 1,2-Dichloroethene	N/D	24
Trichloroethene	460	362
1,1-Dichloroethane	71	108
1,1-Dichloroethene	N/D	12
1,1,1-Trichloroethane	120	128

MW4:

	7/86	12/87	12/87
Acetone	23	N/D	8
Trans 1,2-Dichloroethene	210	483	467
Trichloroethene	220	411	439
1,1-Dichloroethane	N/D	21	22
1,1-Dichloroethene	N/D	8	8
1,1,1-Trichloroethane	9.2	26	30
Total Xylenes	13	N/D	N/D
Bis(2-ethyl hexyl)phthalate	350	N/D	N/D

MW1:

	7/86	12/87
Acetone	N/D	705

Rockholt Well:

	7/86	12/87
Acetone	N/D	15
Trans 1,2-Dichloroethene	76	84
Trichloroethene	320	240
1,1-Dichloroethane	N/D	5

Concentrations Shown are in micrograms/Liter (ug/L)

FIGURE 12 DISTRIBUTION OF ORGANICS IN THE GROUNDWATER ACCORDING TO PHASE I ANALYTICAL DATA

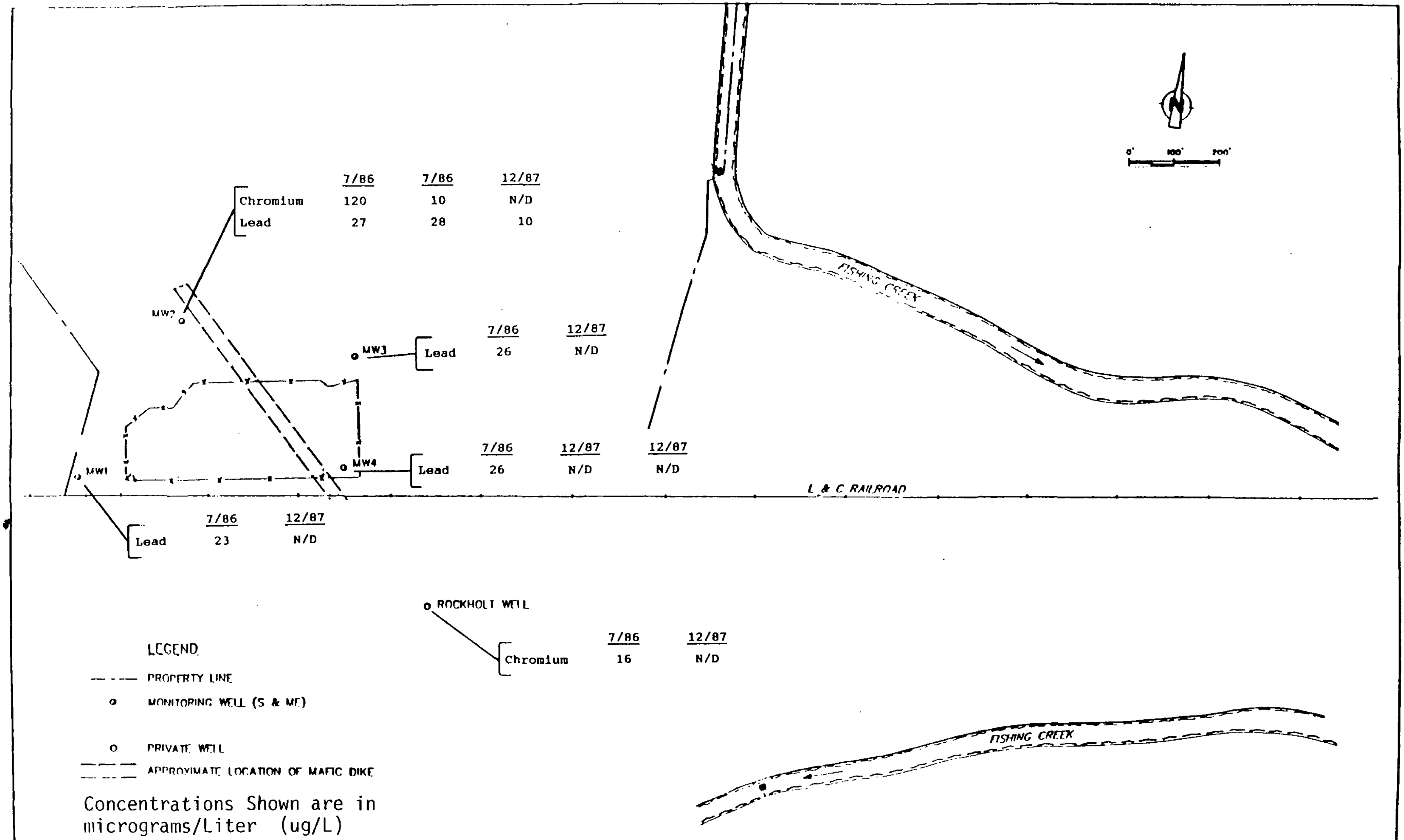


FIGURE 13 DISTRIBUTION OF INORGANICS IN THE GROUNDWATER ACCORDING TO PHASE I ANALYTICAL DATA

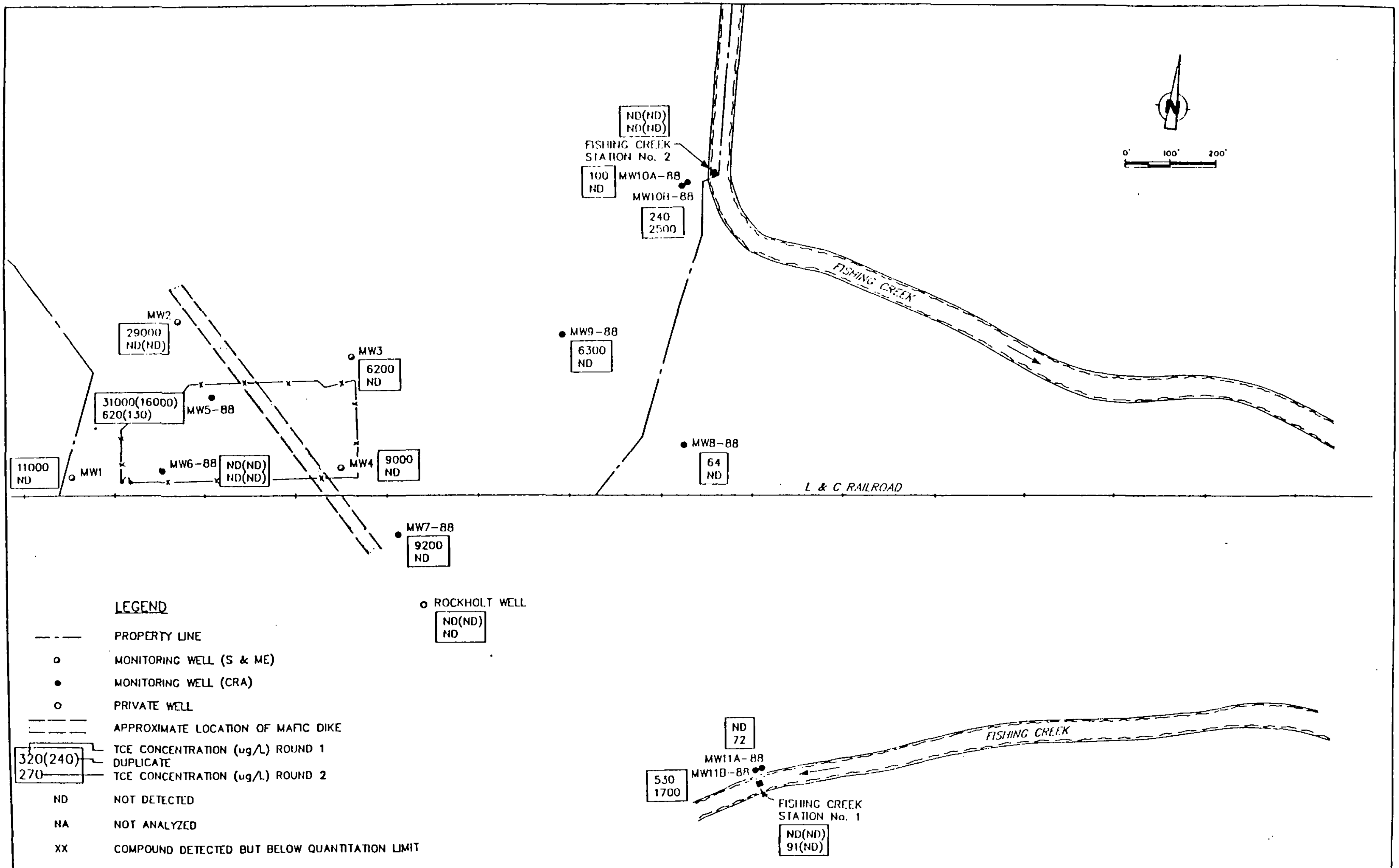


FIGURE 14 DISTRIBUTION OF ACETONE IN THE GROUNDWATER ACCORDING TO PHASE II ANALYTICAL DATA

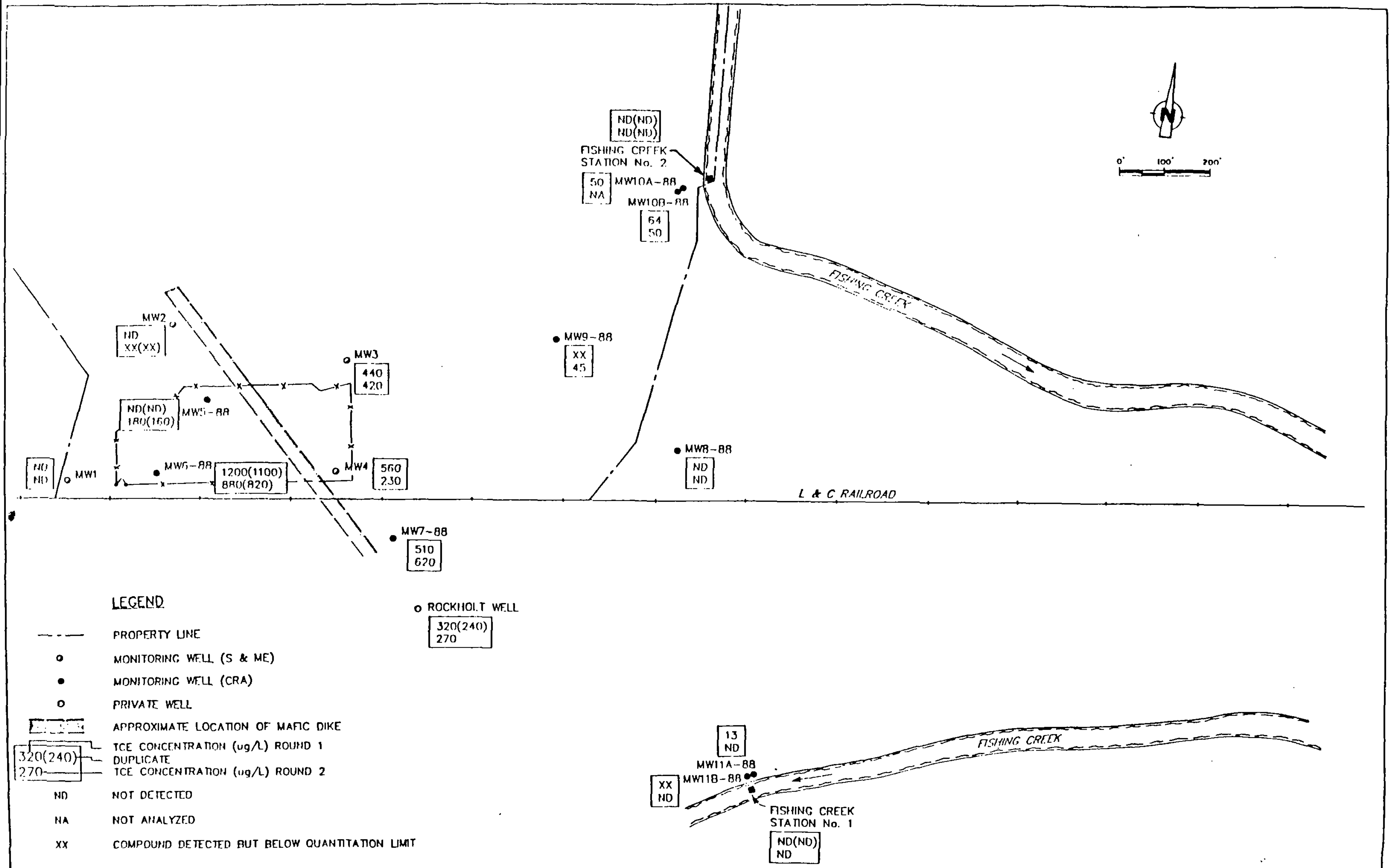


FIGURE 15 DISTRIBUTION OF TRICHLOROETHENE IN THE GROUNDWATER ACCORDING TO PHASE II ANALYTICAL DATA

3.6 SURFACE WATER AND SEDIMENT

Surface water runoff from the Site is channeled into ditches that are located in the north, east and west sides of the fenced area as can be seen in Figure 16. These ditches direct surface runoff to Fishing Creek and contain flowing water only during wet periods. Figure 16 also shows the sampling location for samples collected as part of the hazardous waste site investigation (HWSI) conducted in August 1981. Table 8 provides a brief description of the HWSI sampling locations. Tables 9 and 10 summarize the compounds detected in the August 1981 HWSI.

Surface water and sediment samples were collected during both Phase I and II, however, only Fishing Creek was sampled during Phase II. Figure 17 shows the sampling locations in Phase I. Figure 18 identifies the sampling points for samples collected from Fishing Creek during Phase II. The analytical results of Phase I surface water/sediment sampling are given in Table 11 and the results of Phase II sampling/analyses are presented in Table 12.

The Phase I surface water data indicates that the concentrations of metals and semi-volatile organic compounds were below minimum detection limits. The only volatile organic compound detected, which also was found in the laboratory blank, was methylene chloride.

The six sediment samples collected during Phase I indicate the presence of acetone and elevated levels of lead and arsenic. The elevated metal levels were detected in the sediment collected from the west ditch.

All Phase II surface water samples collected were analyzed for TCL VOCs. Examination of these data indicates that only acetone was detected. No other VOCs were detected. It is possible that the acetone is the result of sampling and/or laboratory contamination as acetone was not detected in the duplicate sample collected at Station 1 during Round 2 of sampling. However, acetone is a confirmed contaminant in the groundwater that is discharging to Fishing Creek.

The surface water analyses conducted during the RI indicates that the discharge of groundwater to Fishing Creek has not had a measureable impact on the water quality in Fishing Creek.

The geometric mean of flow in Fishing Creek is 45.45 cubic feet per second. Figure 19 depicts the 100-year flood zone for Fishing Creek.

3.7 RISK ASSESSMENT SUMMARY

The chemicals of potential concern identified for the site are volatile organic compounds and one heavy metal. More specifically: acetone, 1,1-Dichloroethane (1,1 DCA), 1,1-Dichloroethene (1,1 DCE), 1,2-Dichloroethene (1,2 DCE), 1,1,1-Trichloroethane (1,1,1 TCA), Trichloroethene (TCE) and lead.

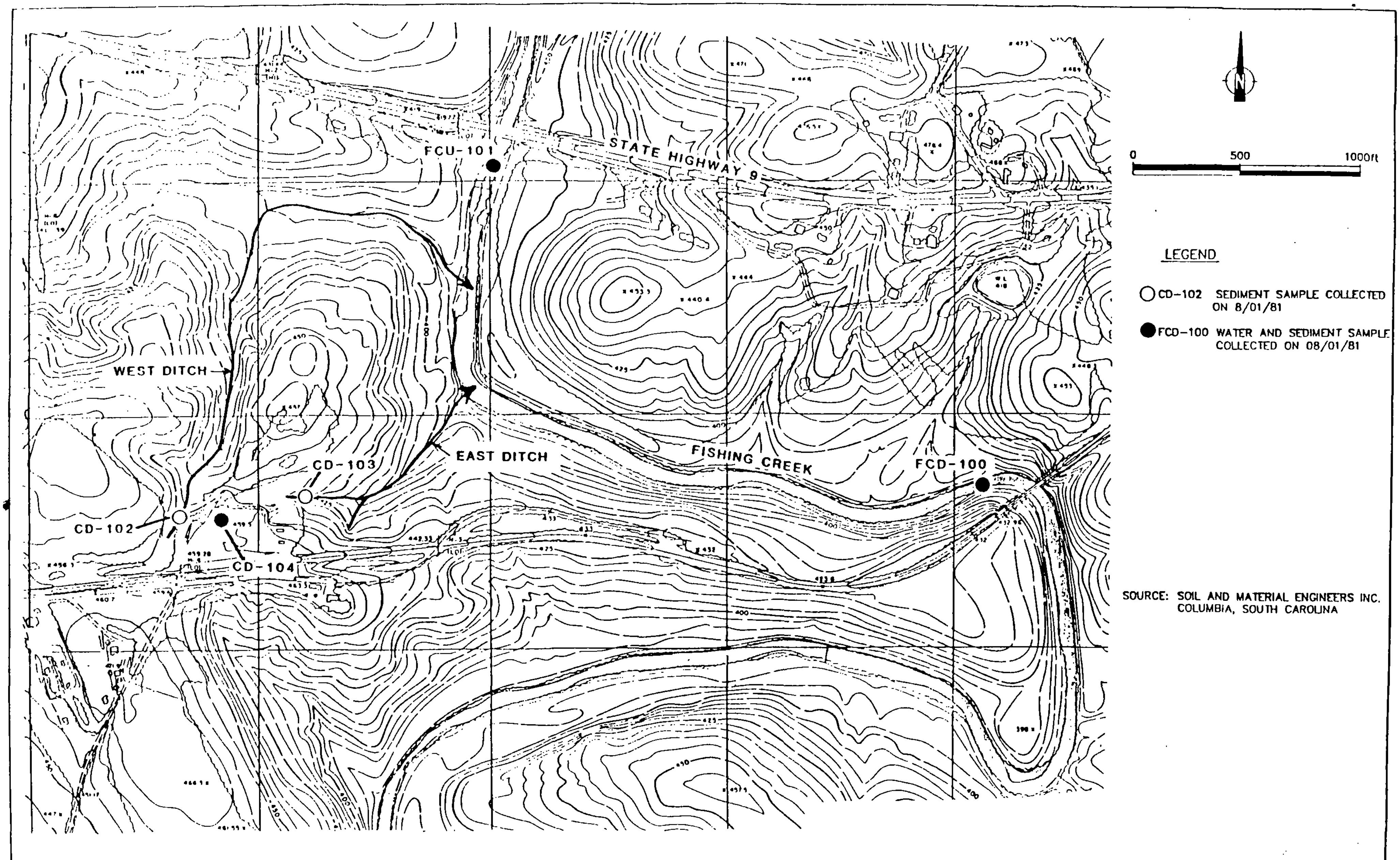


FIGURE 16 HAZARDOUS WASTE SITE INVESTIGATION SAMPLING LOCATIONS

TABLE 8

HWSI SAMPLING LOCATIONS
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

Sample Number	*Sample Type*	*Sampling Location*
FCU-101	Water, sediment	Fishing Creek upstream from site, approximately 200 feet downstream from Highway 9 bridge.
FCD-100	Water, sediment	Fishing Creek downstream from site, approximately 200 feet upstream from railroad tressel.
CD-102	Sediment	Drainage ditch at west end of property downgrade from drums.
CD-103	Sediment	Drainage ditch east of site.
CD-104	Water, sediment	Diked area around large bulk storage tanks.
CDW-105	Waste	Spillage in phenol trailer.
CDW-106	Waste	Spillage at edge of drum storage area by loading dock.
CDW-107	Waste	Spillage from drum outside fence west of site.
CDW-108	Waste	Leakage from tank in the incinerator area at the northeast corner of the site.

Source - USEPA, 1981

TABLE 9

DATA SUMMARY - WASTE SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	CDW-105 Phenol trailer (mg/kg)	*CDW-106 Loading dock (mg/kg)*	*CDW-107 Drum West of fence (mg/kg)*	*CDW-108 Leakage from tank (mg/kg)*
PURGEABLE ORGANIC COMPOUNDS				
1,1,1-Trichloroethane1	ND	ND	ND	<10
Hexane[2]	800	--	130	--
EXTRACTABLE ORGANIC COMPOUNDS (GC/MS)				
Phenol[1]	14,000	ND	ND	ND
Bis (2-ethyl hexyl)phthalate[1]	ND	ND	ND	6,900
C_4 Alkyl pehnol[2]	18,000	ND	ND	ND
C_{10} Alkyl phenol[2]	--	--	<320	--
Dodecanoic acid[2]	--	26,000	--	--
Terradecanoic acid[2]	--	<10,000	--	--
Unidentified compounds[3]	--	--	16,000 [2]	--
Petroleum type compound	--	P	--	P
PESTICIDES, PCBs AND OTHER CHLORINATED COMPOUNDS (GC/EC)				
p,p'-DDE1	54	ND	ND	ND
Alpha BHC[1]	150	ND	ND	ND
Beta BHC[1]	38	ND	ND	ND
Gama BHC[1]	8.9	ND	ND	ND
Delta BHC[1]	6.7	ND	ND	ND
o,p'-DDE	20	--	--	--

TABLE 9
(continued)

DATA SUMMARY - WASTE SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	CDW-105 Phenol trailer (mg/kg)	*CDW-106 Loading dock (mg/kg)*	*CDW-107 Drum West of fence (mg/kg)*	*CDW-108 Leakage from tank (mg/kg)*
INORGANIC ELEMENTS AND COMPOUNDS				
Barium	1,150	1	2	ND
Cadmium[1]	9	ND	ND	ND
Chromium[1]	236	0.3	1	1
Copper[1]	127	0.2	2	178
Molybdenum	33	ND	ND	ND
Nickel[1]	64	ND	ND	ND
Lead	830	0.8	ND	ND
Tin	343	ND	ND	ND
Strontium	37	0.4	1	ND
Titanium	1,480	0.4	55	2
Vanadium	46	1	1	ND
Yttrium	8	0.1	ND	ND
Zinc[1]	880	1.5	2	1
Aluminum	24,400	10	940	13
Manganese	410	0.9	6	ND
Calcium	3,390	70	30	ND
Magnesium	5,010	8	61	ND
Iron	60,000	155	1,120	31
Sodium	ND	13	1,500	ND
Cyanide[1]	9.3	ND	ND	ND

TABLE 9
(continued)

DATA SUMMARY - WASTE SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

All waste concentrations are calculated on a wet weight basis.

p	-	Indicates presence.
NA	-	Not analyzed.
ND	-	None detected at or above the minimum detection limit (MDL). THe MDLs vary from sample to sample and from parameter to parameter, see analytical data sheets (Appendix A) for exact values.
1	-	Compound/element is on the NRDC list of priority pollutants.
2	-	Tentative identification, estimated concentration.
3	-	The value indicates the highest estimated concentration for a compound in this classification. The number in parentheses indicated the number of compounds detected in this classification.
a	-	Presumptive evidence of material; not confirmed on GC/MS or second GC column. See footnote b.
b	-	Confirmed on GC/MS. The lack of a footnote indicates that the compound was confirmed on two different GC columns.

TABLE 10

DATA SUMMARY - WATER AND SEDIMENT SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	SEDIMENT					*WATER*		
	FCU-101 Fishing Cr. upstream (ug/kg)	**FCD-100 Fishing Cr downstream (ug/kg)**	**CD-101 Ditch West of property (ug/kg)**	**CD-103 Ditch East of property (ug/kg)**	**CD-104 Diked Area around tanks (ug/kg)**	**FCU-101 Fishing Cr upstream (ug/l)**	**FCD-100 Fishing Cr downstream (ug/l)**	**CD-104 Diked Area around tanks (ug/l)**
PURGEABLE ORGANIC COMPOUNDS								
Trichlorofluoroethane[1]	ND	ND	ND	ND	ND	ND	ND	8.1
1,1-Dichloroethylene[1]	ND	ND	ND	ND	ND	ND	ND	<3
1,1-Dichloroethane[1]	ND	ND	ND	ND	ND	ND	ND	<3
1,2-Trans-dichloroethylene[1]	ND	ND	ND	ND	9.7	ND	ND	230
1,1,1-Trichloroethane[1]	ND	ND	ND	ND	ND	ND	ND	15
Trichloroethylene[1]	ND	ND	ND	ND	<5	ND	ND	260
1,1,2,2-Tetrachloroethane[1]	ND	ND	ND	ND	<5	ND	ND	ND
EXTRACTABLE ORGANIC COMPOUNDS (GC/MS)								
N-Butyl benzyl phthalate[1]	ND	ND	<3,000	ND	ND	ND	ND	ND
Bis (2-ethyl hexyl)phthalate	ND	ND	9,200	ND	ND	ND	ND	ND
Chrysene and/or benzo(A) anthracene[1]	ND	ND	<3,000	ND	ND	ND	ND	ND
C, ALkyl phenol[2]	--		--	--	--	--	--	60
Unidentified compounds[3]	--	--	13,000(4)	--	--	--	--	--
Petroleum type product	--	--	--	--	--	--	--	--
PESTICIDES, PCBs, AND OTHER CHLORINATED COMPOUNDS (CC/IC)								
PCB-1234	ND	ND	310	ND	86	ND	ND	ND

TABLE 10
(continued)

DATA SUMMARY - WATER AND SEDIMENT SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	SEDIMENT					*WATER*		
	FCU-101 Fishing Cr. upstream (ug/kg)	**FCD-100 Fishing Cr downstream (ug/kg)**	**CD-101 Ditch West of property (ug/kg)**	**CD-103 Ditch East of property (ug/kg)**	**CD-104 Diked Area around tanks (ug/kg)**	**FCU-101 Fishing Cr upstream (ug/l)**	**FCD-100 Fishing Cr downstream (ug/l)**	**CD-104 Diked Area around tanks (ug/l)**
INORGANIC ELEMENTS AND COMPOUNDS								
Barium	36	32	97	61	164	36	38	66
Cadmium[1]	ND	ND	2	ND	ND	ND	ND	ND
Chromium[1]	9	3	32	23	30	ND	ND	ND
Copper[1]	2	1	92	26	63	ND	ND	ND
Nickel[1]	ND	ND	14	14	23	ND	ND	ND
Lead[1]	4	ND	81	8	13	ND	ND	ND
Molybdenum	ND	ND	ND	ND	ND	ND	ND	ND
Strontium	3	3	39	46	91	87	87	33
Titanium	185	122	712	1,070	977	61	93	40
Vanadium	13	10	33	44	40	ND	10	ND
Yttrium	3	3	6	7	9	ND	ND	ND
Zinc[1]	12	10	41	18	30	11	12	14
Mercury[1]	ND	ND	0.33	ND	ND	ND	ND	ND
Cyanide[1]	ND	ND	0.43	0.29	ND	ND	ND	ND
Aluminum	2,200	1,470	11,600	8,300	19,800	2,800	3,600	1,900
Manganese	300	350	180	215	95	75	100	ND
Calcium	400	250	2,100	3,700	7,600	9,100	9,000	3,600
Magnesium	300	383	1,800	3,100	3,100	4,000	4,000	2,700
Iron	6,100	3,100	11,800	13,200	13,800	2,700	3,500	1,500
Sodium	ND	ND	ND	250	1,200	6,000	6,000	40,000
CONVENTIONAL PARAMETERS (Units as specified for each parameter)								
Temperature (°C)	--	--	--	--	--	25	25	29.5
pH (SU)	--	--	--	--	--	6.9	7.4	8.3

TABLE 10
(continued)

DATA SUMMARY - WATER AND SEDIMENT SAMPLES
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

NOTES:

All sediment concentrations are calculated on a dry weight basis.

P - Indicates presence.
NA - Not analyzed.
ND - Not detected at or above the minimum detection limit (MDL). The MDL's vary from sample to sample and from parameter to parameter
1 - Compound/element is on the NRDC list of priority pollutants.
2 - Tentative identification, estimated concentrations.
3 - The value indicates the highest estimated concentration for a compound in this classification. The number in parentheses indicated the highest estimated concentration detected in this classification.
a - Presumptive evidence of presence of material; set confirmed on GC/MS or second CC column. See footnote b.
b - Confirmed as GC/MS. The lack of a leachate indicates that the compound was confirmed on two different GC columns.

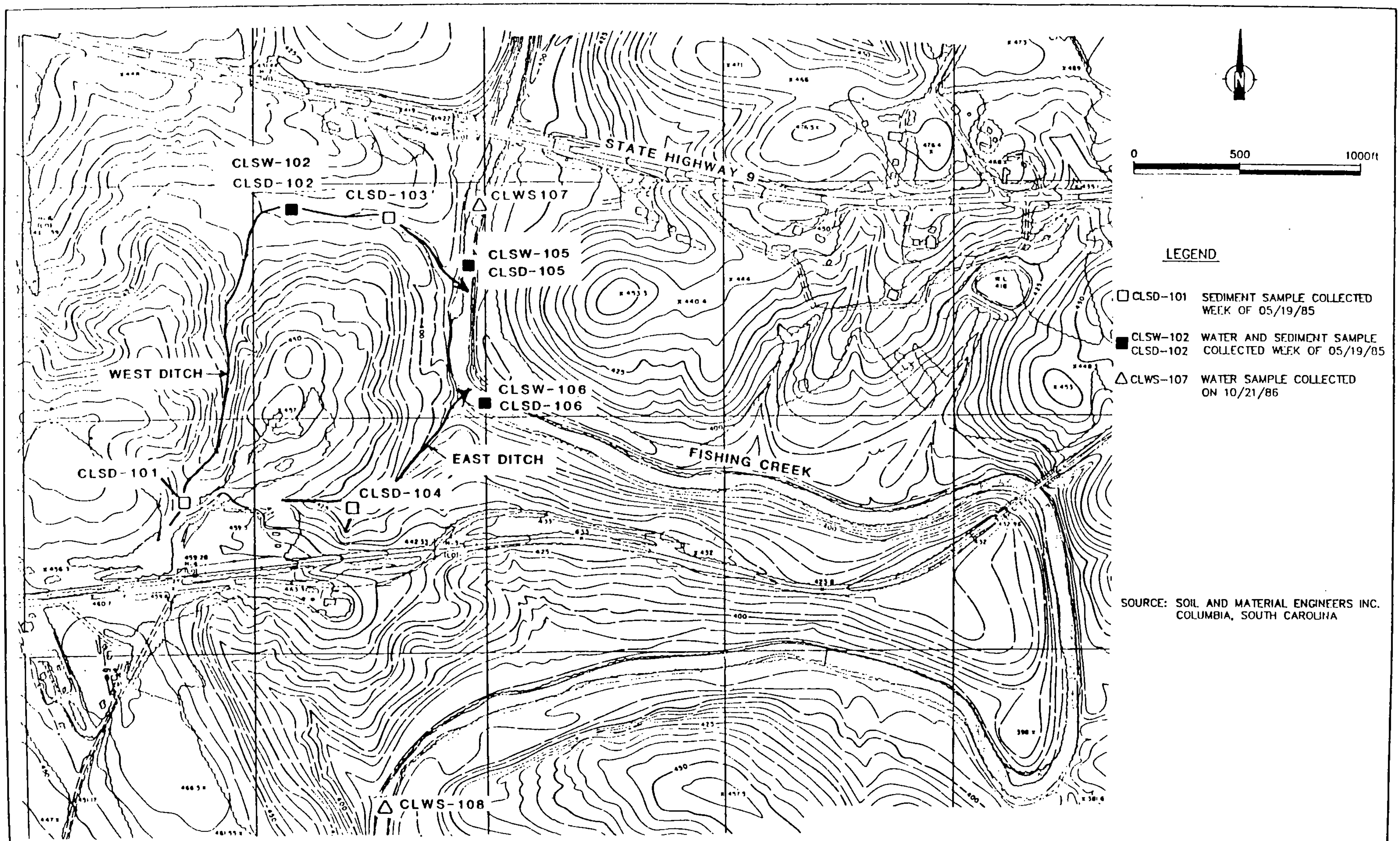


FIGURE 17 PHASE I SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS

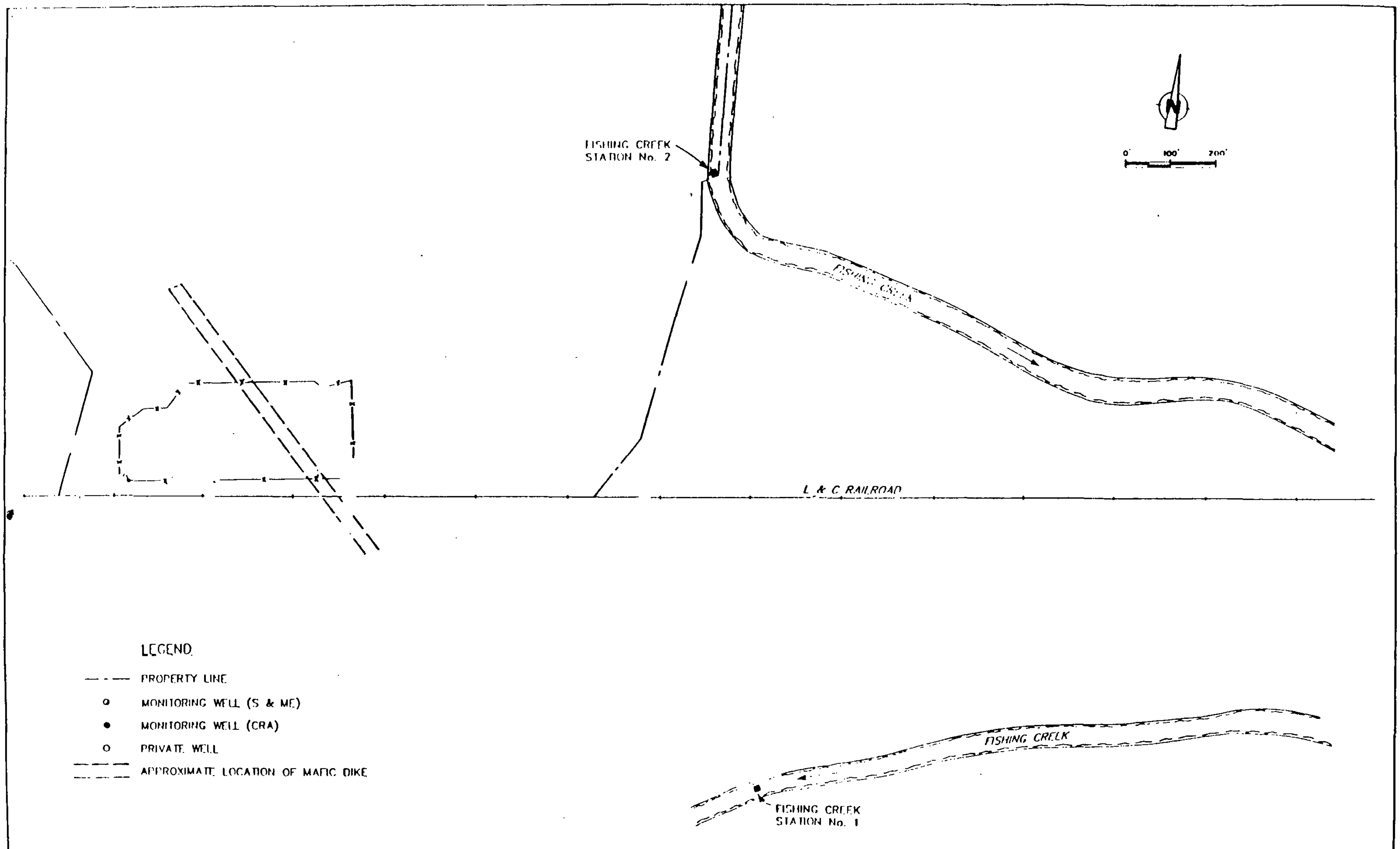


FIGURE 18 PHASE II SURFACE WATER SAMPLING POINTS AND LEVELS OF CONTAMINATION

TABLE 11

SUMMARY OF DETECTED COMPOUNDS - PHASE I
SURFACE WATER AND SEDIMENT
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	Surface Water(1)			*Surface Water(2)*				*Sediment(2)*						
Location	*Detection*	*CLWS-107 Fishing Cr. Upstream*	*CLWS-108 Fishing Cr. Downstream*	*Detection*	*CLSW-102 Intermittent Stream*	*CLSW-105 Fishing Cr. Upstream*	*CLSW-106 Fishing Cr. Downstream*	*Detection*	*CLSD-101 Ditch West of Site*	*CLSD-102 Intermittent Stream*	*CLSD-103 Intermittent Stream*	*CLSD-104 Ditch East of Site*	*CLSD-105 Fishing Cr. Upstream*	*CLSD-106 Fishing Cr. Downstream*
Date	*Limit*	*10/86*	*10/86*	*Limit*	*5/85*	*5/85*	*5/85*	*Limit*	*5/85*	*5/85*	*5/85*	*5/85*	*5/85*	*5/85*
Parameter(3)	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*
pH (field)		6.92	7.01											
pH (lab)		7.4	7.5											
Spec. Cond. (field)(4)		93	90											
Spec. Cond. (lab)(4)		155	145											
Chloride		6.43	5.92											
TDS		108	88											
Antimony				0.05	U	U	U	0.5	U	U	U	U	U	U
Aluminum	0.5	U	U											
Arsenic				0.05	U	U	U	0.5	4.1	0.82	1.9	6.0	1.1	U
Barium	0.2	U	U	1.0	U	U	U	10.0	U	25	24	72	U	U
Beryllium				0.02	U	U	U	0.2	U	U	U	U	U	U
Cadmium	0.005	U	U	0.01	U	U	U	0.1	0.75	0.34	U	U	U	U
Chromium	0.02			0.05	U	U	U	0.5	U	2.4	20	13	U	U
Copper				0.10	U	U	U	1.0	U	1.8	3.0	25	U	U
Lead	0.005	U	U	0.05	U	U	U	0.5	19	1.4	U	3.8	U	U
Mercury				0.0002	U	U	U	0.002	0.016	0.007	0.015	0.0077	0.011	0.0052
Nickel	0.04	U	U	0.10	U	U	U	1.0	U	1.1	3.0	11	U	U
Manganese	0.02	0.178	0.200											
Selenium				0.01	U	U	U	0.1	U	U	U	U	U	U
Silver				0.05	U	U	U	0.5	U	U	U	U	U	U
Thallium				0.05	U	U	U	0.5	U	U	U	U	U	U
Zinc	0.01	U	U	0.02	0.04	0.04	0.01	0.2	U	8.3	6.0	12	U	??(4)

TABLE 11
(continued)

SUMMARY OF DETECTED COMPOUNDS - PHASE I
SURFACE WATER AND SEDIMENT
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

	Surface Water(1)			*Surface Water(2)*				*Sediment(2)*						
Location		*CLWS-107 Fishing Cr. Upstream*	*CLWS-108 Fishing Cr. Downstream*		*CLSW-102 Intermittent Stream*	*CLSW-105 Fishing Cr. Upstream*	*CLSW-106 Fishing Cr. Downstream*		*CLSD-101 Ditch West of Site*	*CLSD-102 Intermittent Stream*	*CLSD-103 Intermittent Stream*	*CLSD-104 Ditch East of Site*	*CLSD-105 Fishing Cr. Upstream*	*CLSD-106 Fishing Cr. Downstream*
Date	*Detection Limit*	*10/86*	*10/86*	*Detection Limit*	*5/85*	*5/85*	*5/85*	*Detection Limit*	*5/85*	*5/85*	*5/85*	*5/85*	*5/85*	*5/85*
Parameter(3)	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*
Volatile Organics	*(µg/L)*	*(µg/L)*	*(µg/L)*	*(µg/L)*	*(µg/L)*	*(µg/L)*	*(µg/L)*	*(µg/kg)*	*(µg/kg)*	*(µg/kg)*	*(µg/kg)*	*(µg/kg)*	*(µg/kg)*	*(µg/kg)*
Methylene Chloride	5.0	6.0	5.0	5.0	5.7	U	3.0	5.0	21N	14B	6.1B	25B	16B	19B
Acetone				10.0				5.0	7.7N	8.7B	5.9B	9.7B	22B	45B

Notes:

(1) Samples collected by S&ME, Inc. on October 21, 1986; analyzed by Davis & Floyd, Inc.

(2) Samples collected by HAZTECH the week of May 19, 1985; analyzed by CompuChem Laboratories.

(3) All metals analyzes were performed on unfiltered samples.

(4) Specific conductance measurement in umhos/cm.

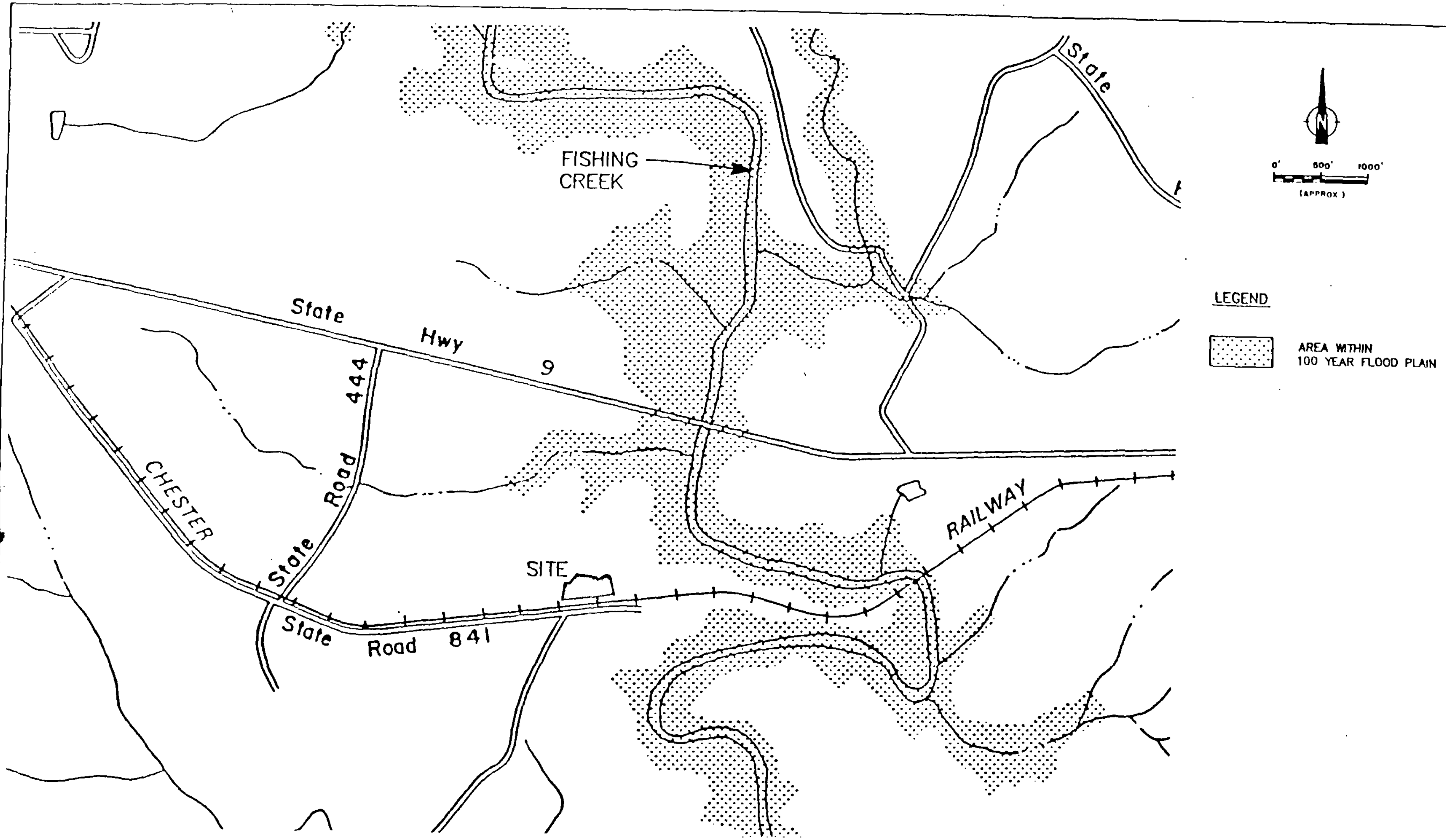
U - Not detected within minimum attainable detection limit of sample.

B - Analyte found in blank as well as sample. Possible/probable blank contamination.

TABLE 12

SUMMARY OF PHASE II SURFACE WATER SAMPLES

Sample Location	Source	Date Sampled	Contaminants Detected	Concentration (micrograms/liter)
Station 1	Fishing Creek	Round 1 Aug/Sept 1988	None	N/A
Station 2	Fishing Creek	Round 1 Aug/Sept 1988	None	N/A
Station 2 Duplicate	Fishing Creek	Round 1 Aug/Sept 1988	None	N/A
Station 1	Fishing Creek	Round 2 October 1988	Acetone	91.0
Station 1 Duplicate	Fishing Creek	Round 2 October 1988	None	N/A
Station 2	Fishing Creek	Round 2 October 1988	None	N/A



SOURCE: FEDERAL EMERGENCY MANAGEMENT AGENCY,
FLOOD INSURANCE RATE MAP,
CHESTER COUNTY, SOUTH CAROLINA, 1982

FIGURE 19 FISHING CREEK 100 YEAR FLOOD PLAIN

Under present conditions, the risk posed by the inhalation of vapors and suspended contaminated particulates in air has a very low probability. Although the chemicals of concern for the site are volatile organics, the removal of the contaminated soils and subsequent back filling with clean fill by EPA in 1982 eliminated this pathway. EPA's 1982 removal was augmented by the PRP sponsored 1986 removal action. Inorganics chemicals are reported in surface soil but at levels that are typical for soils in general. Dust exposure is further limited by a general covering of vegetation over the site. This route of exposure may become important and require further consideration if air stripping is used as part of the treatment train for remediating contaminated groundwater.

Exposure to contaminated surface soil at the site was also evaluated. As with the potential for exposure via the air pathway, the potential to exposure to contaminated surface soils have also been eliminated by the removal actions taken at the site. Therefore, exposure to soil is not considered a risk.

There is one domestic water supply wells drawing water from the bedrock aquifer in the immediate vicinity of the site. The other residences adjacent to the site which had private potable wells were connected to the public water supply system in 1985 as an alternative water supply. The last time the private well currently being used was sampled was in 1986. The analytical data is presented in Table 5. This well is located upgradient of the site and no contamination has been found in this residential well. However, there are contaminants present in the groundwater downgradient and beyond the property lines of the site at concentrations that exceed drinking water standards and/or criteria. Since this land downgradient of the site is privately owned, there is a possibility that some time in the future a private water supply well could be installed downgradient of the site in the contaminated aquifer. Therefore, potential future exposure pathways to contaminated groundwater exist. They consist of consumption, inhalation and dermal absorption.

Fishing in Fishing Creek can occur and since Fishing Creek is the primary receptor of groundwater flowing beneath the site, contaminants emanating from the site are entering the creek with the discharging groundwater. Therefore, the exposure resulting from the consumption of fish from Fishing Creek was evaluated.

Swimming in Fishing Creek is also a possible activity which could result in exposure to contaminants originating from the site. Therefore, the exposure to the surface waters in Fishing Creek was evaluated as a potential pathway of exposure.

Table 13 summarizes the potential release mechanisms to the four primary, environmental mediums of concern: air, surface water and sediment, groundwater, and soils. Table 14 summarizes the identified potential human exposure pathways associated with Carolawn site.

TABLE 13

POTENTIAL PATHWAYS FOR EXPOSURE AT THE CAROLAWN SITE

RELEASE MEDIUM	POTENTIAL RELEASE SOURCE	RELEASE MECHANISM	RELEASE TIME FRAME	RELEASE PROBABILITY/AMOUNT*
Air	Contaminated Surface Soil	Fugitive Dust	Chronic	Low Probability/minor
		Volatilization	Chronic	Low Probability/minor
Surface Water	Contaminated Surface Soil Groundwater	Surface Runoff Groundwater	Chronic	Low Probability/minor
Ground-water	Surface Soils	Site Leaching	Chronic	100% Probability/minor
Soil	Surface Soils & Wastes	Site Leaching	Chronic	100% Probability/minor
		Direct Contact	Episodic	Low Probability/minor

* - Minor, moderate and major refer to comparison of release at this site and do not attempt to quantify the release.

TABLE 14

SUMMARY OF POTENTIAL HUMAN EXPOSURE PATHWAYS

TRANSPORT MEDIUM	SOURCE	MECHANISM	POINT	HUMAN ROUTE	SIZE OF POPULATION EXPOSED*	PATHWAY COMPLETE
Air	Surface Soil	Volatilization and Dust	Nearby Residences (Off-site)	Inhalation	Small	No
			On-site	Inhalation	Small	No
Surface Water	Contaminated Surface Soil	Leaching	River	Dermal	Small	Yes
		Surface Runoff	River	Fish Ingestion	Small	Yes
		Ponds		Water Ingestion	None	No
Groundwater	Surface Soil & Ponds	Leaching	Wells	Ingestion	None	Yes
	Buried Wastes	Leaching	River (Surface Discharge)	(See Surface Water)		Yes
Soil	Surface Soil & Wastes	Direct Contact	On-site	Ingestion	Small	No
				Dermal	Small	No
				Inhalation	(See Air On-site)	
			Off-site	Ingestion Dermal Inhalation	(See Air Off-site)	

* Estimated size of population involved at specific point of exposure:

Small - Less than 200
Medium - 200 to 2,000
Large - 2,000 to 20,000
Major - Over 20,000

In summary, the media and exposure pathways which were examined are:

i) inhalation, consumption and dermal contact of contaminated groundwater;
ii) inhalation, consumption and dermal contact of contaminated surface water; and
iii) consumption of contaminated fish from Fishing Creek.

No endangered species were identified living on or near the site, and no sensitive environments are impacted by the site.

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimates excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(\text{milligrams/kilogram-day})^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in milligrams/kilogram-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainity factors have been applied.

Reference doses (R_fDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. R_fDs, which are expressed in units of milligrams/kilogram-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the R_fD. R_fDs are derived from human epidemiological studies or animal studies to which uncertainity factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainity factors help ensure that R_fDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6} or 1E-6). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's R_fD). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

3.7.1 Health Risk Associated with Groundwater

The health risk associated with exposure to contaminated groundwater off-site is summarized below.

1,1-Dichloroethene and trichloroethene exceed maximum concentration limits (MCLs) in the groundwater off-site. Table 15 presents concentrations and related estimated health risks in wells which represent the fence line groundwater conditions. Estimates of future maximum concentrations of groundwater concentrations immediately upgradient (toward the site) from Fishing Creek and the related health risks are presented in Table 16. Table 17 presents lead concentrations in groundwater. Estimates of mean groundwater lead concentrations were determined by averaging detected lead concentrations, and assigning the detection limit concentration of 5 micrograms/liter (ug/L) to samples with non-detect results. Mean of 19 ug/L and 9 ug/L were calculated for monitor wells MW-1 to MW-4 and residential wells RW-1 to RW-4, respectively. These mean concentrations are below the existing MCL of 50 ug/L but is above the proposed new MCL for lead which is 5 ug/L.

The lifetime cancer risk due to exposure to these carcinogenic compounds at present concentrations ranges from 1.64×10^{-3} to 8.40×10^{-5}. This risk range is above the range of risks (1×10^{-4} to 1×10^{-6}) considered by EPA to be protective of public health. Therefore, groundwater at these levels of contamination are considered unacceptable for human consumption.

3.7.2 Health Risk Associated with Surface Water - Off-site

The health risk associated with exposure to contaminated surface water off-site is summarized below.

The estimated lifetime cancer risk due to exposure of contaminant concentrations that are and will be present in Fishing Creek ranges from 7.3×10^{-11} to 4.8×10^{-12} for swimmers. This is below the acceptable range of 1×10^{-4} to 1×10^{-6}. Consequently, there is no increase in health risks to swimmers due to the exposure to the identified indicator chemicals for the Carolawn site in Fishing Creek.

Table 18 provides the assumptions made for estimating exposure risks for swimming in Fishing Creek and Table 19 summarizes the estimated health risk due to each chemical.

TABLE 15

ESTIMATED HEALTH RISK DUE TO SITE RELATED CHEMICALS BY CONSUMPTION OF GROUNDWATER FROM WELLS REPRESENTING BOUNDARY LINE CONCENTRATIONS CAROLAWN SITE - FORT LAWN, S.C.

Chemical	Well Concentration (1) (mg/L)				Added Cancer (2) Risk from Drinking				Exposure/ADI (3)			
	MW3	MW4	MW8	MW9	MW3	MW4	MW8	MW9	MW3	MW4	MW8	MW9
Acetone	3.23E+00	4.57E+00	5.7E-02	3.28E+00	--	--	--	--	9.21E-01	1.31E+00	1.63E-02	9.37E-01
1,1,1-TCA	1.17E-01	9.20E-02	5.0E-03	3.8E-02	--	--	--	--	6.19E-03	4.87E-03	2.65E-04	2.01E-03
1,2-DCE	1.10E-01	3.75E-01	5.0E-03	7.4E-02	--	--	--	--	5.82E-03	1.98E-02	2.65E-04	3.92E-03
1,1-DCA	9.80E-02	9.20E-02	5.0E-03	3.8E-02	--	--	--	--	2.33E-03	2.19E-03	1.19E-04	9.05E-04
1,1-DCE	1.24E-01	9.20E-02	5.0E-03	3.8E-02	2.05E-03	1.52E-03	8.29E-05	6.30E-04	--	--	--	--
TCE	4.30E-01	3.95E-01	5.0E-03	4.5E-02	1.35E-04	1.24E-04	1.57E-06	1.41E-05	--	--	--	--
				TOTALS	2.19E-03	1.64E-03	8.40E-05	6.44E-04	9.35E-01	1.34E+00	1.70E-02	9.44E-01

NOTES:
(1) Mean concentration based on Phase II (Round 1 and 2) sampling results (Table 6)
(2) Added Cancer Risk - Based on assumptions and formula presented in Table 1.
(3) Exposure/Acceptable Intake Chronic ratio - Ratio below one (1) indicates no health concerns. Exposure based on assumptions in Table 1.

1,1,1-TCA -- 1,1,1-Trichloroethane
1,1-DCE -- 1,1-Dichloroethene
TCE -- Trichloroethene
1,1-DCA -- 1,1-Dichloroethane
1,2-DCE -- 1,2-Dichloroethene

TABLE 16

PROJECTED POTENTIAL FUTURE HEALTH IMPACT FROM CONSUMPTION OF CONTAMINATED GROUNDWATER CAROLAWN SITE, FORT LAWN SOUTH CAROLINA

Compound	*Creek Concentration(1) (mg/L)*	*Chemical Exposure(2) (mg/kg/day)*	*CPF $(mg/kg/day)^{-1}$*	*ADI (mg/kg/day)*	*Risk*	*Exposure/ ADI*
Acetone	6.52	0.179		1.00×10^{-1}		1.79
1,1-Dichloroethane	5.0×10^{-3}	1.43×10^{-4}		1.20×10^{-1}		1.19×10^{-3}
1,1-Dichloroethene	9.0×10^{-2}	2.57×10^{-3}	5.80×10^{-1}		1.49×10^{-3}	
1,2-Dichloroethene	3.4×10^{-1}	9.71×10^{-3}		2.0×10^{-2} (3)		
1,1,1-Trichloroethane	3.6×10^{-2}	1.03×10^{-3}		5.40×10^{-1}		1.91×10^{-3}
Trichloroethene	7.9×10^{-1}	2.26×10^{-2}	1.10×10^{-2}		2.48×10^{-4}	

(1) As developed in Section 6 of the RI Report.
(2) Assumes consumption of 2.0 L groundwater per day by 70 kg adult.
(3) Based upon pMCL of 70 µg/L as given in 54 CFR 22062; May 22, 1989.

TABLE 17

PHASE I GROUNDWATER LEAD CONCENTRATIONS
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

Sampling Date	*MW-1*	*MW-2*	*MW-3*	*MW-4*	*RW-1*	*RW-2*	*RW-3*	*RW-4*
7/86	23	27	26	26	20	4	4	2.6
7/86		28						
12/86	4	10	4		4	14		

Monitoring Well Mean: 19 µg/L
(ND = DL = 5 µg/L)

Residential Well Mean: 9 µg/L
(ND = DL = 5 µg/L)

Notes:

(1) This table summarizes lead concentrations given in Table 5.
(2) Detection Limit = 5.0 µg/L

TABLE 18

ASSUMPTIONS FOR ESTIMATING EXPOSURE AND RISK FROM SWIMMING IN FISHING CREEK CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

ASSUMPTION	*OLDER CHILD 6 TO 18 YEARS*	*ADULT 19 TO 70 YEARS*
Years Exposed	12	35
Body Weight (kg)	21	70
Swim Episodes:		
• Times/Month	20	20
• Months/Year	5	5
Area of Body Exposed (cm^2)(2)	9,400	18,000
Absorption Rate (water)(3)	2 mg/cm^2/swim	2 mg/cm^2/swim
Percent Chemical Absorption(3)		
• Non-Carcinogens (%)	1	1
• Carcinogens (%)	50	50
Life Expectancy (years)	70	70

Calculation to determine exposure for a carcinogen:

$$CE = \frac{C \times WA^{(1)} \times A \times AF \times Time \times U.F.}{BW \times Days/Year \times Years}$$

where:

CE	=	Chemical Exposure (mg/kg/day)
C	=	Water Concentration (mg/L)
WA	=	Water Absorption rate (mg/cm^2/swim)
A	=	Area of the surface of the body (cm^2)
AF	=	Absorption Factor - % chemical absorbed with the water x 100
Time	=	Number of days exposed per year x number of years individual swims
U.F.	=	Unit Factor = $\frac{1L}{1000\ mL}$
BW	=	Body Weight (kg)
Days/Year	=	365 Days
Years	=	Length of Lifetime (70 years)

Calculations of exposure for a non-carcinogen assumes the individual swims 5 times per week.

TABLE 18

ASSUMPTIONS FOR ESTIMATING EXPOSURE AND RISK FROM SWIMMING IN FISHING CREEK CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

The additional risk of cancer was calculated using the following[2] formula:

R	=	CE x PF
Where:		
R	=	Lifetime additional risk of cancer from exposure CE
CE	=	Chemical Exposure (mg/kg/day)
PF	=	Cancer Potency Factor $(mg/kg/day)^{-1}$, Superfund Public Health Evaluation Manual, Appendix C, Exhibit C-4

NOTE:

(1) Water-borne chemicals are assumed to be dermally absorbed at a rate equal to that of water. This is supported in Chapter 6 of the Superfund Exposure Assessment Manual.

(2) Superfund Exposure Assessment Manual, April 1988, EPA/540/1-88/001.

(3) Hawley, J.K (1985) Risk Analysis. 5, No. 4, p. 295.

TABLE 19

ESTIMATED HEALTH RISK FROM SWIMMING IN FISHING CREEK CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

CHEMICAL	*RIVER FLOW(1) cfs*	*CONC. IN(2) CREEK-mg/L*	*ADDED(3) CANCER RISK*	*EXPOSURE/AIC(4)*
Acetone	7	1.40E-03	NC	6.27E-08
	45	2.00E-04	NC	8.95E-08
1,1-Dichloroethane	7	1.00E-06	NC	3.73E-11
	45	2.00E-07	NC	7.46E-12
1,1,-Dichloroethene	7	2.00E-05	4.09E-10	NA
	45	3.00E-06	6.13E-11	NA
1,2-Dichloroethene	7	8.00E-05	NC	6.63E-09
	45	1.00E-05	NC	8.29E-10
1,1,1-Trichloroethane	7	8.00E-06	NC	6.27E-07
	45	1.00E-06	NC	8.29E-11
Trichloroethene	7	1.80E-04	6.97E-11	NA
	45	3.00E-05	1.16E-11	NA
Totals	7		4.78E-10	6.34E-07
	45		7.29E-11	9.04E-08

(1) Creek flow on which groundwater dilution is based.

(2) Concentration estimate in creek based on groundwater flow and concentration estimates. See Section 6 of the RI Report.

(3) Added Cancer Risk - Based on assumptions and formula presented in Table 18.

(4) Exposure/Acceptable Intake Chronic ratio. Ratio below one (1) indicates no health concerns. Exposure based on assumptions in Table 18.

3.7.3 Health Risk Associated with the Consumption of Fish

Using the assumptions that an individual consumes between 14 to 42 grams of fish per day for his entire lifetime and that 10 percent of these fish consumed come from Fishing Creek, the estimated increased lifetime risk of cancer ranges from 1.7×10^{-8} to 2.7×10^{-9}. This range also falls below the acceptable range of 1×10^{-4} to $1x\ 10^{-6}$. Consequently, there is no quantifiable increase in the health risk due to the consumption of fish caught in Fishing Creek. Table 20 provides the assumptions used for estimating exposure risks for consuming fish from Fishing Creek and Table 21 summarizes the estimated health risk due to site related chemicals from the consumption of fish from Fishing Creek.

4.0 CLEANUP CRITERIA

The extent of contamination was defined in Section 3.0, Current Site Status. Section 4.0 examines the ARARs associated with the contaminants found on site and the environmental medium contaminated. As discussed earlier, the primary environmental medium of concern where concentrations of contaminants remain that could prove detrimental to the public health and the environment is in the groundwater. Table 22 provides a summary of the contaminants of concern in the groundwater, the specific clean-up goal for each contaminant, and the source for the specified ARAR.

Depending on the results from the confirmation soil sampling in the storage area north of the fenced area, both Tables 22 and 23 may be expanded to include soil cleanup goals. Table 23 provides the cleanup goals for the contaminants of concern at the Carolawn site.

4.1 GROUNDWATER REMEDIATION

In determining the degree of groundwater clean-up, Section 121(d) of the Superfund Amendment and Reauthorization Act of 1986 (SARA) requires that the selected remedial action establish a level or standard of control which complies with all ARARs, be cost-effective and achieve a clean-up level that is protective of human health and the environment. Finally, the remedy should utilize permanent treatment technologies to the maximum extent practicable.

For those contaminants found in the groundwater at the site, Table 23 presents the remediation levels the remedial alternative needs to achieve.

4.2 SOIL REMEDIATION

The findings presented in the RI (the Public Health Evaluation {Chapter 7.0} of the RI) indicates that the soils inside the fenced area do not pose a risk to the public health or the environment. Therefore, no remediation is proposed for this environmental medium.

TABLE 20

ASSUMPTIONS FOR FISH INGESTION SCENARIO
CAROLAWN SITE
FORT LAWN, SOUTH CAROLINA

Chemical	*Bioconcentration Factor (BCF) (1/kg)*	*Non-Carcinogen Acceptable Daily Intake (ADI) (mg/kg/day)*	*Carcinogen Unit Cancer Risk (UCR) $(mg/kg/day)^{-1}$*
Acetone	NA	1.00 E - 01	NA
1,1-Dichloroethene	5.6	9.00 E - 03	5.80×10^{-1}
1,2-Dichloroethene	NA	1.20 E - 01	NA
1,2-Dichloroethene	cis - 1.6 trans - 1.6	cis - 2.0E - 03* trans - 2.9E - 03*	NA NA
1,1,1-Trichloroethane	5.6	5.40 E - 01	NA
Trichloroethene	10.6	NA	1.10 E - 02
Lead	49	1.40 E - 03	NA

Quantity of fish consumed per day:	
Average intake (chronic)	14 grams
Maximum intake	42 grams
Lifetime	70 years
Average Body Weight	70 kg

* Based on EPA Proposed MCLs in 54 FR 22062; May 22, 1989 for 1,2-Dichloroethene, 2.0L water consumption per day, 70 kg total body mass.

TABLE 21

ESTIMATED HEALTH RISK
FROM EATING FISH FROM FISHING CREEK
CAROLAWN SITE - FORT LAWN, SOUTH CAROLINA

CHEMICALS	*FLOW(1) cfs*	*CONC. IN(2) CREEK mg/L*	*ADDED CANCER RISK (3)*		*EXPOSURE/AIC (4)*	
			LO INTAKE	*HI INTAKE*	*LO INTAKE*	*HI INTAKE*
Acetone	7	1.40E-03	NC	NC	2.80E-06	8.40E-06
	45	2.00E-04	NC	NC	4.00E-07	1.20E-06
1,1-Dichloroethane	7	1.00E-06	NC	NC	2.00E-10	6.00E-10
	45	2.00E-07	NC	NC	4.00E-07	1.20E-10
1,1-Dichloroethene	7	2.00E-05	1.30E-08	3.90E-08	NA	NA
	45	3.00E-06	1.95E-09	5.85E-09	NA	NA
1,2-Dichloroethene	7	8.00E-05	NC	NC	4.74E-08	1.42E-07
	45	1.00E-06	NC	NC	5.98E-09	1.78E-08
1,1,1-Trichloroethane	7	8.00E-06	NC	NC	1.66E-08	4.98E-08
	45	1.00E-06	NC	NC	2.07E-09	6.22E-09
Trichloroethene	7	1.80E-04	4.20E-09	1.26E-08	NA	NA
	45	3.00E-05	7.00E-10	2.10E-09	NA	NA
Totals	7		1.72E-08	5.16E-08	2.86E-06	8.59E-06
	45		2.65E-09	7.95E-09	4.08E-07	1.22E-06

(1) Creek flow on which groundwater dilution is based.

(2) Concentration estimate in creek based on groundwater flow and concentration estimates. See Section 6 of the RI Report.

(3) Added Cancer Risk. Based on assumptions presented in Table 1 that individual eats the designated quantity of fish (Lo-14 grams per day; Hi-42 grams per day) for 70 years lifetime.

(4) Exposure/Acceptable Intake Ratio. If ratio is less than one (1) there is no health concern. Intake is based on same level of fish consumption noted in Note (3) above.

TABLE 22

STANDARDS AND CRITERIA FOR WATER QUALITY
µg/L

	WQC[1]	*MCL*[2]	*pMCL*[5]	*Aquatic Life*[3]
Acetone	3,500*	NA	700[6]	610,000
1,1-Dichloroethane	4,200*	NA	NA	55,000
1,2-Dichloroethene	350[4]	NA	cis-70 trans-100	22,000
1,1-Dichloroethene	0.033	7	NA	58,000
1,1,1-Trichloroethane	19,000	200	NA	58,000
Trichloroethene	2.7	5	NA	4,070
Lead	50	50	5	3.8[7]

(1) WQC - Water Quality Criteria - FR Vol. 45, No. 231, Nov. 28, 1980. For Protection of Human Health from Drinking Water and Aquatic Food. Carcinogens - $1x10^{-5}$ added lifetime risk. *Developed by application of AIC Limit, Exhibit A-6 of the Superfund Public Health Evaluation Manual. Assume 70 kg man drinks 2 liters per day.

(2) MCL - Maximum Concentration Limits. The Manual Exhibit 4-5 and FR Vol. 52, No. 135, July 8, 1987.

NA = Not Available

(3) Criteria for Protection of Aquatic Life (Freshwater) FR Vol. 45, No. 231, Nov. 28, 1980. If not available in FR reference, calcualted at 1/10th the 96 hour LC_{50} as reported in Verschieren, Handbook of Environmental Data on Organic Chemicals, 2nd Edition, VanNorstrand Rheinhold Company, New York, 1983.

(4) EPA Drinking Water Health Advisories - Lifetime. Exhibit 4-8. The Manual.

(5) EPA Proposed National Primary and Secondary Drinking Water Regulations. 54 FR 22062; May 22, 1989.

(6) Based on RfD of 0.1 mg/kg/day, and assumption of 2 L water consumption per day, with relative source contribution of 20% acetone in water.

(7) Criterion at 100 µg/L hardness as $CaCO_3$.

TABLE 23

CLEANUP GOALS FOR THE CONTAMINANTS FOUND
AT THE CAROLAWN SUPERFUND SITE
LEVELS ARE IN MICROGRAMS/LITER (ug/L)

CHEMICAL	CLEANUP GOAL	BASIS FOR CLEANUP GOAL
Acetone	700	+
1,1-Dichloroethane	*	*
1,1-Dichloroethene	7	MCL
1,2-Dichloroethene	70 - cis 100 - trans	Proposed MCL Proposed MCL
1,1,1-Trichloroethane	200	MCL
Trichloroethene	5	MCL
Lead	5	Proposed MCL

+ - The value of 700 ppb for acetone is a lifetime health advisory (LHA).

* - No firm cleanup criteria has been established but it is assumed that due to 1,1-Dichloroethane similar chemical/physical characteristics with the other contaminants present, the levels will decrease proportionally along with the other contaminants.

As discussed above, the soils in the area north of the fenced area, depending on the confirmatory samples, may require remediation.

4.3 SURFACE WATER/SEDIMENT REMEDIATION

Only methylene chloride, which is believed to be a laboratory induced contaminant based on QA/QC data, and acetone were detected in the surface water samples. Acetone was found sporadically in the samples collected. No other TCL compounds were detected in the water column.

The sediment samples collected from the drainage courses near the site and Fishing Creek did not contain any TCL organic compounds attributable to the site. The total metals concentrations are within typical natural levels for soils with similar geographical conditions as found as the Carolawn site.

Both these facts indicates that the overland flow and surface water runoff from the site has not resulted in the accumulation of contamination in the drainage courses. Even under $7Q_{10}$ flow conditions, the rate and level of discharge of contaminants with the groundwater into Fishing Creek will not surpass the Ambient Water Quality Criteria (AWQC) for the contaminants of concern. The AWQC are listed in Table 22.

5.0 ALTERNATIVES EVALUATED

The purpose of the remedial action at the Carolawn Site is to minimize, if not mitigate contamination in the groundwater and to reduce, if not eliminate, potential risks to human health and the environment. The following clean-up objectives were determined based on regulatory requirements and levels of contamination found at the Site:

* Prevent the near-term and future exposure of human receptors to contaminated groundwater both on and off site;

* Restore the contaminated aquifer for future use by reducing contaminant levels to those which will adequately protect human health and the environment;

* Control contaminant migration so contaminant releases from groundwater to Fishing Creek do not exceed clean up criteria to human health and the environment;

* Monitor groundwater in a manner to verify effectiveness of remedial measures; and

* Confirm absence/presence of soil contamination in storage area north of the fenced area.

Table 24 provides a list of possible remedial technologies applicable at the Carolawn Site knowing the environmental media affected, the type of

TABLE 24

GROUNDWATER REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Applicable Response Action	*Remedial Technology*	*Process Options*
Alternate Water Supply	• Connection of future users to municipal water supply	• Connect to existing supply line • Connect to a new supply line to be constructed
Groundwater Extraction	• Extraction of contaminated groundwater from bedrock aquifer	• Pumped extraction wells • Pipe and media drain
Containment	• Hydraulic containment by extraction	• Pumped extraction wells • Pipe and media drain
	• Physical Containment	• Grout curtain
Groundwater Treatment	• Biological	• Activated sludge • Aerobic/facultative lagoons • Fixed film systems
	• Activated Carbon	• Granular Activated Carbon (GAC) • Powdered Activated Carbon (PAC)
	• Air Stripping	• Packed tower stripper • Aeration basin

TABLE 2 4
(continued)

GROUNDWATER REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Applicable Response Action	*Remedial Technology*	*Process Options*
Groundwater Treatment (cont'd.)	• Oxidation • Ion Exchange • Reverse Osmosis • Evaporation	• Solar evaporation • Spray evaporation
	• Disposal to POTW for treatment • Disposal at a RCRA facility for treatment	• Forcemain • Bulk transportation by tanker truck
Groundwater Disposal	• Reinjection • Discharge to POTW • Discharge to surface waters • Disposal at a RCRA facility	• Injection wells

contaminants present and the concentration of each contaminant in each environmental medium. The initial screening evaluates the technologies on the following technical parameters:

* implementability,

* reliability and effectiveness, and

* previous experience.

Table 25 provides a summary of the initial screening of the remedial technologies and the rationale as to why certain technologies were eliminated from future consideration.

These technologies address groundwater and best meet the criteria of Section 300.65 of the National Contingency Plan (NCP).

Following the initial screening of the individual technologies, these technologies were combined to form a number of remedial action alternatives. These remedial action alternatives are than screened and analyzed in relation to the nine point criteria. Table 26 lists the five remedial alternatives and remedial technologies (components) involved in each alternative.

5.0.1 Alternative 1 - No Action

The "No Action" alternative assumes that no remediation of the contaminated groundwater, other than by natural attenuation would occur. The NCP requires the development of a No Action alternative as a basis for the comparison of alternatives. This alternative would include maintenance of the existing alternative water supply to the four affected residences and long-term monitoring.

Since no remedial action is taken, there would be no additional risks posed to the community. However, it is estimated that the groundwater between the site and Fishing Creek would remain contaminated above MCLs for greater than 50 years. This alternative provides no reduction in the toxicity, mobility, or volume of contaminants through treatment, therefore, the potential future risk of exposure to off-site contaminated groundwater remains.

5.0.2 Alternative 2 - Alternative Water Supply and Institutional Controls

Alternative 2 will result in the construction of a new water supply line to replace the existing line serving the residents adjacent to the site. As part of this alternative, institutional controls (deed restrictions) will be placed on all adjacent properties.

TABLE 2 5

SCREENING OF GROUNDWATER REMEDIAL TECHNOLOGIES
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Remedial Technology	*Applicable As a Remedial Alternative Component*	*Comments*
1. Alternative Water Supply		
• Connect to Existing Supply Line	No	Existing community already connected. Existing line does not have sufficient capacity for future connections.
• Connect to a New Supply Line to be Constructed	Yes	Provides sufficient capacity for future connections.
2. Groundwater Extraction		
• Extraction Wells	Yes	Collects groundwater and prevents future migration. Will reduce levels of contamination over time. May be ineffective in low permeability soils or competent rock.
• Pipe and Media Drain	No	Difficult and costly to construct.
3. Containment		
• Hydraulic containment by extraction	Yes	Effectively same remedial technology as groundwater extraction.
• Physical Containment by Grout Curtain	No	Difficult to implement where competence of bedrock is variable. Costly to construct. Effectiveness is typically poor for bedrock with variable competence
4. Groundwater Treatment		
• Biological		
i) Activated Sludge	No	Difficult to sustain process with low levels of hydrocarbon feed from groundwater environment.

TABLE 2 5
(continued)

SCREENING OF GROUNDWATER REMEDIAL TECHNOLOGIES
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Remedial Technology	*Applicable As a Remedial Alternative Component*	*Comments*
4. Groundwater Treatment (cont'd.)		
• Biological		
ii) Aerobic/facultative lagoons	Yes	Microbial community varied and more capable of being self-sustaining with low levels of hydrocarbon feed from groundwater.
iii) Fixed film systems	No	Same limitations as for activated sludge.
• Activated Carbon (GAC or PAC)	Yes	Effective in treating large array of organic contaminants. Can be used as primary treatment or as polisher in combination with other treatment technologies.
• Air Stripping		
i) Packed Tower Stripper	Yes	Effective in removing volatile compounds. May require pretreatment or additional polishing by other technology. Most effective for high concentration of volatiles.
ii) Aeration Basin	Yes	Effective in removing volatile compounds. Does not require pretreatment. May require additional polishing by other technology. Effective for low concentrations of volatiles.
• Oxidation	No	Not effective in treating contaminants found during waste characterization at this Site.
• Ion Exchange	No	Used to treat inorganic wastes (i.e. metals), therefore, not applicable at this Site.
• Reverse Osmosis	No	Used to treat inorganic waste (i.e. metals), and high molecular weight organics therefore, not generally applicable at this Site. Also, highly subject to fouling by precipitates and biological growth.

TABLE 2 5
(continued)

SCREENING OF GROUNDWATER REMEDIAL TECHNOLOGIES
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Remedial Technology	*Applicable As a Remedial Alternative Component*	*Comments*
4. Groundwater Treatment (cont'd.)		
• Evaporization		
i) Solar Evaporization	No	May be effective in treating volatile compounds especially during summer months. Effectiveness is difficult to evaluate
ii) Spray Evaporization	No	May be effective in treating volatile compounds, especially during summer months. Presence of other non-volatile compounds may restrict use of this technology. Effectiveness is difficult to evaluate.
• Discharge to POTW for Treatment	Yes	Would be restricted by operating permit of POTW.
• Disposal at a RCRA Facility for Treatment	No	Difficult to implement and maintain in long term. Cost prohibitive.
5. Groundwater Disposal		
• Reinjection	No	Injection of contaminants to a Class GB aquifer is prohibited
• Disposal at a RCRA Facility	No	Difficult to implement and maintain in long term. Cost prohibitive. Not cost-effective if groundwater treated on-Site.
• Discharge to Surface Water	Yes	Cost effective. Groundwater must meet surface water criteria prior to discharge.
• Discharge to POTW	Yes	Would be restricted by operating permit of POTW. May not be required if groundwater treated on-Site.

TABLE 2 6

ASSEMBLED REMEDIAL ALTERNATIVES FOR DETAILED ANALYSIS
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Alternative No.	*Alternative Description*	*Remedial Components*
1.	No Action	• Institutional deed restriction • Long term monitoring
2.	Alternate water supply	• Institutional deed restriction • Long term monitoring • Construction of new water supply line to service adjacent areas for future development
3.	Groundwater Extraction with Discharge to POTW	• Institutional deed restriction • Long term monitoring • Installation of Groundwater Extraction System • Construction of Discharge Line to POTW Collection System • Extraction with Direct Discharge to POTW System
4.	Groundwater Extraction with Treatment (Aeration) and Discharge to Fishing Creek	• Institutional deed restriction • Long term monitoring • Installation of Groundwater Extraction System • Installation of Aeration Treatment System • Extraction with treated discharge to Fishing Creek
5.	Groundwater Extraction with Biological Treatment and Discharge to Fishing Creek	• Institutional deed restriction • Long term monitoring • Installation of Groundwater Extraction System • Construction of Aerobic/Facultative Lagoons • Extraction with treated discharge to Fishing Creek

Since this alternative does not require remedial activities for the groundwater, there are no short term impacts associated with this alternative. As with Alternative 1, this remedial alternative does not directly address the contaminated groundwater below the site. Consequently, the residual risk will remain unchanged as there is no reduction in toxicity, mobility or volume.

The institutional controls may be effective for new residential developments due to the public tendency to avoid the use of identified contaminated water. This, however, may not be the case where a residence is constructed away form the supply line and the cost to the property owner of connecting to and using the supplied water is greater than the cost of installing a private well.

This alternative is capable of protecting human health in the short-term due to the measures which allow the community to avoid the use of the contaminated groundwater. However, since this alternative does not directly mitigate the groundwater transport pathway and/or contaminant levels, the long term protection of human health will be limited by the ability to enforce the institutional controls. The construction activities for this alternative is not expected to pose any additional risk to the community.

5.0.3 Alternative 3 - Groundwater Extraction and Discharge to the POTW

Alternative 3 will consist of the installation of a groundwater extraction system for hydraulic containment and active restoration of the groundwater, and the construction of a forcemain to the local POTW collection system. Specific remedial activities will include:

i) the construction of rough grade access roads to the extraction well locations;

ii) the installation of groundwater extraction wells;

iii) the conducting of pumping tests on each extraction well;

iv) the construction of a pump station at each extraction well;

v) the construction of forcemains to convey the extracted groundwater to the POTW; and

vi) long-term monitoring.

Due to the nature of the aquifer beneath the site (fractured bedrock), the use of extraction wells is the only feasible method to achieve hydraulic containment.

This alternative will result in the removal and treatment of contaminated groundwater from beneath and downgradient of the site. Therefore, the alternative is effective in reducing the potential future residual risk associated with exposure to contaminated groundwater. It is estimated that approximately 10 years of pumping are required to achieve the cleanup goals on site and off site.

This alternative will result in the reduction of toxicity, mobility and volume of contaminants. Since the extracted groundwater will be discharged to the sanitary sewer, treatment will occur to some degree within the wastewater treatment plant. The mobility of the contaminants within the groundwater to Fishing Creed is effectively eliminated by hydraulic capture and the volume of contaminants in the groundwater is reduced over the life of the remedy.

This alternative is protective of human health and the environment through the collection of the contaminated groundwater and treatment of the groundwater in the local POTW. This alternative also prevents the continued migration of groundwater to Fishing Creek.

5.0.4 Alternative 4 - Groundwater Extraction with Aeration Treatment and Discharge to Fishing Creek

Alternative 4 consists of groundwater extraction with treatment of the extracted groundwater followed by discharge to Fishing Creek. This alternative utilizes the same extraction system components previously described for Alternative 3. However, instead of discharging directly to the POTW system, the extracted groundwater is treated on-site using an aeration system, then discharged to the adjacent surface water via a NPDES permit.

As discussed for Alternative 3, the extraction system will significantly reduce the environmental mobility and volume of contaminants in the groundwater. The treatment technology used in this alternative does not directly result in the reduction of toxicity, mobility, or volume of contaminants through treatment. Instead, the contaminants are removed from the liquid medium and transferred to the gaseous medium. Some degree of treatment is achieved subseq ently through natural processes such as photo-oxidation and environmental biodegradation.

This alternative is considered to be protective of human health and the environment. The alternative addresses both the pathway of concern and the contaminants of concern.

5.0.5 Alternative 5 - Groundwater Extraction with Biological Treatment and Discharge to Fishing Creek

Alternative 5 consists of groundwater extraction with treatment of the extracted groundwater followed by discharge to Fishing Creek. This alternative is identical to Alternative 4, with the exception of the treatment technology which is utilized. Treatment of the extracted groundwater consists of biological treatment using an aerobic/facultative lagoon.

As discussed for Alternative 3, the extration system will significantly reduce the environmental mobility and volume of contaminants in the groundwater. the treatment technology used in this alternative will result in the direct reduction of toxicity, mobility, or volume of contaminants through biological treatment. Some additional degree of treatment is also achieved in the lagoon through natural processes such as photo-oxidation and evaporation.

This alternative is considered to be protective of human health and the environment. The alternative addresses both the pathway of concern and the contaminants of concern.

5.1 NINE POINT EVALUATION CRITERIA FOR EVALUATING REMEDIAL ACTION ALTERATIVES

The five remedial alternatives were individually evaluated to determine which alternative provides the "best balance" of tradeoffs with respect to the following evaluation criteria:

Threshold Criteria	i) Overall protection of human health and the environment; and ii) Compliance with applicable or relevant and appropriate requirements.
Primary Balancing Criteria	iii) Long-term effectiveness and permanence; iv) Reduction of toxicity, mobility, or volume; v) Short term effectiveness; vi) Implementability; and vii) Costs.
Modifying Criteria	viii) State/support agency acceptance; and ix) Community acceptance.

Based on the individual evaluations, the remedial alternatives were subsequently compared for their relative performance against the evaluation criteria. The two Modifying Criteria which could not be evaluated in the Feasibility Study are included below.

Based on the statutory language and current U.S. EPA guidance, the nine criteria used to evaluate the remedial alternatives listed above were:

1. Overall Protection of Human Health and the Environment addresses whether or not the remedy provides adequate protection and describes how risks are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs addresses whether or not the remedy will meet all of the applicable or relevant and appropriate requirements of other environmental statues and/or provide grounds for invoking a wavier.

3. Long-Term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

4. Reduction of toxicity, mobility, or volume is the anticipated performance of the treatment technologies a remedy may employ.

5. Short-term effectiveness involves the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation periods until cleanup goals are achieved.

6. Implementability is the technical and administrative feasibility of a remedy including the availability of goods and services needed to implement the chosen solution.

7. Cost includes capital and operation and maintenance costs.

8. Support Agency Acceptance indicates whether, based on its review of the RI/FS and Proposed Plan, the support agency (IDEM) concurs, opposes, or has no comment on the preferred alternative.

9. Community Acceptance indicates the public support of a given remedy. This criteria is discussed in the Responsiveness Summary.

Table 27 summarizes the factors that are considered under each of the nine evaluation criteria.

TABLE 27

DETAILED ANALYSIS CRITERIA AND FACTORS

EVALUATION CRITERIA	EVALUATION FACTORS
Threshold Criteria	
Overall protection of human health and the environment	* Elimination, reduction, or control of risks
Compliance with applicable or relevant and appropriate requirements	* Compliance with contaminant-specific ARARs * Compliance with action-specific * Compliance with location-specific
Primary Balancing Criteria	
Long-term effectiveness and permanence;	* Magnitude of residual risk * Adequacy of controls * Reliability of controls
Reduction of toxicity, mobility, or volume;	* Treatment process used and materials treated * Amount of hazardous materials destroyed or treated * Type and quantity of residuals remaining after treatment * Degree of expected reductions in toxicity, mobility, and volume * Degree to which treatment is irreversible
Short-term effectiveness	* Protection of community during remedial action * Protection of workers during remedial action * Time until objectives and protection are achieved * environmental impacts
Implementability	* Technical feasibility * Administrative feasibility * Availability of services and materials
Costs	* Total capital costs * Operating and maintenance costs * Total present worth cost at 5 percent

TABLE 27
(continued)

DETAILED ANALYSIS CRITERIA AND FACTORS

EVALUATION CRITERIA	EVALUATION FACTORS
Modifying Criteria	
State/support agency	* Level of community acceptance * Specific comments of State * Impact of the selected remedy on the State and the community
Community acceptance	* Level of community acceptance * Specific comments from the Community * Impact of the selected remedy on the community

5.1.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

All of the alternatives, with the exception of the no action alternative, would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk from the environment through treatment, engineering controls or institutional controls. As the no action alternative (Alternative 1) does not satisfy the remedial action goal to provide adequate protection of human health and the environment, it is not eligible for selection. Although Alternative 2 would be protective of human health, the degree of protection is dependent on the ability to enforce the identified institutional controls. Alternative 2 is eliminated from further consideration for the following two factors: this alternative does not address the remediation of groundwater, resulting in the continuing residual risk of contamination of the groundwater remaining unchanged and secondly, the limited ability of EPA, the State or the local government to strictly enforce the institutional controls at the site.

Alternatives 3, 4, and 5 address the residual risk associated with groundwater in terms of mitigating both the transport pathway and contaminant levels. Consequently, they are deemed to provide the best overall protection to human health and the environment. Due to the potential for minimal air emissions from Alternative 4, this alternative is deemed to be marginally less protective than the other two treatment alternatives during the period of implementation.

The overall level of protection reduces accordingly with Alternative 2 and Alternative 1 due to concerns over the adequacy of the institutional controls and the failure to address the groundwater transport pathway and contaminant levels.

5.1.2 COMPLIANCE WITH ARARS

The ARARs which were determined to be applicable to the remedial alternatives included MCLs for the groundwater, surface water criteria for discharges to Fishing Creek and pretreatment requirements for the POTW.

Alternatives 1 and 2 will not achieve MCLs for at least 50 years whereas Alternatives 3, 4 and 5 are expected to achieve MCLs within ten years.

Alternatives 4 and 5 will achieve approximately the same level of compliance with the surface water ARARs. Minor exceedances of the health-based criteria will occur under the $7Q_{10}$ flow condition, however, these are deemed to be not significant.

Compliance with the POTW pretreatment requirements for Alternative was not assessed and is not expected to be major hurdle.

5.1.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternatives 3, 4 and 5 will result in long-term effective remedies which will reduce the magnitude of the residual risk associated with the contaminated groundwater. Since these three alternatives utilize the same groundwater extraction component, they are deemed to be equivalent in terms of long-term effectiveness and permanence.

Alternatives 1 and 2 do not directly address the contaminated groundwater; consequently they are deemed to less effective in the long-term than the other alternatives.

5.1.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

The greatest degree of reduction of toxicity, mobility, or volume of contaminants is achieved by Alternatives 3 and 5, followed by Alternative 4. All three of these alternatives will reduce the mobility and volume of contaminants within the groundwater flow system to the same extent. However, Alternatives 3 and 5 utilize biological treatment to reduce the toxicity of extracted contaminants whereas Alternative 4 indirectly achieves a reduction in toxicity. Alternative 4 which employs air stripping, results in the transfer of contaminants from the groundwater to the atmosphere. Consequently, Alternative 4 is deemed to be less effective for this evaluation factor.

Alternatives 1 and 2 do not require extraction and treatment of contaminated groundwater; therefore these alternatives do not address this evaluation factor.

5.1.5 SHORT-TERM EFFECTIVENESS

The degree of short-term effectiveness achieved by the alternatives which involve remedial action on the groundwater is essentially the same for Alternatives 3, 4 and 5 due to the identical groundwater remedial component for each alternative. Of these three alternatives, Alternatives 4 and 5 will have greater potential for environmental impacts, however, the estimated in stream concentrations for these two alternatives indicate that this impact is negligible. Alternative 4 will result in increased air emissions compared to Alternative 5, however, the impact is not deemed to be significant.

Alternatives 1 and 2 do not directly address the contaminated groundwater; consequently, they are deemed to be less effective in the short-term than the other three alternatives.

5.1.6 IMPLEMENTABILITY

There are no major foreseeable implementability concerns for any of the remedial alternatives. The technologies used for these alternatives rely on standardized construction methods and demonstrated technologies. For the treatment alternatives, the administrative concerns include the ease of obtaining NPDES permits for Alternatives 4 and 5, and the capabilities and capacity of the POTW for Alternative 3. Based on the type and concentrations of contaminants of concern, these concerns are not deemed to be sufficiently significant to eliminate any of the treatment alternatives from further consideration.

5.1.7 COST

The costs associated with implementation of the remedial alternatives are lowest for the "no action" alternative and increase successively for Alternatives 2, 4, 5, and 3. Since Alternative 1 does not involve capital construction, the total present worth for this alternative is attributable to leng-term monitoring and maintenance costs only. The total costs for the other alternatives consists of capital and operation and maintenance costs.

For those alternatives involving capital construction, the capital cost estimates range from $243,750 for Alternative 2 to $802,670 for Alternative 3. The long-term operation and maintenance costs range from $331,914 for Alternatives 1 and 2 to $645,833 for Alternative 5. For those alternatives which consist of both capital and operation and maintenance costs, the operation and maintenance cost components are significant, being of the same order of magnitude as the capital costs.

The total present worth of the alternatives vary from a low of $331,914 to a high of $1,365,305. In increasing order of total costs, the alternatives are Alternative 1, Alternative 2, Alternative 4, Alternative 5, and Alternative 3. The total costs for the treatment alternatives are all within the same magnitude whereas the total costs for the other two alternatives are only a fraction thereof.

Table 28 provides a comparison of costs for each alternative evaluated over a 10 year period and a 30 year period.

5.1.8 STATE ACCEPTANCE

The State of South of Carolina concurs with the selected remedial alternative.

TABLE 2 8

COST SENSITIVITY ANALYSIS
10 YR VS. 30 YR DURATION

CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Alternative	*10 Year Period*			*30 Year Period*			*Percent Increase in Total Cost*
	Capital Cost	*O & M Cost*	*Total Cost*	*Capital Cost*	*O & M Cost*	*Total Cost*	
1) No Action	$0	$331,914	$331,914	$0	$331,914	$331,914	0%
2) Alternative Water Supply	$243,750	$331,914	$575,664	$243,750	$331,914	$575,664	0%
3) Direct Discharge to POTW	$802,670	$553,635	$1,356,305	$802,669	$753,433	$1,556,102	15%
4) Aeration Treatment and Discharge to Fishing Creek	$504,807	$636,264	$1,141,071	$504,806	$898,828	$1,403,634	23%
5) Facultative Lagoon Treatment and Discharge to Fishing Creek	$525,931	$645,833	$1,171,764	$525,931	$916,723	$1,442,654	23%

5.1.9 COMMUNITY ACCEPTANCE

The draft RI and FS documents along with the Proposed Plan for the Carolawn site were released to the public in August 1989. These three documents were made available to the public in the administrative record file and an information repository maintained at the EPA Docket Room in Region IV and at the Lancaster County Public Library. The notice of the public meeting and the availability for these two documents and the Administrative Record was published in the Lancaster News on August 25, 1989 and the Chester News and Reporter on August 28, 1989. A public comment period was held from August 28, 1989 through September 22, 1989. In addition, a public meeting was held at Lancaster County Public Library meeting room on August 30, 1989. At this meeting, representatives from EPA and the South Carolina Department of Health and Environmental Control answered questions about problems at the site and the remedial alternatives under consideration. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this ROD. The Responsiveness Summary also assesses the community acceptance of the Agency's proposal. This decision document presents the selected remedial action for the Carolawn site, in Fort Lawn, South Carolina, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Contingency Plan. This decision, for this site, is based on the Carolawn administrative record file.

6.0 RECOMMENDED ALTERNATIVE

Table 29 furnishes a summary of the detailed analysis on the remedial alternatives considered for the Carolawn Superfund site.

6.1 DESCRIPTION OF RECOMMENDED REMEDY

MIGRATION CONTROL (Remediation of Contaminated Groundwater)

Installation of a groundwater interception and extraction system at the site. The level and degree of treatment of the extracted groundwater will depend on 1) the ultimate discharge point of this water and 2) the level of contaminants in the extracted groundwater. Three water discharge alternatives for the treated groundwater are 1) the local sewer system, (i.e., Publicly Owned Treatment Works), 2) Fishing Creek via a National Pollution Discharge Elimination System permit or, 3) on-site irrigation. A fourth discharge possibility is groundwater injection. The range of treatment for the extracted groundwater includes air stripping, biodegradation, filtration through activated carbon filter and metal removal. The most cost effective combination for the point of discharge and the degree of treatment will be determined in the Remedial Design stage. The discharged water will meet all ARAR's. Concurrence on the final design will be requested from the State of South Carolina. Comments will also be solicited from the public on the final design.

TABLE 29

SUMMARY OF DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Evaluation Criteria	*Alternative 1 No Action*	*Alternative 2 Alternate Water Supply*	*Alternative 3 Groundwater Extraction with Discharge to POTW*	*Alternative 4 Groundwater Extraction with Aeration and Discharge to Fishing Creek*	*Alternative 5 Groundwater Extraction with Biological Treatment and Discharge to Fishing Creek*
Short-Term Effectiveness	• NA [1]	• Short-term impacts typical of any construction activities and are not of concern	• Short-term impacts to workers consist of contact with contaminated groundwater • No additional risk to community • Short-term impacts readily controlled	• Short-term impacts to workers consist of contact with contaminated groundwater • Air emissions deemed to be insignificant • Environmental impact from treated discharge to surface water deemed negligible • Short-term impacts readily controlled	• Short-term impacts to workers consist of contact with contaminated groundwater • Air emissions not anticipated • Environmental impact from treated discharge to surface water deemed negligible • Short-term impacts readily controlled

TABLE 29
(continued)

SUMMARY OF DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Evaluation Criteria	*Alternative 1* *No Action*	*Alternative 2* *Alternate Water Supply*	*Alternative 3* *Groundwater Extraction with Discharge to POTW*	*Alternative 4* *Groundwater Extraction with Aeration and Discharge to Fishing Creek*	*Alternative 5* *Groundwater Extraction with Biological Treatment and Discharge to Fishing Creek*
Long-Term Effectiveness and Permanence	• Residual risk associated with contaminated groundwater unchanged	• Residual risk associated with contaminated groundwater unchanged	• Residual risk associated with contaminated groundwater reduced	• Residual risk associated with contaminated groundwater reduced	• Residual risk associated with contaminated groundwater reduced
	• Groundwater contaminant concentrations will exceed MCLs for 50 years	• Groundwater contaminant concentrations will exceed MCLs for 50 years	• Groundwater contaminant concentrations will exceed MCLs for 10 years	• Groundwater contaminant concentrations will exceed MCLs for 10 years	• Groundwater contaminant concentrations will exceed MCLs for 10 years
	• Long-term effectiveness relies on institutional controls which may not be effectively enforced in the long-term	• Long-term effectiveness relies partially on institutional controls which may not be effectively enforced in the long-term	• Long-term effectiveness relies partially on institutional controls during implementation period	• Long-term effectiveness relies partially on institutional controls during implementation period	• Long-term effectiveness relies partially on institutional controls during implementation period
	• Alternative not effective in long-term	• Effectiveness will depend on available capacity of new line and connection/user costs which will determine user acceptance	• Post-implementation effectiveness and permanence will be ensured through long-term monitoring program	• Post-implementation effectiveness and permanence will be ensured through long-term monitoring program	• Post-implementation effectiveness and permanence will be ensured through long-term monitoring program

TABLE 2 9
(continued)

SUMMARY OF DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Evaluation Criteria	*Alternative 1* *No Action*	*Alternative 2* *Alternate Water Supply*	*Alternative 3* *Groundwater Extraction with Discharge to POTW*	*Alternative 4* *Groundwater Extraction with Aeration and Discharge to Fishing Creek*	*Alternative 5* *Groundwater Extraction with Biological Treatment and Discharge to Fishing Creek*
		• Effectiveness will depend partially on maintenance of supply system in the long-term. • Alternative may be effective in long-term	• Alternative will be effective in long-term	• Alternative will be effective in long-term	• Alternative will be effective in long-term
Reduction of Toxicity Mobility, or Volume	• No reduction achieved	• No reduction achieved	• Direct reduction in groundwater contaminant mass and mobility due to extraction • Direct reduction in toxicity of extracted groundwater through treatment in POTW	• Direct reduction in groundwater contaminant mass and mobility due to extraction • Indirect reduction in toxicity of extracted groundwater through natural processes such as photo-oxidation and environmental biodegradation	• Direct reduction in groundwater contaminant mass and mobility due to extraction • Direct reduction in toxicity of extracted groundwater through treatment in aerobic/facultative lagoons

TABLE 2-8

COST SENSITIVITY ANALYSIS
10 YR VS. 30 YR DURATION

CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Alternative	*10 Year Period*			*30 Year Period*			*Percent Increase in Total Cost*
	Capital Cost	*O & M Cost*	*Total Cost*	*Capital Cost*	*O & M Cost*	*Total Cost*	
1) No Action	$0	$331,914	$331,914	$0	$331,914	$331,914	0%
2) Alternative Water Supply	$243,750	$331,914	$575,664	$243,750	$331,914	$575,664	0%
3) Direct Discharge to POTW	$802,670	$553,635	$1,356,305	$802,669	$753,433	$1,556,102	15%
4) Aeration Treatment and Discharge to Fishing Creek	$504,807	$636,264	$1,141,071	$504,806	$898,828	$1,403,634	23%
5) Facultative Lagoon Treatment and Discharge to Fishing Creek	$525,931	$645,833	$1,171,764	$525,931	$916,723	$1,442,654	23%

TABLE 29
(continued)

SUMMARY OF DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Evaluation Criteria	*Alternative 1* *No Action*	*Alternative 2* *Alternate Water Supply*	*Alternative 3* *Groundwater Extraction with Discharge to POTW*	*Alternative 4* *Groundwater Extraction with Aeration and Discharge to Fishing Creek*	*Alternative 5*
Overall Protection of Human Health and the Environment	• Protective of of human health and the environment, however, protection of human health in the long-term cannot be ensured through enforcement of institutional controls	• Protective of of human health and the environment, however, protection of human health in the long-term cannot be ensured through enforcement of institutional controls	• Protective of of human health and the environment in the long-term	• Protective of of human health and the environment in the long-term	• Protective of of human health and the environment in the long-term
	• Does not address transport pathway or contaminants of concern	• Protection relies on use avoidance	• Protective of of human health and the environment in the short-term, however, protection of human health will rely on short-term enforcement of institutional controls	• Protective of of human health and the environment in the short-term, however, protection of human health will rely on short-term enforcement of institutional controls	• Protective of of human health and the environment in the short-term, however, protection of human health will rely on short-term enforcement of institutional controls
		• Does not address transport pathway or contaminants of concern	• Addresses transport pathway and contaminants of concern	• Addresses transport pathway and contaminants of concern	• Addresses transport pathway and contaminants of concern

Note:
[1] N/A - Not Applicable

TABLE 29
(continued)

SUMMARY OF DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Evaluation Criteria	*Alternative 1* *No Action*	*Alternative 2* *Alternate Water Supply*	*Alternative 3* *Groundwater Extraction with Discharge to POTW*	*Alternative 4* *Groundwater Extraction with Aeration and Discharge to Fishing Creek*	*Alternative 5*
Overall Protection of Human Health and the Environment	• Protective of of human health and the environment, however, protection of human health in the long-term cannot be ensured through enforcement of institutional controls	• Protective of of human health and the environment, however, protection of human health in the long-term cannot be ensured through enforcement of institutional controls	• Protective of of human health and the environment in the long-term	• Protective of of human health and the environment in the long-term	• Protective of of human health and the environment in the long-term
	• Does not address transport pathway or contaminants of concern	• Protection relies on use avoidance	• Protective of of human health and the environment in the short-term, however, protection of human health will rely on short-term enforcement of institutional controls	• Protective of of human health and the environment in the short-term, however, protection of human health will rely on short-term enforcement of institutional controls	• Protective of of human health and the environment in the short-term, however, protection of human health will rely on short-term enforcement of institutional controls
		• Does not address transport pathway or contaminants of concern	• Addresses transport pathway and contaminants of concern	• Addresses transport pathway and contaminants of concern	• Addresses transport pathway and contaminants of concern

Note:
[1] N/A - Not Applicable

Review the existing groundwater monitoring system to insure proper monitoring of groundwater. If deemed necessary, additional monitor wells will be installed to mitigate any deficiencies in the existing groundwater monitoring system.

Appropriate institutional controls (deed restrictions) will be implemented.

Upon the condemnation of the adjacent contaminated private, potable wells by the County of Chester, these wells will be plugged in accordance to South Carolina Department of Health and Environmental Control regulations.

SOURCE CONTROL (Remediation of Contaminated Soils)

Due to the effectiveness of the removal actions, no source of contamination remains within the fenced area of the site. However, additional field work is required in the disposal area north of the fenced area. This field work will consist of the installation of confirmatory soil borings to verify the presence or absence of contamination in this area. If no contamination is found, there will no source control remediation required at the Carolawn site, however, if contaminated soil is found, a second Record of Decision will be necessary to address this source of contamination.

GENERAL SITE CLEANUP ACTIVITIES

The two inactive incinerators will be inspected and any remaining residue will be sampled and analyzed. Also, wipe samples will be collected and analyzed. The results of the analyses will determine the method of disposition for the incinerators. The two remaining drums will also be sampled and analyzed to determine how they will be disposed. In addition, site cleanup will include closing of the equipment decontamination area used during Phase I RI activities.

6.2 OPERATIONS AND MAINTENANCE

Long term operation and maintenance (O&M) will concentrate on the groundwater extraction, water treatment and groundwater monitoring systems.

6.3 COST OF RECOMMENDED ALTERNATIVE

The estimated present worth cost for extracting and treating groundwater ranges from $1,141,071 to $1,356,305 million, depending on the extent of treatment and ultimate discharge point for the treated water. The capital costs and present worth O&M costs over 30 years range from $121,369 to $802,669 dollars and $753,433 to $916,723, respectively.

TABLE 30

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Law, Regulation, Policy and Standard	Application
Resource Conservation and Recovery Act (RCRA)	
NONE	
Clean Water Act (CWA)	
40 CFR 122, 125: National Pollutant Discharge Elimination Systems (NPDES)	Discharges of extracted/treated groundwater will be subject to substantive requirements of the NPDES process if discharged to a local stream. NPDES is administrative by the state
40 CFR 403: Effluent Guidelines and Standards: Pretreatment Standards	Discharges of extracted/treated groundwater will be subject to pretreatment requirements if discharged tot he POTW
Ambient Water Quality Criteria	AWQC may be used for discharge requirements where there are no state water quality standards
CAA Section 109 and 40 CFR 50: National Ambient Air Quality Standards	NAAQS for PMIO applied to fugitive dust
40 CFR 404 (b)(1): Wetland Protection	Protects the destruction of wetlands by requiring no net lost of wetlands
Occupational Safety and Health Act	
29 CFR 1910: General standards for work protection	Worker safety for construction and operation of remedial action
29 CFR 1090: Regulations for workers involved in hazardous waste operations	Worker safety for construction and operation of remedial action

TABLE 29

SUMMARY OF DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES
CAROLAWN SITE, FORT LAWN, SOUTH CAROLINA

Evaluation Criteria	*Alternative 1* *No Action*	*Alternative 2* *Alternate Water Supply*	*Alternative 3* *Groundwater Extraction with Discharge to POTW*	*Alternative 4* *Groundwater Extraction with Aeration and Discharge to Fishing Creek*	*Alternative 5* *Groundwater Extraction with Biological Treatment and Discharge to Fishing Creek*
Short-Term Effectiveness	• NA [1]	• Short-term impacts typical of any construction activities and are not of concern	• Short-term impacts to workers consist of contact with contaminated groundwater • No additional risk to community • Short-term impacts readily controlled	• Short-term impacts to workers consist of contact with contaminated groundwater • Air emissions deemed to be insignificant • Environmental impact from treated discharge to surface water deemed negligible • Short-term impacts readily controlled	• Short-term impacts to workers consist of contact with contaminated groundwater • Air emissions not anticipated • Environmental impact from treated discharge to surface water deemed negligible • Short-term impacts readily controlled

The present worth cost of the preferred remedy, including all activities, ranges from $1.4 to $1.6 million.

6.4 SCHEDULE

The planned schedule for remedial activities at the Cape Fear Site is as follows:

September 1989 --	Approve Record of Decision
October 1989 --	Issue RD/RA Notice Letters and Initiate RD/RA Moratorium Period
March 1990 --	Initiate Remedial Design/Treatability Study
May 1990 --	Complete Treatability Studies
August 1990 --	Initiate Remedial Action for Addressing Contaminated Groundwater and Other Specific Cleanup Activities

6.5 FUTURE ACTIONS

Due to the limited analytical soil data collected from the storage area north of the fenced area, additional confirmatory sampling will be conducted in this area to confirm the presence or absence of residual soil contamination.

The only anticipated long-term action expected to be conducted at the site following completion of the remedial action is periodic monitoring of groundwater to insure remediated levels obtained during the remediation are maintained.

6.6 CONSISTENT WITH OTHER ENVIRONMENTAL LAWS

A remedial action performed under CERCLA must comply with all applicable Federal, State and local regulations. All alternatives considered for the Carolawn Site were evaluated on the basis of the degree to which they complied with these regulations. Table 30 lists the identified ARARs for the Carolawn site. The recommended alternative meets or exceeds all applicable environmental laws.

7.0 COMMUNITY RELATIONS

The Proposed Plan Fact sheets was transmitted to interested parties, residents, media and local, state and federal officials on August 23, 1989. The Agency also conducted the FS public meeting.

The Information Repository/Administrative Record was established at Lancaster County Public Library located at 313 South White Street in Lancaster, South Carolina.

A public meeting was held on August 30, 1989, at the Lancaster County Public Library in Lancaster, South Carolina. At this meeting, the remedial alternatives developed in the FS were reviewed and discussed and EPA's preferred remedial alternative was disseminated. The groundwater mitigation alternative was presented as described in Section 6.1 Description of Recommended Alternative. In addition to discussing the groundwater remediation alternative, activities to confirm the absence or presence of soil contamination in the storage area north of the fenced area as well as general house cleaning activities to be performed at the site were discussed.

The public comment period concluded on September 22, 1989.

The only comments received during the public comment period were those aired and responded to at the public meeting. The Responsiveness Summary summarizes the comments stated in the public meeting.

8.0 STATE INVOLVEMENT

The State involvement has been maintained throughout this lengthy RI/FS process with reviewing pertinent documents such as the draft Remedial Investigation Report, the draft Feasibility Study, the draft Record of Decision and have been carbon copied all relevant correspondences.

The State of South Carolina supports the alternative stated in the Declaration and Section 6.0.

APPENDIX A

RESPONSIVENESS SUMMARY

APPENDIX A

RESPONSIVENESS SUMMARY

This community responsiveness summary is divided into the following sections:

SECTION I. Overview. This section discusses EPA's preferred remedial action alternative and public reaction to this alternative.

SECTION II. Background on Community Involvement and Concerns. This section provides a brief history of community interest and concerns raised during remedial planning activities at the Carolawn Site.

SECTION III. Summary of Major Comments Received During the Public Meeting and the Public Comment Period and EPA's Responses to These Comments. Both the comments and EPA's responses are provided.

SECTION IV. Remaining Concerns. This section describes the remaining community concerns that EPA should be aware of in conducting the remedial design and remedial action at the Carolawn Site.

SECTION V. Transcript of the Public Meeting. This section provides a transcript of the Remedial Investigation/Feasibility Study Public Meeting held on August 30, 1989 at the Lancaster County Public Library located near the site.

SECTION I. OVERVIEW

The public meeting at which EPA presented its preferred alternative to the public initiated the public comment period which ended on September 22, 1989. The alternative addresses the groundwater contamination problem at the Site. The preferred alternative specified in the Record of Decision (ROD) includes: extraction and permanent treatment of contaminated groundwater, confirmation soil sampling, and general site "house cleaning" activities.

In the public meeting, held August 30, 1989, five remedial alternatives were described to the public for migration control. One of these five alternatives was then proposed to the public as EPA's preferred remedial alternative for the Carolawn site. The actual treatment train to be installed to treat the extracted groundwater will be determined during the Remedial Design stage of the Superfund process. The discharge location of the treated groundwater will also be selected during the Remedial Design stage.

The community, in general, favors remedial action at the Site.

SECTION II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

The Carolawn Site is an abandoned waste storage and disposal facility located near Fishing Creek and South Carolina Highway 9, three miles west of Fort Lawn in Chester County, South Carolina. The 60-acre site is situated in a rural setting bordered to the south by the Lancaster/Chester railroad track and to the north by a large wooded area. One-half mile east of the site is Fishing Creek and the west is bordered by woodland.

Five households are located adjacent to the Site. Approximately 2,000 people live within a four-mile radius of the Site, with an estimated 100 people within a one-mile radius. Fort Lawn (population 471) is located 2.5 miles east of the Site and Richburg (population 269) is located three (3) miles west of the Site. The population estimations are based on the 1980 U.S. census.

Due to the rural nature of this region and the sparse population, concern over the events at the Carolawn site have been limited to the residents living near the site. SCDHEC received its first complaint about the site in 1972 when chemical recycling was being done on-site. The residences made informal and formal complaints to SCDHEC, the South Carolina Pollution Control Authority, U.S. EPA and the local media. The local families complained to local and state authorities about strong organic odors, fuming drums and chemical vapors that reportedly could be seen 1/2 mile from the site.

A primary concern in 1982 of local residents was the contamination of their drinking water. To remedy the situation, a city water supply line was extended from Chester to the adjacent residences in 1985. The Rockholt and Hunter residences hooked up to the line but the Morrison home turned down the offer. Their decision was based on a letter they received from SCDHEC in 1985/1986 stating that their potable well was contaminant free.

In 1987, the primary concern of area residents is the question of land value. Underlying this concern is the confusion over groundwater contamination. All of the parties who own property near the site have expressed an interest in selling their land but all had doubts as to whether this could be done successfully due to the condition of the groundwater.

Another chief interest expressed by area residents is the monitoring of residential wells. Residents want to know whether this will be an ongoing activity or whether all investigations are complete.

III. SUMMARY OF PUBLIC COMMENTS RECEIVED DURING THE PUBLIC MEETING AND THE PUBLIC COMMENT PERIOD AND AGENCY RESPONSES

Comments raised during the Carolawn public meeting and public comment period are summarized briefly below. The comment period was open from August 28 to September 22, 1989 to receive comments from the public on the draft Feasibility Study and proposed remedial alternative.

There was a moderate response from the community in the public meeting but no comments were received during the pursueing the public comment period. Summaries of the questions received during the public meeting are presented below. A complete record of questions and responses that transpired during the public meeting can be found in Section V - Transcript of the Public Meeting.

Public Meeting

The public meeting was held on August 30, 1989 at the Lancaster County Public Library meeting room. Questions and comments fell into the following categories. They included the lack of initial communication with the public prior to the commencement of an activity, the preference of residents for their well water over city supplied water, the start of clean up activities, other disposal areas with no known association with the Carolawn site, the level of lead found in the groundwater, the impact of discharging treated groundwater to Fishing Creek, and the duration and sampling interval during long term monitoring.

Public Comment Period

No comments were received by the Agency during the three week comment period that ended on September 22, 1989.

IV. REMAINING PUBLIC CONCERNS

In addition to those concerns voiced at the public meeting, some additional public concerns are described below.

* Additional sampling/analysis of residential wells for site related contaminants and

* Location of Information Repository/Administrative Record and future public meetings.

V. CAROLAWN REMEDIAL INVESTIGATION/FEASIBILITY STUDY PUBLIC MEETING

CAROLAWN PUBLIC MEETING
Lancaster, South Carolina
30 August 1989
7:00 PM

MINUTES OF

CAROLAWN SUPERFUND SITE

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

PUBLIC MEETING

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

AUGUST 30, 1989

7:00 - 9:00 P.M.

LANCASTER COUNTY PUBLIC LIBRARY
313 SOUTH WHITE STREET
LANCASTER, SOUTH CAROLINA

MEETING CONDUCTED BY MR. JON BORNHOLM

REMEDIAL PROJECT MANAGER,
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

AND

PROJECT MANAGER, CAROLAWN SUPERFUND SITE

CYNTHIA S. ELEAZER, CVR
COURT REPORTER
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FLORENCE, SC 29503
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The public meeting of the United States Environmental Protection Agency Carolawn Superfund Site Remedial Investigation/Feasibility Study was held at 7:00 P.M. on August 30, 1989 at the Lancaster County Public Library, 313 South White Street, Lancaster, South Carolina, conducted by Mr. Jon Bornholm, Remedial Project Manager for the United States Environmental Protection Agency and Project Manager for the Carolawn Superfund Site.

MR. JON BORNHOLM: Good evening. My name is Jon Bornholm. I am the Remedial Project Manager for the Environmental Protection Agency. I am the Project Manager for the Carolawn Superfund Site. I have been with the Agency for a little bit over five years, serving in this role. I became the Project Manager for the Carolawn Site in the fall of '87.

Briefly, this is what I hope to cover tonight. If you have any questions during my presentation, please don't hesitate to interrupt and ask them. We have a court reporter up here who is recording the entire presentation, the question and answer period, or the question and answer session. This all becomes part of the administrative record as well as part of the Record of Decision. There are some sign-up sheets on either side of the table here. I would appreciate it if everybody would sign in. Again, this becomes part of the official record for this meeting and for the Carolawn Site. There are also handouts, one on Superfund in general, two that I put together. One is the fact sheet that I sent to individuals on the mailing list about three weeks or so ago and the other one is a copy of the overheads that I'll be showing tonight.

Okay, basically, the purpose of this meeting is to present to the public EPA's proposed preferred remedial alternative for the Carolawn Site. We have conducted and are in the process of completing what we call a remedial investigation and feasibility study. We use the acronym RI/FS for the remedial investigation/feasibility study, so if I slip to use that acronym, that's what we're talking about, or what I'm talking about. It basically began back in late '85, early '86, and we're in the process of, as I said, finishing it up now.

I'll just briefly go through site history. According to our records, the site was initially started to be used as a storage area back in 1970 for hazardous waste. They had built the -- What we call potentially responsible parties, the companies, the generators of the material as well as the transporters, started to store hazardous waste at the site in the 70's. In November of '80, due to heightened awareness, the South Carolina Department of Health and Environmental Control went out and did a study of the site and their results are the discovery of one of contamination of private wells. EPA got involved in August of '81. We did a hazardous waste site investigation and this led to EPA's removal action in '81, '82 -- It began in the winter of '81 and it ended up in February of '82 -- in which EPA removed drums and contaminated soil from the site. The site was placed on the National Priorities List which allows my program to basically become involved and expend monies at the site. It was placed on the National Priorities List back in '83. Between '83 and '85, discussions with PRP's, getting finances in order. The Agency had the potentially responsible parties sign a consent decree -- partial consent decree, directing the potentially responsible parties to conduct the remedial investigation/feasibility study. Also in '85, for the public an alternate water supply was brought into the local residences. As part of the initial phase of the potentially responsible parties' remedial investigation/feasibility study, they removed the remaining tanks and the contents of those tanks from the site. Those were left behind after EPA's cleanup in '81. And as I mentioned earlier, the initial RI/FS, what we call Phase I, was initiated in '86. The potentially responsible parties submitted a report from that study and in the spring of '87 EPA determined it was insufficient, did not provide sufficient data to justify or support the conclusions reached in that decision, or in that document, so the Agency made the potentially responsible parties go back out in the field and collect additional data. That additional data question began in the fall of '88 and we're now in the process of pooling all that information in together and completing the remedial investigation/feasibility study.

Tonight, as I just mentioned, is the remedial investigation/feasibility study public meeting. It is the meeting that the Agency proposes to the public what we feel, the Agency, is the most appropriate remedial alternative for the site. We encourage public participation in this process and we are -- As part of that, there is a public comment period set up for this to fulfill this role and that public comment period ends on September 22nd.

MRS. MARGARET MORRISON: Mr. Bornholm --

MR. JON BORNHOLM: Yes, mam.

MRS. MARGARET MORRISON: -- before we go into that, I have a few questions I'd like to ask. I'm Margaret Morrison and I am one of those people who live at the Carolawn Site.

Going back to your groundwater investigation in 1980. The first letter we got from DHEC told us in the letter that we did have contaminants in our water and then they said that we did not have them and the explanation for that was because a previous test was done and the contaminated vials or what have you, whatever they do it with, was not clean and it showed contaminants in our well test. And then after that, they changed their minds and said we did not have the waste chemicals in our well. And I have many letters telling us that we do not. Twice in 1983 there was an article in The State paper, October the 2nd, 1983, saying that EPA was going to do a study and all three families had been told that their wells were contaminated and not to drink the water from those wells. That was not the case with us. We have not been told that ever. Then your report comes out, we continue to get -- In fact, after that happened, I got a registered letter from DHEC telling me that all was well. Then this report comes out and you're telling me again the Morrison and Hunter wells were also contaminated by volatile organic compounds. So this is very upsetting to me.

Mr. Faulkner, when the water line was put in, came to me one morning at eleven o'clock, the first we had heard from him about that particular thing, and he asked us if we wanted the water. And I said, "Well, I don't know. I'll have to talk with my husband," which was on the mail route. And he said, "Well, I've got to know by four-thirty this afternoon." So my husband got home at four-fifteen. We had fifteen minutes to discuss it and get back to him with what we had decided. So I flatly asked him if we had chemicals in our well water and he told me no.

So now I want to know once and for all, do we have chemicals in our well or do we not?

MR. JON BORNHOLM: I can't give you a yes or no because I don't have the data to show one way or the other. That sampling that I have information on is back in '86 and it showed no contamination in your well. I have asked our Environmental Services Division people, who are basically our field support people, to come out and sample your well, and that will be done in -- by the end of next month -- by the end of September.

MRS. MARGARET MORRISON: Thank you.

MR. ARCHIE LUCAS: And I'm not going to stand up. I'm Archie Lucas and I am a representative of Chester County Council in that district over there. And I don't remember the exact dates, but Mr. and Mrs. Morrison and them, they're my constituents also, and this thing was brought to our attention. Mr. L. A. Swegerman, which represented District 3 along the period of 1982, some time in there -- was it, Mrs. Morrison? -- and we went up and seen this. Mrs. Rockholt -- Is she still living?

MRS. MARGARET MORRISON: Yes.

MR. ARCHIE LUCAS: Okay. They was having a lot of health problems, or she was, and she was attributing it to the groundwater. So we got involved, got DHEC up here.

DHEC did not have the -- Chester County did not give DHEC permission to go in there. They -- The Morrison family had sold the property properly and they went in there and they painted them a pretty picture. And the Mr. Morrison that sold them the property, he has deceased since then and he shared with me many times they painted them a picture of roses there and they left a bad sore there. And we had to get our House of Representatives at that time, Ernie Nunnery, involved in it. We had to get DHEC involved in it. We had a big hearing at the Chester County Courthouse concerning this, and the people, as Mrs. Morrison said, could not get a definite answer out of DHEC, was there water level contaminated. Now I understand since then, that since we got the grants out of Washington on the Superfund, that they're on pipe water on our water system over there now.

MR. JON BORNHOLM: The Rockholts.

MR. ARCHIE LUCAS: All of them.

MRS. MARGARET MORRISON: No.

MR. ARCHIE LUCAS: Y'all are not?

MRS. MARGARET MORRISON: No, we are not.

MR. ARCHIE LUCAS: Okay. And then my reading in Monday's paper, was a week ago, concerning this, did y'all not say in that paper that the water was contaminated?

MR. JON BORNHOLM: The groundwater, which I'll get to, underneath the site is contaminated, yes.

MR. ARCHIE LUCAS: And I have -- really, I have several questions. Why is it taking so long? This has been five years -- at least five years. Why is it taking so long to -- I know that it's got to -- the tests have got to continue to be done, but why is it taking so long to do these things? These peoples' lives could be at stake here.

MRS. MARGARET MORRISON: We have already lost a neighbor. Our closest neighbor died with liver cancer. And has there been any kind of study done that you know of or any concern as to whether or not she might have died with what came out of her well? I went back over some of my material today and we were all interviewed one time and it said something about the Morrison well and the Morrisons and the Rockholts were not drinking their water but the Hunter -- Mrs. Hunter was. And then in another paper -- another interview, it said that she said that, "Well, it was only just a little paint thinner." So poor soul, she's not with us today. But are there any kind of studies being done concerning the health of the people who live near there?

MR. JON BORNHOLM: To my recollection, there has not been one. No.

MR. JOHN A. TIDDS: I mean why?

MR. ARCHIE LUCAS: This says -- and this is August the 27th -- It was saying the EPA is to hold off on family well found tainted here.

Again, there's other questions that I would like to ask. And I can respect the public forum that you're holding, but why is it held here in Lancaster County instead of Chester County where there's people that it affects?

MR. JON BORNHOLM: Basically, this is the closest meeting place I could find.

MR. ARCHIE LUCAS: Chester County's got the same facilities.

MR. JON BORNHOLM: It's my understanding this is a tad closer than Chester. I might be wrong, but --

MR. ARCHIE LUCAS: Well, you're wrong. I don't know who led you wrong, but --

MR. JOHN A. TIDDS: Where do you live?

MR. JON BORNHOLM: Down in Atlanta.

MR. ARCHIE LUCAS: Chester County has a fine library, it has a meeting room, that would have been glad to sponsor it.

MR. JON BORNHOLM: I won't argue that point because I don't know.

MR. ARCHIE LUCAS: And, you know, had I not read this in the paper, this thing would have went untold to the people that are concerned about this thing. And being one of those that brought it to the public's attention, it still bothers me that our -- this whole thing is over here in Lancaster County, where it does not even pertain to Lancaster County. It pertains to Chester County and Chester County residents and the people that are responsible for this contamination. And out of this, Chester County drew an ordinance -- drew up an ordinance that prohibits this type of going on. This is not the first dump that these people were involved in. They were involved in one right across the Chester County line in Fairfield County. They were involved in Carolawn. They were involved in one up 21, still in Chester County. Now are these people going to continue to live a rebellious life of going and intervening on other peoples' rights and privileges and contaminations that's going to eventually take their lives, or is the right agencies and the right people going to say, "You're not going to do this anymore"?

MR. JON BORNHOLM: I'm hoping that that is what is happening.

MR. ARCHIE LUCAS: You're hoping?

MR. JON BORNHOLM: My program is involved with the cleanup of abandoned hazardous waste sites. I am not privy -- I am not involved with ongoing activities. That's another part of the Agency, as well as DHEC.

MR. ARCHIE LUCAS: I'm not trying to give you a hard time, young man, but I'm just -- it's just a question that's a very concern to me because this area is still in my representation over there.

MR. JON BORNHOLM: And I don't have any answers for you because I'm not involved with that --

MR. ARCHIE LUCAS: And the water is going into the -- The contaminated underground water level is going in -- continuing to go into Fishing Creek, which comes by our living quarters. It comes through our community.

MR. JON BORNHOLM: I understand your concern and I'm not -- I don't have the knowledge to answer your question. I am hoping that the right people are doing the right thing.

MR. JOHN JOHNSTON: Jon, if I may. I'm John Johnston. John and I work together. I'm John's supervisor. You've all got a lot of questions and undoubtedly a lot of concerns. What I think we'd like to do is let John go through what we know so far. Certainly, we're not going to sit here tonight and tell you we know everything or that we're through trying to figure the situation out. We want to get to the point of saying, "Well, here's what we know," be fair about what we don't know, and talk about how we're going to deal with what we know and find out what we don't know. You've asked a lot of questions. Obviously, there's a lot of concern. You've asked if, you know, these activities are going to continue. Certainly, there's a whole national program to try and keep that from happening. Now the Environmental Protection Agency, one of the biggest programs between EPA and the State Department of Health and Environmental Control is in place to try and regulate those activities. Now, you know, if somebody wants to run out and drop a drum off beside the road, you know, at night sometime, not you, not me, not anybody is going to stop them from doing that; but, certainly, yes, there's a whole regulatory framework in place that was not in place in 1970. It wasn't in place really in 1980. It is in place now. So when John says "he hopes," I can assure you that there are fairly massive regulatory program to track waste from the cradle to the grave, the way we say it. So I think it's more than a hope. I'm fairly certain that that's not going to happen again, this type of situation.

Have we done individual studies on your neighbor and the situation related to her passing? No. That is not to say that we don't care, certainly. As a scientist, I'll have to tell you what you probably already know. There isn't a real good answer from anybody as to what causes a particular person's cancer of any type. I think we all know that. Why do -- you know, would one person get leukemia and one person next door not? I can't tell you that. I'm a biologist with the Environmental Protection Agency and people have spent lifetimes as physicians and researchers trying to figure that out. I'd like to know that myself, but the state of our information and the state of science now is the only thing that can be done, that is being done, at these and other sites are what we call epidemiological studies, large -- look at a large group of people who all live in the same area and see if they're any different than a similar group of people who don't live in an area next to a hazardous waste site. There is a federal agency that does those sorts of things, the Agency for Toxic Substances and Disease Registry, and that's -- you know, who they are is not nearly as important as that they're there. They look at the information we have, they work with the EPA to determine if that type or that level of work needs to be done here versus any of the other thousand or so sites that we're working on like this around the country. Certainly I can tell you that they have taken a look at the information. I don't know what they see about this site versus another site. I can tell you that once they've done an epidemiological survey, that they have looked at the information and found that there is nothing that they could do to answer that question, which is not to say that they might find -- change their mind in the future.

I think what we can do is we can let Jon get through a presentation on what we have done up to this point, what we know, what we're proposing tonight. We can stay here as late as anybody wants to stay and answer the questions we can answer, own up to the questions that we can't. I apologize that we're not in Chester County. I can tell you that Jon in all good faith has tried to find a comfortable meeting place and that's kind of hard to do from Atlanta, Georgia. Okay? It's just nigh on impossible to find all of the right people. What we're hoping tonight to do is find the right people, find you and you, and let you tell us a little bit more. We won't be in Lancaster next time; we'll be in Chester County in trying to solve some of those types of problems.

MR. JOHN A. TIDDS: Why has this taken you nine years to hold this meeting?

MR. JOHN JOHNSTON: Why has it taken us nine years to hold this meeting?

MR. JOHN A. TIDDS: Yes, sir.

MR. JOHN JOHNSTON: I'll tell you what. I've never had a good answer for why didn't we do this site first.

MR. JOHN A. TIDDS: All right. You did this site in '81 before you were up here last year.

MR. JOHN JOHNSTON: We've done some removal activities here.

MR. JOHN A. TIDDS: But you still don't know if these people have got toxics in their well right adjacent, two hundred yards from the site?

MR. JOHN JOHNSTON: All the information that we have says that they do not and certainly the information that we have that was looked at incorrectly. Our information was in Atlanta, Georgia that these folks were hooked up to the city water supply. And now that's just to be quite frank with you. If our information had been otherwise, that well would have been sampled at least two years ago again to confirm what was or was not in it, is or is not in it.

MR. JOHN A. TIDDS: You're saying that none of the wells adjacent to this site have contamination in them as to your knowledge right now.

MR. JOHN JOHNSTON: No, I am not. And one of the things that we have --

MR. JOHN A. TIDDS: You're not saying that?

MR. JOHN JOHNSTON: I'm not saying that at all. I'm saying that what we found several years ago led to the water line being placed in this area, led to the connection, I believe, of three out of the four homes in the area to the water line.

MR. JOHN A. TIDDS: That's a little teeny band-aid on a real big problem.

MR. JOHN JOHNSTON: We wouldn't -- I wouldn't argue with that for a minute. And what we're trying to do is get a bigger band-aid on it right now and tell you what that might look like and how we can find out what the ultimate solution is. But I think what we need to do is then answer some specific questions, see if in his presentation Jon answers some of those questions, where we don't -- Let's ask them here in a few minutes once we go through what we can tell you and move on from there.

MR. JON BORNHOLM: Basically, the overall objective of remedial investigation/feasibility studies is to characterize the nature of the waste and to define as best we can the extent of the contamination at hazardous waste sites. The objectives of the RI -- of the remedial investigation is that first part, to characterize the waste there present and find the extent, determine the pathways of exposure to either the public or the environment. And then the objective of the FS is to select the most cost effective remedial alternative to address the problems at the site.

For those who may not be familiar as to where the site is, it's off of Route 9 on the east side of Fishing Creek. This overhead locates with respect to the site, the private wells that were in use back in 1980. And this is a schematic of how the site looked during its operation. EPA's removal or emergency reaction in 1981-82 removed contaminated soils within the fenced area as well as in this area to the north, removed drums on top of the surface as well as surface soils that were contaminated. The Agency left, if my memory serves me from hearing the information, is that this row of tanks were left on the site following that removal and those were the tanks that were removed by the potentially responsible parties in '86. The next three drawings basically show direction of groundwater, the flow of groundwater. The major flow is headed to the -- towards Fishing Creek and each of these, this drawing and the next two, are prepared from data collected on different -- different times of the year. This one's on --collected on August 31st. This one's collected a few months later in October. And the last one was based on data collected in December and, basically, it's showing that the groundwater is flowing towards Fishing Creek, to the east. As I mentioned earlier, the remedial investigation/feasibility study occurred in two phases. Phase I was basically between '86 and '87. During that, those activities, soil samples, surface soil and subsurface soils, were collected. This --

MR. JOHN A. TIDDS: Excuse me. When was this done?

MR. JON BORNHOLM: This was done during the '86/'87 time frame.

MR. JOHN A. TIDDS: Thank you.

MR. JON BORNHOLM: Phase I of the RI/FS.

This map locates where those samples were collected as well as the data -- the analytical data. The contaminants found on site were from the samples collected. And this is following the removals in '81 and '86, which removed the source of contamination, the contamiıated soil as well as the drums and tanks. Also, as far as the remedial investigation of Phase I, four monitoring wells were installed: Monitoring Well 1 and Monitoring Well 2, Monitoring Well 3 and Monitoring Well 4. As part of Phase II, additional monitoring wells were installed, monitoring wells that were further out away from the site, away from the periphery of the site.

Okay. Some of the analytical data from Phase I of the monitoring wells as well as the Rockholt or the Ventura well are shown in this overhead. It shows the contaminants present and the levels of contamination as well as the sampling dates. From this overhead, the main contaminants concerned, or group of contaminants of concern, are organic volatile compounds. And this is the inorganic compounds detected in those wells from Phase I data.

From the information we collected during Phase I, as I mentioned, the Agency determined that the study was incomplete. It did not provide sufficient information to determine an effective remedial alternative for the site.

We required the potentially responsible parties to go back out to the field to collect additional information, data. As part of that, they installed those additional wells. The other determination that the Agency made from the Phase I data was that no source of contamination remains within the fenced area. Okay. It's our belief that the remedial -- the emergency actions, the removals done by the Agency in '81 and the potentially responsible parties in '86, removed all source within the fenced area so that the only contaminants that remain are those that were in the groundwater, and that was the driving force to get the potentially responsible parties back out in the field to install additional monitoring wells further away from the site so we could determine the extent of contamination in the groundwater. We also made a determination that the only group of contaminants of concern are the volatile organics, with the exception of one inorganic, which is lead.

This overhead shows the distribution of Acetone in the groundwater and, as you can see, it has reached Fishing Creek in the groundwater. It has traveled in the ground with the groundwater to Fishing Creek in both up this way and this way, east of the site.

This overhead looks at this Trichloroethene, another common solvent, organic volatile compound. And, again, the same conclusions can be reached, that contaminated groundwater has reached Fishing Creek and discharging into Fishing Creek.

MR. ARCHIE LUCAS: Jon, can I ask a question here? Are these elements cancerous?

MR. JON BORNHOLM: Trichloroethene, I believe, is a potential carcinogen. And Acetone?

MR. GLENN ADAMS: Yeah, and Acetone.

MR. JON BORNHOLM: Trichloroethene is believed to be a -- or is classified as a potential carcinogen.

MR. JOHN JOHNSTON: Jon, what are the concentrations, though, that was in the stream at the point of discharge?

MR. JON BORNHOLM: I have --

MR. JOHN JOHNSTON: Low?

MR. JON BORNHOLM: They're low.

MR. JOHN JOHNSTON: Yeah.

MR. JON BORNHOLM: Below any health criteria. I'll get to that and cover that in a minute.

I don't want to jump back and forth in time, but I try to look at each environmental media together, the surface water and sediment, groundwater, and soils and subsurface soils. This overhead that we're looking at, sediment and subwater samples collected. These were samples or sampling locations collected back in '81 as part of the initial hazardous waste site investigation. These are the locations of the surface water samples collected during Phase I of the remedial investigation/feasibility study. From the data provided by these samples, we were able to eliminate surface water and sediment as a pathway of exposure to both the environment and the public. Therefore, it was based on that decision -- During Phase II we collected surface water samples just from Fishing Creek to see what impact, if any, discharge of contaminated groundwater was having to the creek, and this is the sampling points and these were the analytical results.

As part of the remedial investigation, we also devised health standards, or cleanup goals might be a better term for it. These are levels -- If we have levels that exceed these levels of contamination here, remedial action is required. If it does not exceed that based on assessments done by our health people, then no remediation is required. So these are the numbers that we use basically to draw a line, whether or not we need to clean up the site or not. Groundwater, our levels of contamination exceed these levels. Now, as you can see, in the third column -- the middle column for ambient water standards, no contamination in Fishing Creek were found above those levels. That basically concludes the information generated during the remedial investigation.

The feasibility study looks at a universal list of possible remedial alternatives to clean up the site. From that universal list, those that are not applicable to the site -- will not work on the site, are eliminated. Through that process, these were the five remaining alternatives that we considered for the site. We are required by the Superfund Law to keep the no action alternative. That provides us a basis to measure the gains of the other alternatives evaluated.

So the first alternative is no action, nothing is done at the site except for long-term monitoring.

The second alternative was to bring in a larger water supply line to meet future development of the area.

Alternatives three, four, and five all involved the extraction of contaminated groundwater. The only difference between each of alternatives three, four, and five is what we do with that contaminated groundwater.

Alternative three is to discharge -- run a line to the publicly owned sewer plant -- treatment works and let them deal with it.

Alternative four and five involve on-site treatment of the contaminated groundwater and then alternately discharging to Fishing Creek upon treatment of the water.

Alternative four is running the contaminated water through an aeration treatment process to remove the organic volatiles.

And then alternative five is a facultative lagoon treatment system, running the contaminated water through basically a mini sewer plant and letting bacteria degrade the volatile organics and then discharging to Fishing Creek.

On the right-hand side are the cost estimates for each alternative over a ten-year period and over a thirty-year period.

What we have -- the Agency has settled upon as our proposed remedial alternative for the site, again based on the data generated during the remedial investigation, we are not requiring any type of soil remediation within the fenced area. It's our opinion, based on the data generated, that there is no more source in that area. There is some concern about that one disposal area -- or not disposal area, but let me say storage area -- north of the fenced area. Additional sampling will occur in that area to confirm the presence or absence of contamination in the soil in that area. As far as -- And that's the storage area to the north, confirmation samples.

Addressing the contaminated groundwater, the Agency is selecting extraction of the contaminated groundwater and we're leaving open right now a range of treatments that may include all or several. It'll be a treatment train, sets levels of contaminants that would be allowable to be discharged into that stream. The other alternative could be on-site irrigation. The decision will basically be made during the next phase of the Superfund process, which is called the remedial design, which I'll talk about in a second. Let me get through this.

Other activities to be conducted on site will be decide what to do with the defunct, inactive incinerators on site, whether dismantle them or leave them standing. There's two drums on site. We'll be sampling those and determine what to do with those. And there is one little pit near the fenced area that was constructed during Phase I to decon the equipment used on the field -- out in the field and we'll determine what to do with that little -- It's like a ten by ten little lagoon a foot deep or so.

What follows this is, following input from the community, the Agency generates a responsiveness summary. Basically, we respond to all comments sent to us. That becomes part of the record. Looking at -- evaluating the response we get may or may not alter this approach. We can't say until we get a response.

Then the next step will be to begin negotiations with the potentially responsible parties. It's the Agency's goal to have them finance the actual cleanup of the site.

per se, of air stripping, biodegradation, filtration through a activated carbon filter, and, if necessary, removal of metals from the water. So it will be extraction of contaminated groundwater and treatment.

As with the treatment, we're also leaving open our options of what to do with that groundwater -- that treated groundwater. Ideally, the easiest solution would be to discharge to the publicly-owned treatment works, the local sewer system. That may not be a feasible alternative. We haven't discussed that idea with the operator and owners of the treatment works. They may not accept it. It's a possibility. That will be decided during the remedial design phase.

MR. ARCHIE LUCAS: Jon, would they be qualified to handle this type of stuff, though?

MR. JON BORNHOLM: Basically, what would be discharged to the system would be clean water because we are going to be treating the water on the site.

MR. ARCHIE LUCAS: Okay.

MR. JON BORNHOLM: The other two alternatives to dispose -- discharge the treated groundwater to, would be to Fishing Creek. If that method of discharge is selected, we have to meet the technical requirements of what's called the National Elimination -- National Pollution Elimination Discharge System -- the acronym is NPDES -- permit and that

And that's a hundred -- We allow ourselves a hundred and twenty days to complete that negotiations.

Following that negotiations, we begin with remedial design. If necessary, there'll be some -- Additional data will be collected, if necessary, to design the extraction system, to determine how to treat that groundwater, knowing -- once we find out exactly what's in it after we run some pump tests, determine how to discharge that water.

Then we go into what's called the remedial action stage, which is actually the cleanup. I am anticipating that the remedial action stage should begin sometime next summer.

That's the end of my prepared presentation. Some gentlemen came up from Atlanta with me. Glenn Adams, who is our Regional Toxicologist, came up and Michael Henderson, who is with our Community Relations program, also came up. We're more than willing to answer any questions you may have. Because this is being recorded for the record, I would ask each of you to state your name, basically what your relation to the site is, whether or not you're a potentially responsible party or a concerned citizen or reporter, so that we can keep track of that and we'll stay here as long as we need to. Glenn, come on up.

MR. JOHN A. TIDDS: I'd like to ask you a question. My name is John Tidds and I drink the well water. When was the Clean Air and Water Act passed?

MR. JON BORNHOLM: I don't know offhand.

MR. DICK DUBOSE: The Clean Air Act was passed in 1970 originally and it was amended several times after that, about '74 and '77.

MR. JOHN A. TIDDS: Thank you. They never did do the clean water part?

UNIDENTIFIED PERSON: The Safe Drinking Water Act was in 1976.

MR. JOHN A. TIDDS: Okay. Thank you. I'd like to ask Mr. Lucas, which site were you referring to on North 21 a while ago?

MR. ARCHIE LUCAS: The one -- the same gentleman that was from the York area was involved in the one off of -- You know where you cut through off to go over to Lancaster, off of 21 down there, where that old filling station used to sit? Back off down in there somewhere, John.

MR. JOHN A. TIDDS: Okay. That's all.

MR. ARCHIE LUCAS: It's right next to Fort Lawn down there, that old white filling station.

MR. JOHN A. TIDDS: You don't know anything about behind Colonel Frank's off 21?

MR. ARCHIE LUCAS: Well, not since the gentleman over here --

MR. JOHN H. TIDDS: My name is Herb Tidds. I live in

Great Falls. I have some property up on the Fishing Creek Lake. Did I understand you to say that this cleanup program would start the summer of 1990?

MR. JON BORNHOLM: That would be about right. Yes. It would be the earliest it could start.

MR. JOHN H. TIDDS: Is this lag due to finances?

MR. JON BORNHOLM: No. We have -- First we try to -- We will enter into negotiations with the generators and transporters of this hazardous waste, the potentially responsible parties.

MR. JOHN A. TIDDS: Do you know who they are?

MR. JON BORNHOLM: Yes, we do. They're the ones who financed the remedial investigation/feasibility study.

MR. JOHN H. TIDDS: Do you propose to take any samples from the Morrison's well and analyze them?

MR. JON BORNHOLM: That will be done some time in September -- of next month.

MR. WILLIAM W. MORRISON: That's what I was wanting to ask you. I'm William W. Morrison. I don't know why we didn't have some kind of discussion like this to let us know what is going on before that pipeline was put in. I'd rather have my well water if it was good like the man said it was than that water that's coming in that pipeline, but most everybody that gets it tells me the same thing and -- because I don't know what it's got in it.

MR. JOHN A. TIDDS: You don't know what's in it, either.

MR. WILLIAM W. MORRISON: Because -- They checked it. They don't know what -- They ain't going to tell you what's in it, anyway. But they said that we didn't have it and they give us about six hours to decide whether we wanted to drink our good well water that didn't have anything in it or hook onto that pipeline.

MR. JON BORNHOLM: I --

MR. WILLIAM W. MORRISON: And then they go and build these wells and I know what the wells cost -- about five times what a well driller drills one. Then they don't want to -- It costs too much to test our water, see, but those wells cost I don't how many thousands each.

MR. JON BORNHOLM: See, the reason -- It was really a miscommunication somewhere down the line.

MR. WILLIAM W. MORRISON: Well, he said it cost too much to test our water. They won't test it anymore.

MR. JON BORNHOLM: Who is he?

MR. WILLIAM W. MORRISON: Then they go build the wells --

MR. JON BORNHOLM: Who is he?

MR. WILLIAM W. MORRISON: -- to test the water. He told her.

MRS. MARGARET MORRISON: The District man one day told me how much the equipment cost to test the water and how much our tests cost each time we did it. So it sounded to us like he was telling us we don't -- you know, "You're too much bother to us." And then --

MR. WILLIAM W. MORRISON: They never come there and discussed anything --

MRS. MARGARET MORRISON: And then --

MR. WILLIAM W. MORRISON: -- about what they're going to do.

MRS. MARGARET MORRISON: And then the day he -- No, I think it was after that because I had written a letter to the editor of The Chester Reporter because when this last -- in '83 when it came out that we were told that we were not to drink our water, I was trying to find out where they got their information, whether it came from EPA or DHEC. And I called The Chester editor and he didn't seem to -- He said he didn't really know where it came from, but he says, "Why don't you write a letter to the editor and let people in this county know what you people have been going through," so I did. And during the time, Mr. Parker called me on the telephone and told me not to believe anything that I read in the paper, so I put that in my letter what -- that he called. And when that letter came out, he came back to me with two other men and he told me that we would not get our well checked again. So that's the last we've seen of Mr. Parker.

MR. JON BORNHOLM: The last study that we have that I've seen for your well is '86 and it showed no contamination. It would have been sampled from that point on until now prior to tonight if we had known that you were still using your well, between that time frame -- between '85 and now, there's truly a --

MR. WILLIAM W. MORRISON: There's no record of who hooked onto that pipeline? How's all these things done and nobody knows what's going on?

MR. JOHN A. TIDDS: I bet somebody did some work down there in a month.

MRS. MARGARET MORRISON: What he's talking about is, does DHEC not report to you people what they do?

MR. ARCHIE LUCAS: DHEC don't report to nobody.

MR. JON BORNHOLM: I can't speak for DHEC.

MRS. MARGARET MORRISON: If they don't, I don't see how you know what you're doing.

MR. JOHN JOHNSTON: Well, we do avail ourselves of all the information we can, working with the State, their efforts, our efforts. In fact, something was wrong, quite frankly. What Jon is saying is we understood you to be on the city water well. There's no way anybody can stand up in front of you and say that that wasn't a mistake and that that doesn't potentially affect you. Nobody was, you know, going to come here tonight and say different. We would -- As Jon said, we should have been taking samples from this well. Now those other -- Unless you want to hear it, there's no need to go into why we construct very expensive groundwater monitoring wells instead of coming by and using your wells for sampling. There are technical reasons, but my point is that your drinking water, that we should know what was in it today. And what we're going to do is, as quick as we can get out there, we're going to go find out what's in it today. We're also, I can assure you, will be approaching the responsible parties who conducted this study to see if they want to go back to where we were a few years ago and offer again to connect you to the city water supply. I can assure you that -- I mean people -- I think what I've heard said is two hundred million people can drink out of the city water supplies around the country, then they're known to be as safe as state and federal government can make them. So if you're concerned about what's coming through that pipe, they're sampled regularly by law and forwarded to the state, Safe Drinking Water folks and federal folks, so we've got a way of finding out what's in that pipe on a regular basis. And that, quite frankly and obviously, we haven't had as far as what's coming out of your well. Now if they said that -- Once again, what we -- the information that we do have today holds this, that there wasn't anything found in your well, but I know if it was my well that that wouldn't make -- wouldn't answer my questions. So what we want to do is get out as quickly as the federal government can and find out for you what's in your well while we're also talking to the people who could come out and hook you up to that water supply.

Yes, sir.

MR. ARCHIE LUCAS: Do you not think, though, that it would have been well if they would have let the local people know what's happening with them or either the county officials or at least the county supervisor so he could relay the messages on to the people of concern what's been happening with the EPA monitoring?

MR. JOHN JOHNSTON: Yes, sir.

MR. ARCHIE LUCAS: And none of this has transpired?

MR. JOHN JOHNSTON: Yes, sir. You're exactly right. There should be more effort on our part to find who you are. That's just a point. It's not an excuse. It's not a reason, but we're in Atlanta and it's difficult to find everybody. We should do what you're describing and we will be doing what you're describing. We want to find out more about who to talk to. I'm not going to sit here and tell you that I know everything and who's who in your county. We should know and, quite frankly, I do not. I'm hoping that we will know so that we can do a better job with that. I was speaking to my boss on the way over here and that's something that we ought to do a better job with. Basically, I'm responsible for forty-two some of these sites and it is difficult to keep up with that level of information from Atlanta, but, again, that's not an excuse. We need to. That's what I get paid for. That's what Jon gets paid for and we want to do better. I'm certain that the folks who are here tonight can help us do that better. We've had -- I would imagine we had a public meeting when we had a work plan concerning this site? I don't know, but probably that was the last time we had this type of meeting. What I want to do is be sure when we ask you to sign up and give us an address -- The very reason that we ask you to do that on nights like this, so we know at least who wanted -- who came out to the meeting, that we can contact you. You know more people, you can tell us. We obviously need your help to do that, to get into your community and do a better job of letting you know what we're up to and finding out what your concerns are.

MR. ARCHIE LUCAS: Another good question that comes to my thought on this going into -- discharging into Fishing Creek, the information of possible contamination that might be there. How does this affect the fish that we might catch and eat there?

MR. JOHN JOHNSTON: Well, certainly, we would not discharge anything in Fishing Creek that would create a problem. I can guarantee that.

MR. ARCHIE LUCAS: But then the groundwater level might already have it there.

MR. JOHN JOHNSTON: Well, what we know of what's going into the creek and -- from the groundwater, we know that those levels are not a problem. When we say volatile organic compounds, we're talking about -- First of all, the material, it isn't going to stay in the creek a great deal of time. It volatilizes. It's up in the air. It dissipates quite rapidly. But we also know that what is discharging out is at levels that don't pose a hazard either through the fish or through direct contact with that water, and we're not going to do anything, believe me -- In terms of solving one problem, we're not going to move that problem out of the ground water into Fishing Creek. That's not a solution. That's not what we get paid to do. We get paid to treat the material, to take care of it. What goes into the creek has to meet some incredibly stringent standards, so it's not -- we're not going to relocate the problem, believe me.

MR. JON BORNHOLM: I think you have a question?

MR. AL WILLIAMS: No, I was going to make a comment. My name is Al Williams. I'm District Director of the South

Carolina Department of Health and Environmental Control. In relationship to Mrs. Morrison's question about her well, I'm not sure where all the miscommunication has derived from, but our records clearly state that her well did not contain contamination. It has been sampled a number of times over a period of time and, like I say, in terms of any verbal conversation you had with other people, I can't address that, but our record clearly states that there was no contamination in it.

MR. JOHN H. TIDDS: When was the last sampling done?

MR. AL WILLIAMS: I don't have that information with me.

MRS. MARGARET MORRISON: 1985, sometime before the --

MR. JOHN H. TIDDS: 1985?

MRS. MARGARET MORRISON: -- water line was --

MR. JOHN H. TIDDS: It could be by now.

MR. AL WILLIAMS: Of course, we'll be happy to do it again. Sure. But in terms of continuous sampling, I would assume that once the determination was made over a period of time of successive samplings, that being no indication of contamination, that that was the reason no further sampling was deemed necessary.

MR. JOHN H. TIDDS: It takes some time for this groundwater to migrate, doesn't it?

MR. JON BORNHOLM: Yes, sir.

MR. JOHN H. TIDDS: In some cases.

MR. JON BORNHOLM: Yes, sir.

MR. JOHN H. TIDDS: So what you say may or may not be valid.

MR. AL WILLIAMS: I'm saying that she was talking about reading later on that her well contained contamination. This fact report states here that under repeated sampling that those wells showed contamination and that is not accurate. The initial sampling showed a trace in your well, which was attributed to maybe sampling protocol or inadequate purging of equipment. All those are possibilities. Normally, we would not -- We would always pull a confirmation sample to support the first examination if -- which we did and we sampled thereafter, so --

MR. JOHN H. TIDDS: It looks to me like as long as there's a possibility of contamination in the groundwater that samples would be taken periodically until it was firmly established that there was no further contamination or migration of that contamination.

MR. AL WILLIAMS: Well, the Department reached that decision to do that.

MR. JIM FERGUSON: With the information that the Morrisons are not on city water, that can be done through the remainder of this process?

MR. JOHN JOHNSTON: Sure. That will be done.

MR. JOHN A. TIDDS: I want to address this to both of y'all, your part. You represent DHEC?

MR. AL WILLIAMS: I am with DHEC, yes.

MR. JOHN A. TIDDS: Department of Environmental Health Control? Do y'all sample the Catawba River --

MR. AL WILLIAMS: Yes, sir. We do.

MR. JOHN A. TIDDS: -- and the bottom thereof?

MR. AL WILLIAMS: Yes, sir. We do.

MR. JOHN A. TIDDS: You do? And how many different compounds do you check for there, if you call those compounds or whatever?

MR. AL WILLIAMS: You sure you want to get into this?

MR. JOHN JOHNSTON: Well, I don't know that there's a relationship between that site and the Catawba River.

MR. AL WILLIAMS: I mean I'll be glad to furnish you that information, but I don't think maybe that it's appropriate.

MR. JOHN JOHNSTON: The short answer is when they run analysis of the river -- when we run analysis, normally they're running a wandering list of chemical compounds, but it depends upon what the river's being sampled for. I don't know if there's a connection between this site -- what we're here to discuss and the Catawba River, but the short answer --

MR. JOHN A. TIDDS: It's all the same water.

MR. JOHN JOHNSTON: Certainly. But the contamination -- What we're supposed to be determining is does this site and anything coming from this site get that far down the stream. From what I understand from our study is the answer would be no.

MR. JOHN A. TIDDS: Okay. I have one more question and then I'm going to hush up. Do either one of your parties knowledgeable about the dump site behind Colonel Frank's off of U. S. 21 almost to the Chester County line?

MR. JOHN JOHNSTON: I tell you what, it would be kind of hard for me to answer standing here. I'll tell you for me, for Jon, I know the answer is no. We've got a list in the Southeast of four or five thousand different sites that we're working on, trying to figure out if any of them are a problem like this one might be, less of a problem, more of a problem, so it may be on there, it may be under investigation at some level. I can't tell you. What I do -- I can tell you is before we leave this evening, somebody is going to need that description again so that I can make sure it's not --

MR. JOHN A. TIDDS: See, it's right on Duke Power's right-of-way underneath their towers and they put drums in there in '81 and '82 after all these rules were supposed to be in place. There's row after row after row after row of 55-gallon drums buried on that right-of-way. It looks like

Duke Power or you people, DHEC, or somebody ought of knew about it.

MR. JOHN JOHNSTON: It's possible that we do.

MR. JOHN A. TIDDS: I asked the Sheriff about it. He said he didn't know nothing about it.

MR. JOHN JOHNSTON: Well, I tell you what, let's see if we can't -- see if there's any more questions and then I'd like to get that, what you just said, so I can jot down as to where it might be.

MR. ARCHIE LUCAS: Who legally owned this property, the chemical waste dump?

MR. JOHN H. TIDDS: What was your question, Archie? I didn't hear that, sir.

MR. ARCHIE LUCAS: Who legally owns the property, the chemical waste dump? The people declared bankruptcy and at that time Representative -- State Representative, again Ernie Nunnery at that time, he had to go through a whole lot of hassle to get this thing and I think he had some -- in this thing in order to get it done. Somebody had to take the responsibility and he put his neck out on the chopping block. But now that this thing has been in the cleanup stage for approximately six years, who legally owns this property?

MR. JOHN JOHNSTON: I don't really think we legally know. That's why, quite frankly, I'm going to back off of that because it doesn't -- That's why we have thirty or forty lawyers that we can call upon to go find out for sure. I don't think I've got it today -- an answer for you. Now we know -- The people we've been working with --

MR. JOHN A. TIDDS: Do you know who's responsible?

MR. JOHN JOHNSTON: -- made the waste, put it out there, are responsible for this local site.

MR. JOHN A. TIDDS: But you know who's responsible for putting it there, though.

MR. JOHN JOHNSTON: Yeah. That we know.

MR. JOHN H. TIDDS: That brings up the question with me of who is responsible. This question may be a little bit redundant, but yet it could be important to the future. I might want to dump a few barrels myself.

MR. JOHN JOHNSTON: I hope not.

MR. JOHN H. TIDDS: But does bankruptcy exonerate the operators of these dump sites from any further liability? It seems to me like you people been --

MR. JOHN JOHNSTON: You're talking to an engineer and a biologist. Now I've done a lot of enforcing over the last dozen years. Okay? So I can't give you an attorney's answer and I wouldn't presume to. My experience is that it depends upon the conditions of the bankruptcy and, quite frankly, the bankruptcy judge that conducts the hearing. If you ask for specific examples, I can tell you both yes and no. Okay.

MR. JOHN H. TIDDS: That's a good answer.

MR. JOHN JOHNSTON: That's the legal system. I'm a biologist.

MRS. MARGARET MORRISON: I would like to ask you about the lead. You have a five up there and I'm not a chemist at all. Is that in the ratio of a small amount, a medium amount, or a large amount? I'm very concerned about lead.

MR. GLENN ADAMS: I'll answer. That's a very small amount. In parts per billion it's -- I'll explain it. The only way I can think to relate it is, you know, millions -- or a billion stars in the sky and you're looking at one of them and there's five of them. Five -- Our present standard for lead right now is fifty parts per billion and in August the 18th of 1988 EPA proposed a new standard of five parts per billion in public water supplies at the source, which would be at the distribution point, and ten is per a household. And we are recommending that they go with this five parts per billion as a cleanup goal because in the near future that will be our standard instead of fifty. Does that answer you?

MRS. MARGARET MORRISON: I understand that lead cannot be extracted from water. Is that right?

MR. GLENN ADAMS: No, mam. It can be.

MRS. MARGARET MORRISON: It can be?

MR. GLENN ADAMS: Yes, mam.

MR. JOHN H. TIDDS: But it is accumulative. It is accumulative.

MR. GLENN ADAMS: In the body?

MR. JOHN H. TIDDS: Yeah.

MR. GLENN ADAMS: Yeah. That's why we have such a low number for it. The samples where we derived this five from was studied by ATSDR, the Agency for Toxic Substances and Disease Registry, which Jon had mentioned before, did an epidemiological study with lead and determined it for blood levels in children, say lead paint, and the numbers were back calculated to derive these numbers. That's why they're being more stringent.

MR. ARCHIE LUCAS: If this monitoring continues for the thirty-year period, how often will this site be actually monitored? Soil samples, water samples? How often would it have to be done, Jon?

MR. JON BORNHOLM: Initially, it'll probably be yearly until we get a data base to base what the extraction system is doing and then it might become every other year and once in every five years. That has not been determined, the exact monitoring sequence yet. But initially it will be -- Other sites have been bi-yearly or yearly to start off with.

MR. ARCHIE LUCAS: I have a reason for asking that question, because y'all know very well that Subtitle D is coming down and if we're going to be liable for it for thirty years -- and everybody thinks that that's going to be increased -- and if y'all are going to say y'all have got to do it, then what are y'all going to do with y'all's thirty-year program? That's the reason I asked this question.

MR. JOHN JOHNSTON: Quite frankly, our thirty-year program might be fifty years. It might be five years. Our program is based less on what's in a law than what is needed to clean up the site. The effectiveness of the remedy that we're talking about will determine how long we have to do this and how long we have to monitor it.

MR. ARCHIE LUCAS: And, again, will the local people be informed of this monitoring?

MR. JOHN JOHNSTON: Yeah.

MR. ARCHIE LUCAS: I think that's a big plus, not only on y'all's part, but DHEC's, too, to keep the local people there informed of what is and is not.

MR. JON BORNHOLM: The information depository for this particular site is located here at this library.

MR. ARCHIE LUCAS: Again, why is it in this library and not that library?

MR. JOHN JOHNSTON: We'll talk about that. We can do both.

MR. JON BORNHOLM: Other questions, concerns anyone wants to voice now? Okay, as mentioned before, we are in the public comment period for the proposed remedy for the Carolawn site. The public comment period closes on September 22nd. That information, your response will be evaluated. Responses will be sent to the people who submit comments to us. We will respond to those. As a collective group, they will be evaluated and taken into consideration.

MR. JOHN A. TIDDS: You represent the federal government, right?

MR. JOHN JOHNSTON: Yes, sir.

MR. JOHN A. TIDDS: And this gentleman down here represents the State of South Carolina, this gentleman right here represents Chester County, and I don't know who all these other people are in here. But the fact that you people will tell me you're not aware of a large chemical dump ten miles from the one we're talking about on a power line right-of-way. If somebody had two little pot plants out there, I bet everybody'd know about it. But the fact that we've got three agencies represented here and everybody's telling me they don't know anything about these hundreds and hundreds of drums, that bothers me.

MR. JOHN JOHNSTON: Well, first of all, let's say that we're -- there are thousands of people in this country and hundreds of people in this region who are responsible for investigating that type of situation. The fact that I or Jon may not be one of those people does not mean that the federal and the state and the county government aren't working on them, aren't aware of them. My response is I can't tell -- I can't answer your specific question about that particular spot and that's not to say that it is -- that we are unaware of it now. That's why I say what I want to know is so I can -- I can answer that question once I have a good description of the location where I can pull the map out when I go back to the office and tell the people who are supposed to know, "Do you or do you not?" But if -- To put it this way, I've worked in the Discovery Program for years. I've worked in and managed a program that decided which of these sites needed to go onto the National Priorities List to be the subject of this type of work. I'll guarantee you that there are hazardous waste sites that the federal and state government are not aware of. I'd like to believe that there are sites that -- that those are not causing a problem, but I don't know that if I'm not aware of it. It's a big country. There are a lot of people. I would have to say if there's anyone in this room who knows about a potential hazardous waste site, the best way to make sure that the federal and state government know about it is to write them or call them and we've got a lot of ways to try and get you to do that.

MR. DICK DUBOSE: That's a key point, John, that we depend very much on this type of information flowing to us. We don't know where all these places are. This is very helpful information for us. It's our main resource.

MR. JOHN A. TIDDS: It's real hard to take three or four bulldozers and earth-moving machines and dump trucks and twenty-five or thirty people and camouflage them all day long where can't nobody see them. That's why I know about it.

MR. JOHN JOHNSTON: Sure. And it's not hard to camouflage them from Columbia and it's absolutely easy to camouflage them from Atlanta unless somebody who lives in Chester County can let us know about it. And that's really what we want to do. That's why I say when you bring up this sort of information -- I'm real anxious to get the record down and find out if we know about it so I can take it on -- talk to the people at DHEC, get somebody out to take a look at it. I mean we do have some people here that are capable of doing that.

MR. MICHAEL HENDERSON: Yes, sir. We can't more than emphasize this thing of your input because we don't have district officers here. Everything of ours basically works out of Atlanta and we cover eight states, so we don't have people here so we don't know, so this is why we do need your input. I can understand your concern, but if we don't have people, we don't know unless you tell us.

MR. AL WILLIAMS: Please, I would like to clear the record. Mr. Tidds has indicated that the we are -- that the State is unaware. The site that he describes is Landfill, Incorporated. The State has been aware of it from day one. It has been continuously monitored The EPA is aware of it. They have had representatives there. It's inspected annually, monitored monthly and quarterly.

MR. JOHN A. TIDDS: Well, if all those drums start leaking, y'all going to run up there and mop them up right quick and they're under the dirt?

MR. AL WILLIAMS: I wanted to clear the record in terms of awareness. You have implied that the Department is not aware of it. I'm sure Mr. Lucas --

MR. JOHN A. TIDDS: I bet you DHEC don't know about it.

MR. AL WILLIAMS: Chester County is the one that passed an ordinance prohibiting --

MR. JOHN A. TIDDS: You're the first person admitted to knowing about it.

MR. AL WILLIAMS: But I just wanted to clear the record concerning that.

MR. JOHN JOHNSTON: Thank you.

MR. JON BORNHOLM: Any other questions? I thank you for coming and sharing your evening with us.

MR. JOHN H. TIDDS: When are we going to meet again?

MR. JOHN A. TIDDS: It's on your menu there.

MR. JON BORNHOLM: The next public meeting will be associated with the remedial design, when we have something to show the public what is going to be built out there. But we will be --

MR. ARCHIE LUCAS: Jon, I have one question on my part.

MR. JON BORNHOLM: If there is important information, it'll be sent out in the form of a fact sheet.

MR. ARCHIE LUCAS: Who will decide what of the four options will be taken? Who will decide that?

MR. JOHN JOHNSTON: The person that signs that decision is a regional administrator, a man named Greer Tidwell out of Atlanta. He's Regional Administrator in charge of the Southeastern Region of the United States --

MR. ARCHIE LUCAS: Final decision?

MR. JOHN JOHNSTON: -- EPA.

MR. ARCHIE LUCAS: Final decision?

MR. JOHN JOHNSTON: Final decision, exactly. What you're seeing and taking part in tonight is we're trying -- I'm trying to do the job of getting information out so you can say, "I like number four and part of number three," or make whatever comments that we should take into account when we make a recommendation, Jon, myself, Dick Dubose.

And the State has to be consulted. We ask their -- for their concurrence. The final decision, if you will, is made by EPA in Atlanta.

MR. JON BORNHOLM: I'd like to comment on what John is saying. Some decisions may need to be postponed until the actual design. We won't have time and we don't have sufficient data right now to talk with the local -- the owners or runners of the local sewer treatment plant to tell them or to ask them whether or not they'll help with it. So the decision point -- I guess the remedy that's actually -- we're discussing is, we are proposing to extract and treat the groundwater, but the final discharge point may not be determined until the remedial design phase.

MR. JOHN A. TIDDS: Do I understand that today -- I'm just listening to what's been said collectively -- today that people can go bury these 55-gallon drums as long as everybody knows about it and they monitor them?

MR. JOHN JOHNSTON: No, sir.

MR. JOHN A. TIDDS: Just drill a bunch of holes and you can put what you want in there?

MR. JOHN JOHNSTON: No, sir. By no means. By no means. There are stringent standards for disposal facilities, depending on the type of materials going into the disposal facility. There's a whole host of regulations over the site enforcing capability. To say that anyone can do whatever they want as long as everybody knows about it, no. That's not the case. That would take another evening to try and describe all the things that people have to do to get legally into that business.

MR. JOHN A. TIDDS: But it's evidently being done from, you know, what I'm hearing now about this site up behind Colonel Frank's.

MR. JOHN JOHNSTON: Not to the best of my knowledge. And what I've just heard is that this a permitted and regulated landfill now.

MR. AL WILLIAMS: No, it's closed.

MR. JOHN JOHNSTON: It's closed.

MR. AL WILLIAMS: It has been for a number of years.

MR. JOHN A. TIDDS: Well, that's the way it was when I was in there. There's nothing in there. It's covered up with dirt and it's closed, you know. And if you drill some test holes around it -- But still you can't get it back. You tried to get it back from underground at Carolawn in the 70's. You can't get it back out of there. And you it know as well as I do that after it leaks out the drum, it's a little too late to close the barn door.

MR. JOHN JOHNSTON: Certainly we're trying to keep that from happening.

MR. JOHN A. TIDDS: And carbon steel 55-gallon drums don't have a great history for lasting a long time in the ground.

MR. ARCHIE LUCAS: John, let me retract that. I told you I thought this other waste dump was off to the right down at the filling station. What he's doing is confirming -- The one that you're referring to is the one that took us into court on our ordinance. That site's been stopped since 1985, I guess, or '84.

MR. AL WILLIAMS: Yeah.

MR. ARCHIE LUCAS: Somewhere in that period of time.

MR. JOHN A. TIDDS: But they didn't take the drums back with them when they stopped.

MR. ARCHIE LUCAS: Now I don't know --

MR. JOHN A. TIDDS: They closed the gate --

MR. ARCHIE LUCAS: No. No.

MR. JOHN A. TIDDS: -- and put a lock on it and the weeds grew up, but it's still sitting there.

MR. ARCHIE LUCAS: But the gentleman was ceased from putting it there. And it's not on a cleanup as this Carolawn is.

MR. JOHN A. TIDDS: No, because the drums ain't busted yet.

MR. ARCHIE LUCAS: Yeah. It's not on the cleanup program as Carolawn is.

MR. JOHN JOHNSTON: Let me suggest --

MR. ARCHIE LUCAS: That's a total separate dump from this one.

MR. JOHN A. TIDDS: I understand all that.

MR. JOHN JOHNSTON: Okay, if there's no further questions on this issue, I'm here to stay folks. We'll be around. Anybody, if you want to, take your leave; or if you want to, stay and talk about the landfill after anybody else -- we'll stay.

THERE BEING NO FURTHER FORMAL DISCUSSION, THE MEETING WAS CONCLUDED.