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OU1 REMEDIAL INVESTIGATION REPORT

Four County Landfill
Fulton County, Indiana

VOLUME 1
TEXT, FIGURES & TABLES

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OU1 REMEDIAL INVESTIGATION REPORT

Four County Landfill
Fulton County, Indiana

VOLUME 1
TEXT, FIGURES & TABLES

Prepared for:
The Four County Landfill Group

JULY 1996
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CONESTOGA-ROVERS & ASSOCIATES

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EXECUTIVE SUMMARY

In August 1972, a sanitary landfill site located in Fulton County, Indiana began operations at the Four County Landfill Site (Site). Initially, only sanitary wastes were accepted but the variety of wastes accepted for disposal broadened and ultimately included hazardous wastes as defined by the Resource Conservation and Recovery Act (RCRA). The landfill became subject to the requirements of RCRA, 42 U.S.C. ##6901-6991 in November 1980 and qualified to continue operating by satisfying the requirements for interim status. On March 29, 1989, the U.S. District Court for the Northern District of Indiana ruled that landfill operations had violated requirements applicable to landfills and ordered the owners and operators to cease receiving hazardous wastes for storage or disposal immediately, to implement a closure plan for the facility, and to implement a facility investigation and corrective action. Shortly thereafter, the owners and operators filed bankruptcy petitions and the Indiana Department of Environmental Management (IDEM) pursued Potentially Responsible Parties (PRPs) under the Indiana State Cleanup Law.

IDEM's activities culminated in the execution of an Agreed Order by the Commissioner of the IDEM with a group of responsive Potentially Responsible Parties (PRPs). Upon execution of the Agreed Order, the PRPs commenced a Remedial Investigation/Feasibility Study (RI/FS) and Site Operation and Maintenance (O&M) activities at the Site. The RI/FS and O&M activities were detailed in a document entitled "Site Background Summary and Detailed Scope of Work" (ERM, 1992). In 1993, an RI/FS Work Plan was submitted to IDEM which detailed the specific activities to be conducted to determine the nature and extent of contamination, evaluate the degree of risk posed to human health and the environment and to select an appropriate remedy for the Site in accordance with CERCLA.

To date, a number of rounds of multimedia sampling and other data gathering tasks associated with the RI have been completed and sufficient data have been acquired to determine the nature and extent of contamination on-Site. Although groundwater beneath the Site has been sufficiently characterized by investigative activities performed to date, additional activities are required to investigate groundwater and subsurface

soil off-Site. These supplemental RI investigative tasks were detailed in a document approved by IDEM, entitled "Addendum 1 to the RI/FS Work Plan" (CRA, 1995).

In order to expedite closure of the landfill, the Four County Landfill PRP Group voluntarily submitted a proposal to IDEM to divide the Site into two operable units. IDEM concurred with this approach, clarified the components of each operable unit and formally approved the concept. The two operable units approved by IDEM have been designated the landfill cap operable unit (OU1) and the groundwater operable unit (OU2). OU1 addresses the landfill cap, landfill gas, institutional controls to supplement engineering controls, leachate collection and treatment from both lined and unlined cells, and source area groundwater control and treatment. Dividing the Site into operable units allowed the completion of the RI/FS for the landfill (as well as identification, evaluation and implementation of remedial measures) on a separate schedule from the RI/FS for OU2. A substantive benefit of the operable unit approach is to expedite closure of the landfill thus minimizing any potential for ongoing risk to human health and the environment posed by the Site.

This document provides a detailed discussion of the data acquired during the RI and extensive investigative activities performed prior to the RI. Although the RI Report has been prepared specifically for OU1, this document provides a comprehensive summary of RI-related data including data related to OU2 (the RI for OU2 is continuing and an OU2 RI report will be prepared upon completion of that investigation). Sufficient data are now available to evaluate and select remedial alternatives necessary to close the landfill.

On the basis of the information compiled to date, remedial action objectives for the OU1 have been established for surface soil and the landfill contents, air and dust, landfill gas, surface water, sediment leachate and source-area groundwater. The established remedial action objectives consist of medium- or operable unit-specific goals for protecting human health and the environment.

1.0 INTRODUCTION

1.1 BACKGROUND

The Four County Landfill (Site), located in Fulton County, Indiana, began operation in August 1972. During the period from 1972 to 1978, the Site was licensed as a sanitary landfill. From November 1978 to November 1980, the Site was approved to also accept industrial waste. The landfill became subject to the requirements of RCRA, 42 U.S.C. ##6901-6991, in November of 1980. On March 29, 1989, the U.S. District Court for the Northern District of Indiana ruled that landfill operations had violated several requirements applicable to landfills and ordered the owners and operators of the landfill to cease receiving hazardous waste for storage and disposal immediately, to implement an approved closure plan for the facility, and to implement a facility investigation and corrective action at the landfill. Shortly after the U.S. District Court ruling, the owners and operators filed bankruptcy petitions.

On August 13, 1993, an Agreed Order for a Remedial Investigation/Feasibility Study (RI/FS) and Site Operation and Maintenance (O&M) between a group of Potentially Responsible Parties (PRPs) and the Indiana Department of Environmental Management (IDEM) became effective upon execution by the Commissioner of IDEM. The PRPs identified by IDEM comprised both de minimis and non-de minimis respondents who allegedly contributed waste materials to the Four County Landfill and/or participated in the operation of the landfill. Most of the non-de minimis respondents identified by IDEM formed the Four County Landfill Group (Group).

Prior to execution of the Order, a "Site Background Summary and Detailed Scope of Work" (SOW) prepared by Environmental Resources Management - North Central, Inc. (ERM) was submitted to IDEM by the Group, in support of a Good Faith Offer to IDEM (put forth on April 27, 1992). The SOW was incorporated into the Agreed Order by reference and presents a summary of existing data previously collected at the Site, including a compilation and evaluation of available information regarding Site history, Site physical characteristics, waste characteristics, and the nature and extent of

contamination. Moreover, the SOW, in accordance with the Agreed Order, set out the basis for the work to be undertaken during the RI/FS.

An RI/FS Work Plan (hereinafter "Work Plan") was prepared by Conestoga-Rovers & Associates (CRA) in accordance with Paragraphs 38 and 39 of the Agreed Order and the SOW (Exhibit II of the Agreed Order) and is consistent with Section 121 of CERCLA and U.S. EPA guidance documents. Much of the Site background and ancillary historical operational information contained in the SOW was incorporated into the Work Plan. On May 3, 1994, the Work Plan was approved by IDEM. Initiation of investigative activities detailed in the approved Work Plan commenced on May 23, 1994.

Following the successful implementation of the Work Plan, a Groundwater Technical Memorandum which summarized Site groundwater data acquired during the RI as well as historical data, was submitted to IDEM. IDEM subsequently approved the Groundwater Technical Memorandum by letter dated May 22, 1995. The Groundwater Technical Memorandum provided a comprehensive database of available groundwater information. The purpose of the Groundwater Technical Memorandum, therefore, was to evaluate and discuss the comprehensive database and assess whether supplemental data were necessary to evaluate remedial alternatives for this Site.

A significant finding of the Groundwater Technical Memorandum was that supplemental investigative activities were necessary to adequately define the nature and extent of groundwater contamination at the Site. Addendum 1 to the approved RI/FS Work Plan (hereinafter "Addendum 1") was prepared to outline the additional work that was necessary. Addendum 1 set forth the rationale for these tasks and detailed data collection and analytical protocols which had not been previously established by the Sampling and Analytical Plan (SAP) provided as Appendix H of the approved RI/FS Work Plan. IDEM approved Addendum 1 by letter dated September 27, 1995.

Early in 1995, the Four County Landfill Technical Committee proposed to divide the Site into two operable units: the first

proposed operable unit (OU1) was the landfill cap and the second proposed operable unit (OU2) was groundwater. Dividing the Site into operable units would allow the flexibility to close and stabilize the landfill on a separate timetable from the groundwater investigation which could require several phases to complete. The "operable units approach" was first proposed in a memorandum to IDEM dated February 10, 1995. In response, IDEM approved the "operable units approach" and clarified the components of each of the operable units (Appendix A). On this basis, operable unit OU1 consists of the landfill cap, leachate collection and treatment from both lined and unlined cells, landfill gas collection and treatment, institutional controls to supplement engineering controls, and "source-area groundwater" control and treatment. [1]

At the time the Four County Landfill Group received IDEM's August 16, 1995 letter defining the components of OU1, the PRPs understood "source-area groundwater" to refer to the perched water within stratigraphic unit A beneath the Site, together with leachate generated from the landfill as currently configured. In subsequent communications, IDEM noted that the exclusion of any discussion of stratigraphic units B and C prevented IDEM from addressing concerns regarding the viability of any remedial action for OU2, if a remedy for OU1 were already completed. The PRPs recognized the validity of IDEM's comments regarding the need to consider the impacts of an OU1 remedy upon future remedies which may be required for OU2. Accordingly, the data generated during the OU1 Remedial Investigation from stratigraphic units B and C are presented in this RI Report so that it can be used to determine whether the potential remedial options identified in the Feasibility Study would prevent implementation of an OU2 remedy.

RI activities have provided a detailed understanding of the physical characteristics of the Site and the nature and extent of contamination. Moreover, the data compiled during the RI to date are sufficient to identify remedial action objectives for the Site and evaluate remedial action alternatives and select a final remedy for Operable Unit 1.

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[1] Source-area groundwater refers to all groundwater beneath the Site. Definition of operable units per IDEM letter dated August 16, 1995, Re: Four County Landfill Site, Fulton County Indiana.

Recommended remedial action objectives for OU1 address the following environmental media:

i) soil and landfill contents,
ii) air and dust,
iii) landfill gas,
iv) surface water,
v) sediment, and
vi) leachate and source area groundwater.

This RI Report has been prepared to encompass Operable Unit 1 and includes a comprehensive summary of the Site background information, the pre-RI analytical database, the RI activities performed to date, the nature and extent of contamination, results of the baseline risk assessment and the fate and transport of chemicals detected at the Site.

Although analytical data compiled prior to and during the RI are sufficient to characterize the nature and extent of groundwater impacts beneath the Site, additional investigative activities are required to determine whether groundwater and subsurface soil impacts extend off-Site. These additional off-Site investigative needs have been identified in Addendum 1. These activities, as well as any other investigative activities deemed necessary on the basis of the findings of the data compiled during the additional investigative activities summarized in Addendum 1, will be conducted under the auspices of the OU2 RI. A separate RI report presenting the results of the OU2 investigation will be prepared upon completion of the OU2 investigation.

1.2 PURPOSE

This RI report summarizes the data acquired during the RI as well as historical data, whose inclusion is in accordance with the CERCLA RI report format and the precepts of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Thus, this report provides a comprehensive database of available information. The purpose of the report

is to evaluate and discuss the comprehensive database as it relates to OU1, evaluate Site risk, if any, establish remedial action objectives for the Site and assess whether supplemental data are necessary to design remedial alternatives for OU1.

1.3 REPORT ORGANIZATION

This document has been organized into ten sections. Section 1.0 provides the background, purpose and organization of this submittal. Section 2.0 presents an overview of the Site including the Site location and description, Site history, physical setting and a description of inactive waste disposal areas. Section 3.0 provides a summary of previous Site-specific geologic, hydrogeologic and groundwater quality data acquired prior to the RI. Section 4.0 describes the activities undertaken during the RI to further assess Site conditions. Section 5.0 summarizes the nature and extent of contamination. Section 6.0 presents the baseline risk assessment. Section 7.0 summarizes the results of the previously performed environmental evaluation. Section 8.0 discusses contaminant fate and transport. Section 9.0 summarizes the RI and details the conclusions which stem from a comprehensive analysis of the compiled data. In addition, Section 9.0 establishes remedial action objectives for OU1. Section 10.0 summarizes the major references relied upon to compile this document.

2.0 SITE BACKGROUND

2.1 SITE LOCATION

The Site is located in Aubbeenaubbee Township, in north-central Indiana, in the southern half of the southwest quarter of Section 16, Range 1 East, Township 31 North (Figure 2.1). The Site is located approximately 3.5 miles southeast of the common corner of Fulton, Marshall, Starke, and Pulaski counties, near the intersection of State Highway 17 and County Highway 525 North. The nearest towns are Delong, located approximately one mile to the northeast, and Leiter's Ford, located approximately two miles to the east-southeast. The Site is approximately six miles south of Culver and 15 miles northwest of Rochester.

The Site occupies approximately 61.5 acres, including the County and State highway rights-of-way. State Highway 17 divides the property into an eastern and western parcel. Land disposal activities were formerly conducted on approximately 30 acres of the western parcel, which has been the focus of investigative activities conducted to date (Figure 2.2). The western parcel (the property upon which the landfill is located) is bounded on the east by State Highway 17, on the north by County Highway 525 North, on the west by a county road right-of-way, and on the south by wooded land.

2.2 SITE DESCRIPTION AND HISTORY

2.2.1 Overview

The following subsections present a chronology of the Site history as it relates to ownership, general operations, regulatory actions, and investigative activities. This information was originally provided in the approved SOW and subsequently, incorporated into the RI/FS Work Plan. This information is incorporated and supplemented herein to provide a comprehensive report of available Site information. As reported in these

reports, historical information was obtained primarily from the following documents:

- "Hazardous Waste Ground-Water Task Force Evaluation of the Four County Landfill, Fulton County, IN," prepared by U.S. EPA Region V and IDEM. Document Number: EPA-700 8-87-013, dated May 1987.

- "Comprehensive Monitoring Evaluation" (CME), prepared by Jacobs Engineering Group Inc. (Jacobs) in Lakewood, Colorado, for U.S. EPA Region V. Final, dated January 27, 1988.

- "Corrective Action Plan (CAP) Task I - Description of Current Conditions," submitted by Environmental Waste Control, Inc. (EWC) and prepared by Geosciences Research Associates, Inc. (GRA) in Bloomington, Indiana. Final, dated December 7, 1989.

- "Four County Landfill Fact Sheet," ("Fact Sheet", 1990) prepared by Katten, Muchin & Zavis, Special Environmental Counsel for the bankruptcy estate, based on interviews with Mr. Stephen Shambaugh and Mr. James Wilkins of EWC. Document number: 00150573, dated October 12, 1990.

2.2.2 Site History

1972 to 1977

Prior to 1972, no landfilling or dumping operations were conducted on the property, which consisted of farmland. A document entitled "Engineering Report - Proposed Commercial Sanitary Landfill Project" was prepared on June 21, 1972. The report included a proposed Site plan and soil boring logs for approximately six to eight borings that were advanced in both the western and eastern parcels. In July 1972, Mr. Avery Wilkins received approval from the Indiana State Board of Health (ISBH) and the Fulton County Commissioners to use the property as a

sanitary landfill (GRA, CAP Task I, 1989). Operations began in August 1972, and in accordance with a permit from the ISBH, the Site accepted primarily municipal waste. In addition, some liquids were accepted after 1972 (Jacobs, 1988). During this period of time, cut and fill and area fill landfilling operations were conducted. Unlined waste deposits were covered with backfill ("Fact Sheet", 1990). On March 13, 1973, the ISBH sent Mr. Avery Wilkins a Notice to Cease and Desist regarding the dumping of barrels of waste solvent. The facility was also ordered to comply with ISBH's compaction and cover regulations.

1978 to 1981

On June 22, 1978, Mr. Stephen Shambaugh and Mr. Doug Johnson (as major shareholders) formed EWC to operate the Four County Landfill Site (GRA, CAP Task I, 1989 and "Fact Sheet", 1990). In September 1978, the ownership of the property containing the present landfill was transferred to Mr. James Wilkins (the son of Mr. Avery Wilkins). The landfill construction and operating permits were transferred from Mr. Avery Wilkins to EWC in October 1978 (GRA, CAP Task I, 1989).

The groundwater at the Site was originally evaluated between December 1978 and February 1979 to determine whether the landfill could be permitted to accept "separate area waste", the ISBH's general definition for commercial and industrial waste prior to promulgation of RCRA (U.S. EPA, 1987 and "Fact Sheet", 1990). Seven monitoring wells were installed by water well contractors in a surficial, glacial till.

From November 1978 to November 1980, the Site was approved by the ISBH to handle separate area waste that included plating sludge, municipal wastewater treatment sludge, asbestos (brake dust grindings), and liquid (including hydroxides and dewatered sludges). These materials were reportedly placed in unlined cells ("Fact Sheet", 1990). On August 18, 1980, EWC notified the U.S. EPA that it was disposing of hazardous wastes at the Landfill. Moreover, according to IDEM: On November 18, 1980, as required by law, EWC submitted Part A of an

application for authorization to treat, store or dispose of hazardous waste at the Landfill. Under RCRA, EWC was then accorded "interim status" pending final administrative disposition of its permit application, allowing it to operate its facility.[1]

1982 to 1984

In 1982, EWC received letters from the ISBH stating that the existing groundwater monitoring system was inadequate (Jacobs, 1988 and "Fact Sheet", 1990). Mr. James M. King, a consulting hydrogeologist, completed additional soil borings to a maximum depth of 80 feet in 1982. In May 1983, Salisbury Engineering in Griffith, Indiana, a division of ATEC Associates, Inc. (ATEC), installed three additional monitoring wells through the surficial till and into an unconfined aquifer comprised of silty sand (GRA, CAP Task I, 1989). ATEC reported their results in a June 23, 1983 report entitled "Ground Water Study and Monitoring Well Installation". In October 1984, EWC notified the U.S. EPA of statistical differences in groundwater indicator parameters, particularly total organic carbon (TOC), and the need to further evaluate the groundwater at the Site. In addition, ATEC submitted the "Program Proposal - Ground Water Quality Assessment Plan" on November 1, 1984, in response to a formal complaint by the ISBH (GRA, CAP Task I, 1989).

Interim status facilities were required to file a Part B application and certify compliance with all applicable groundwater monitoring requirements and financial responsibility requirements by November 8, 1985[2]. EWC filed the first Part B Permit Application on January 31, 1984, through which it proposed to conduct landfill disposal of low-level, hazardous, industrial waste. On November 7, 1985, EWC filed the certificate of compliance with applicable interim status groundwater monitoring and financial responsibility requirements, and a Part B

[1]Reference: IDEM letter dated December 7, 1993, Re: Four County Landfill RI/FS Work Plan.
[2]IDEM, December 7, 1993 Reference: IDEM letter dated December 7, 1993, Re: Four County Landfill RI/FS Work Plan.

application[3]. Specific wastes listed on the application included emission control dust; wastewater treatment sludges; and wastes containing cadmium, chromium, and lead. The application indicated that EWC would not accept any ignitable, reactive, radioactive, acidic, or explosive wastes, or any wastes containing free liquids. In response to a letter from the U.S. EPA, EWC provided additional information to clarify the deficiencies identified in its original Part B Application (GRA, CAP Task I, 1989).

In 1984, Mr. Stephen Shambaugh bought out Mr. Doug Johnson's interest in EWC and became the sole owner and active operator of the Site ("Fact Sheet", 1990).

1985 to 1988

In accordance with the ATEC Ground Water Quality Assessment Plan, EWC installed three additional monitoring wells in the northeast quadrant of the Site in April 1985. The deepest of these wells was installed in a gravely sand unit to a depth of 122 feet (GRA, CAP Task I, 1989). Relative to the groundwater issues, EWC and the Indiana Environmental Management Board entered into an Agreed Order (Cause No. N-128) in July 1985 that required EWC to prepare a Groundwater Assessment Plan (GWAP) and submit the plan to the State for approval. On August 21, 1985, the first GWAP was submitted by ATEC (GRA, CAP Task I, 1989). IDEM did not approve the GWAP and subsequently notified the U.S. EPA that the Site was not in compliance with groundwater monitoring requirements ("Fact Sheet", 1990). The U.S. EPA sampled surface water and the existing monitoring well network in June 1986 and summarized the results of this investigation in a report (U.S. EPA, 1987). In October 1986, IDEM sent EWC a Notice of Inadequacy in response to the GWAP and requested the submission of a plan to describe the installation and location of additional wells (GRA, CAP Task I, 1989).

A data summary report (Dames & Moore, 1986) indicated that the GWAP should allow for modifications to the existing groundwater

[3]IDEM, December 7, 1993 Reference: IDEM letter dated December 7, 1993, Re: Four County Landfill RI/FS Work Plan.

monitoring system to improve the assessment of upgradient groundwater quality at the Site. Dames & Moore then prepared several versions of a "Hydrogeologic Assessment Report" between 1987 and 1988 to describe data associated with the installation of piezometers and additional monitoring wells. Concurrent with the Dames & Moore investigations, GRA was retained to provide an interpretation of the geologic setting and stratigraphy. Initially, three stratigraphic units were identified at the facility: (1) a surficial till sequence; (2) a glacial outwash deposit; and (3) a second, deeper till. Discontinuous, perched water zones were found in the surficial till sequence; the aquifer was identified as an unconfined, glacial outwash unit and the deeper till unit was interpreted as the base of this aquifer. GRA's detailed findings are included in the final "Hydrogeologic Assessment Report," dated January 12, 1988. This report identified the Site's existing stratigraphic framework.

The construction of a synthetically lined disposal cell (Cell A) at the Site was initiated in the fall of 1985 and completed in August 1986. As shown in Figure 2.3, Cell A, which was constructed in the southeast quadrant, is double lined and has a leachate collection system ("Fact Sheet", 1990). According to the 1990 "Fact Sheet", after Cell A was completed, EWC began the construction of an additional double-lined cell (Cell B) and did not dispose of waste on any other portion of the property (i.e., in unlined cells). After the completion of Cell A in August 1986, EWC did not dispose of waste on any other part of the Site ("Fact Sheet", 1990).

In February 1987, the U. S. Department of Justice filed a civil action suit (Cause No. S87-55) against EWC, Mr. Shambaugh, and Mr. James Wilkins in the Federal Court of the Northern District of Indiana ("Fact Sheet", 1990). The complaint alleged that landfill operations failed to satisfy applicable groundwater monitoring and financial responsibility requirements. Since failure to satisfy financial and groundwater monitoring requirements would result in the termination of the landfill's interim status, the complaint alleged that the landfill was operating illegally and should be closed. In addition, the complaint alleged that the minimum technology requirements (MTRs) were violated by the disposal of hazardous wastes when the MTRs became effective, through August 19, 1986, in cells and trenches that did not have double liners or leachate collection systems. The complaint

also alleged that a release of hazardous waste constituents had occurred at the landfill. The complaint requested the court to order corrective measures to be implemented at the landfill. At this time, EWC operated the landfill and managed several consultants working at the Site, including:

- Regional Services Corporation (RSC) in Columbus, Indiana, which was working on cell construction at the landfill;

- Advanced Waste Management, Inc. (AWM) in Terre Haute, Indiana, which was providing engineering services;

- ATEC, which was working on hydrogeological studies; and

- Dames & Moore, the firm that had been retained to evaluate regulatory compliance information for both the RCRA Part B Permit Application and the groundwater monitoring program ("Fact Sheet", 1990).

The Site was still in operation and the completed Cell B was being filled while Cell C, also double lined, was under construction ("Fact Sheet", 1990).

On June 30, 1987, EWC submitted a revised RCRA Part B Permit Application to IDEM that included three bound volumes of text and 13 plan sheets. IDEM and U.S. EPA Region V subsequently issued a document entitled "Fact Sheet - Intent to Deny a RCRA Operating Permit" and began a period of public comment on September 30, 1987. On January 18, 1988, EWC submitted a Part B Comments and Supplemental Information package to IDEM that consisted of seven bound volumes of text, including a position letter from Baker & Daniels, the law firm representing EWC, and detailed responses to IDEM's "Fact Sheet". Following the public comment period, a Notice of Decision was issued by IDEM on June 30, 1988, stating that a final decision to deny the RCRA Part B Permit Application was appropriate (GRA, CAP Task I, 1989).

On January 27, 1988, Jacobs submitted its CME to U.S. EPA Region V as an evaluation of the design and construction of the groundwater

monitoring system and the facility's ability to collect and analyze groundwater samples. As a result of the inspection/evaluation, several RCRA violations and method deficiencies were identified (Jacobs, 1988). EWC submitted a proposed RCRA Interim Status "Groundwater Monitoring Plan" (Plan) to IDEM on June 2, 1988. The Plan proposed: (1) the construction of more than 70 new or replacement monitoring wells and piezometers to be installed as clusters at multiple depths within the A, B, and C stratigraphic units defined in the GRA and Dames & Moore reports; and (2) a detailed sampling and laboratory characterization of soil materials (GRA, CAP Task I, 1989). Although some of the monitoring wells proposed in this Plan were designed to replace existing wells that were constructed inappropriately (e.g., with long filter packs and glued joints), no information regarding well abandonment was presented.

IDEM approved EWC's Plan in July 1988, and between November 1988 and December 1989, EWC installed the most recent series of wells and piezometers (GRA, CAP Task I, 1989). In accordance with the Plan, test borings were advanced to bedrock at locations near the four corners of the Site (i.e., to a maximum depth of 217 feet below ground surface), and monitoring wells were installed at variable depths in the aquifer (GRA, CAP Task I, 1989).

The complete results of the 1988 and 1989 investigations are presented in two "Memorandum Reports" prepared by GRA: (1) dated April 28, 1989 and submitted to Baker & Daniels; and (2) dated December 15, 1989 and sent to Mr. Shambaugh. These memoranda include soil boring logs, soil analytical data and well/piezometer completion diagrams. As described in these memoranda, solvent odors were detected in a thin, shallow sand seam within the upper till unit at several locations in the northwest quadrant of the property. Subsequent to the detection of volatile organic compounds (VOCs) within the perched water of this unit, EWC installed a groundwater recovery sump (sump P-34A) as an interim corrective measure.

On December 5, 1988, the civil suit filed by the U. S. Department of Justice (Cause No. S87-55) went to trial in the U.S. District Court, Northern District of Indiana, South Bend Division (GRA, CAP Task I, 1989). West Holding Company, Inc. (WHC), a wholly owned subsidiary of

EWC, was formed in 1988 to hold the real estate for the Site ("Fact Sheet", 1990). WHC was also named as a defendant in the civil suit (GRA, CAP Task I, 1989).

1989 to Present

On March 29, 1989, the U.S. District Court (i) ruled that the landfill lost its interim status on November 8, 1985, and was operating illegally; (ii) ruled that hazardous substances had been released from the landfill into the groundwater under the landfill; (iii) reaffirmed its prior ruling that the landfill illegally disposed of hazardous wastes in cells or trenches without liners and leachate collection systems; (iv) permanently enjoined the defendants from operating a hazardous waste storage and disposal facility at the Site, and (v) ordered the defendants to cease receiving hazardous waste for storage and disposal immediately, to implement an approved closure plan for the facility, to implement corrective action at the landfill, and to pay a civil penalty to the United States of 2.78 million dollars. At the time of the court decision, Cell C had been completed and was in use. Two weeks after the court decision, Mr. Shambaugh, Mr. James Wilkins, EWC, and WHC filed for Chapter 11 bankruptcy ("Fact Sheet", 1990).

In June 1989, GRA began collecting data to fulfill Task I (Description of Current Conditions) of the proposed CAP, under the direction of the U.S. EPA Region V, RCRA Enforcement Branch. The U.S. District Court decision was appealed to the 7th Circuit Court of Appeals (GRA, CAP Task I, 1989) and was subsequently affirmed.

On April 12, 1990, RSC submitted a GWAP to IDEM on behalf of EWC. This GWAP was approved by IDEM on October 10, 1990, with extensive attached modifications, to fulfill the requirements of the original July 1985 Agreed Order. Pursuant to the March 1989 Judicial Decree for a CAP, EWC submitted several progress reports, including groundwater and sump sampling results, to the U.S. EPA Region V, RCRA Enforcement Branch, between April 1990 and July 1991. Several CAP project plans were prepared by WW Engineering & Science in Grand Rapids, Michigan and Bloomington, Indiana (formerly GRA). These documents consisted of an RFI Work Plan

(Task II of the CAP) and a January 31, 1990 corrective measures study (Task VI of the CAP). The Work Plan was approved with modifications by U.S. EPA Region V, RCRA Enforcement Branch in January 1991, and a final version reflecting these modifications was submitted by WW Engineering & Science on March 11, 1991.

According to a June 13, 1991 progress report from EWC to U.S. EPA Region V, WW Engineering & Science notified EWC that it would not continue its involvement in the project because of EWC's financial insecurities. In December 1991, IDEM began a unilateral removal action to stabilize the facility, including the collection, storage, and disposal of leachate and erosion control measures (IDEM Draft Statement of Work, February 1992). OHM Remediation Services Corporation began these Site maintenance activities under the direction of IDEM.

In January 1992, IDEM notified certain persons that it had identified potentially responsible parties and requested that they make good faith offer to conduct Site maintenance activities and an RI/FS study for the Site. After several meetings between the PRP Group and IDEM and pursuant to a requested extension, a group of PRPs submitted a good faith offer by June 1, 1992. IDEM provided comments on the proposed SOW, to which the PRPs subsequently responded. Upon completion of negotiations for terms of an Agreed Order and finalization of the SOW, (Exhibit II to the Agreed Order) signature pages were submitted to IDEM on behalf of the Four County Landfill PRPs on May 7, 1993, pursuant to the schedule specified by IDEM.

On August 13, 1993, IDEM concurred and executed the Agreed Order. Pursuant to its terms, the Agreed Order became effective upon signature. Site maintenance activities began, as specified in the Agreed Order, on August 29, 1993. The RI/FS Work Plan required under the Agreed Order was submitted within 60 days of the effective date of the Agreed Order. The RI/FS Work Plan was approved by IDEM, after review and comment by the U.S. EPA, on May 3, 1994 and field activities associated with the RI were initiated on May 23, 1994, within the time period allotted under the Agreed Order. The Groundwater Technical Memorandum which summarized Site data acquired during the RI as well as historical data, the acquisition of which, preceded implementation of the RI was approved by IDEM by letter dated

May 22, 1995. Addendum 1 to the approved RI/FS Work Plan was prepared to outline the additional scope of work necessary to determine the nature and extent of groundwater contamination. Addendum 1 was approved by IDEM in October 1995.

2.2.3 Landfill Methods

2.2.3.1 Unlined Deposits

Prior to 1978, the State of Indiana did not require wastes to be separated as hazardous or non-hazardous. The General Refuse Area shown on Figure 2.3 contains a mixture of general refuse, commercial, and industrial waste (U.S. EPA, 1987). During 1974, Fulton County opened a landfill for general refuse, and the volume of general household refuse received at the landfill was reduced (U.S. EPA, 1987). Between 1974 and 1978, the materials deposited in the General Refuse Area were likely a combination of commercial and industrial wastes (U.S. EPA, 1987).

After 1978, the State of Indiana required disposal facilities to separate general refuse from the commercial and industrial wastes (i.e., the "separate area waste"). The approximate boundaries of the separate area waste deposits are shown on Figure 2.3. Prior to November 1980, EWC did not keep complete records of the volume and types of wastes accepted (U.S. EPA, 1987). On November 19, 1980, with the aid of a contract survey company, EWC began recording the placement of waste within the individual unlined waste areas (U.S. EPA, 1987).

Detailed locations of individual waste deposits within the unlined areas and the respective dates of placement are shown in Figure 2.3. The actual dimensions of these units or cells were not recorded. These small waste management units or cells were excavated and used on a daily basis (i.e., the "graveyard" method) until the "modified trench" method was adopted by the facility in the spring of 1985. According to information presented in the U.S. EPA's Task Force Report (1987), the graveyard method involved digging a pit (unit) with dimensions of 20 feet by 20 feet by 15 feet (deep), placing the waste within the pit, and backfilling over the waste with

excavated soil. The modified trench method was similar to the graveyard method, but individual pits were dug, as necessary, in a line that was called a "trench" and the waste in any unfilled pit was covered daily with soil. Therefore, with the modified trench method of disposal, only a small pit or waste management unit (RCRA landfill cell) was being used at any one time. Although the width of each trench varied and was generally not recorded, the trenches were typically excavated to a depth of approximately 15 feet (U.S. EPA, 1987).

2.2.3.2 Lined Deposits

Cell A, a waste management unit with a flexible membrane and double-liner systems, was being constructed during the U.S. EPA Task Force inspection in June 1986 (U.S. EPA, 1987). Wastes were placed in this cell beginning on August 18, 1986. Cell A covers an area of approximately 300 feet by 500 feet and the bottom of the cell lies at approximately 760 feet above mean sea level (amsl). The base consists of two 80-mil, high-density, polyethylene (HDPE) synthetic liners separated by a drainage mesh that allows for the detection and collection of liquids that may be indicators of liner failure. A second drainage mesh, a permeable geotextile fabric, and 10 to 12 inches of sand are located between the double liner and the waste deposits and were installed to facilitate the collection and removal of leachate (U.S. EPA, 1987).

Additional construction details are available in the most recent RCRA Part B Permit Application submissions (June 1987 and January 1988) and the "Closure and Post-Closure Plans" (April 13, 1989). It is assumed that Cell B and Cell C were constructed on the basis of similar designs. The "area" method of waste disposal was used in the lined cells (Jacobs, 1988). This method consisted of placing the waste in 3- to 5-foot lifts and covering the waste as it is "built out" into the cell. Because a portion of Cell C was constructed in an area that was previously landfilled, the older waste materials may have been excavated and replaced in the double-lined cells.

The leachate production records for Cells A-North, A-South, B, and C were reviewed in an internal memorandum dated

January 24, 1990 from the IDEM Engineering Section to the IDEM Enforcement Section. Based on this review of graphical data, visual observations, and laboratory analyses of the leachate, IDEM concluded that leaks were present in all of the primary liner systems within the engineered cells. This information suggested the presence of a breach in the primary synthetic liner that allowed leachate to infiltrate into the secondary leachate detection system.

A more detailed discussion of the available construction information for the lined cells is provided in Appendix B.

2.2.3.3 Leachate

Leachate generated in the lined landfill deposits is currently being collected and shipped for disposal at a RCRA-permitted facility approved by IDEM. The leachate shipment records for the years 1994 and 1995 has been tabulated and provided in Table 2.1. An average of 43,400 gallons of leachate per month were produced in the lined landfill cells during this two year period. During this period, the monthly rate of leachate production varied from 19,300 gallons during December 1995 to 64,800 gallons during July 1995. In general, the monthly volume of leachate produced in the lined landfill cells lies between 30,000 and 50,000 gallons.

Between April 1987 and September 1993, a total of eleven leachate samples were collected from the lined cells. The majority of the collected samples were analyzed for a list of approximately 200 individual compounds including VOCs, semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), metals and cyanide. Leachate analytical data which has been produced periodically since 1987 has been compiled and summarized in Appendix C. With the exception of the September 1993 data, leachate data were previously reported in the following documents: "Four County Landfill Leachate Treatment at POTW" (June 1992), and "Analysis of Primary Liners at Four County Landfill" (January 1990). In order to meet Site operation and maintenance obligations under the Agreed Order, the Four County Landfill Group authorized sampling of the leachate generated in the lined landfill cells. Leachate

samples were collected in September 1993 for the purpose of characterizing the leachate for proper disposal. The September 1993 leachate analytical data were previously submitted to IDEM under cover of the November 1993 monthly progress report (Progress Report No. 3).

2.3 PREVIOUS HYDROGEOLOGIC INVESTIGATIONS

Available records indicate that a total of 118 monitoring wells, piezometers, and water supply wells have been installed on the Site (Figure 2.4). Monitoring well MW-8 was originally installed as a water supply well for a residence formerly located in the northwest quadrant of the property (GRA, CAP Task I, 1989). In addition, two other water supply wells were identified at the Site, including a 6-inch diameter well in the northwest quadrant and a well located near the former support facilities (trailer) in the southeast quadrant. In addition, the following monitoring wells and piezometers were installed at the Site between 1978 and 1989:

i) seven monitoring wells (MW-1 through MW-7) between December 1978 and February 1979 by water well contractors;

ii) six monitoring wells (MW-20, MW-21S, and MW-22 between May and June 1983, and MW-23S, MW-23M and MW-23L in April 1985) by ATEC;

iii) twelve monitoring wells (MW-21M, MW-21L, MW-24S, MW-24M, MW-24L, MW-24L2, MW-25, MW-26, MW-27S, MW-27M, MW-28S, and MW-28M) and four piezometers (P-1, P-2, P-3, and P-3A) between 1986 and 1987 by Dames & Moore; and

iv) all of the remaining piezometers and wells in 1988 and 1989 by GRA.

A piezometer/monitoring well cluster with a numeric designation of "34*" was installed by GRA between December 1988 and

January 1989 (the asterisk "*" is not a footnote, but rather a means of distinguishing this cluster from "P-34A," a piezometer formerly located in the northwest quadrant).

Although all of the wells are constructed of polyvinyl chloride (PVC) material, those installed prior to 1988 are constructed according to various specifications. In some cases, the effective well screen length (including the sand pack) were inappropriately long and well casing are attached using glued joints which may contribute organic analytes to samples collected from these wells. For this reason, several monitoring wells and piezometers were abandoned during the RI.

Several rounds of water level data were collected by GRA in 1989 and tabulated according to separate "hydrostratigraphic" units (including Units B, C1, C2, C3, and C4). Water table contour maps generated from these data generally indicated a north to northeasterly groundwater flow direction with a very gentle horizontal gradient.

As described in the "Hydrogeologic Assessment Report" (January 12, 1988), Dames & Moore completed slug tests in 1987 to determine the hydraulic conductivity at five monitoring wells installed in Units B and C. The hydraulic conductivity values, which were calculated by using two separate analytical solutions, ranged between 10^{-6} and 10^{-4} cm/s. By using the average hydraulic conductivity values derived from the field slug tests, the laboratory permeability tests of Unit B and Unit C aquifer material, and representative ranges of the Site hydraulic gradient and effective soil porosity, Dames & Moore estimated groundwater flow velocities between 4.8×10^{-8} and 1.6×10^{-5} cm/s (0.05 to 17 feet per year).

During investigative activities conducted prior to the RI, a substantial analytical database was compiled on groundwater quality, sediment and surface water, air and landfill gas, biota and residential wells. These data are summarized in Section 3.0 of this document.

2.4 PHYSICAL CHARACTERISTICS

2.4.1 Demography and Land Use

Fulton County had a population of 17,453 in 1900; 15,577 in 1940; 16,984 in 1970; and 19,208 in 1980. The major concentration of the population is in and near Rochester, which is the largest town in the county. Rochester had a population of 5,016 in 1980. Some of the population is concentrated around other small towns in the area. Agriculture is the main source of income and employment, and the area businesses and industries are relatively small.

During the period from 1958 to 1967, the number of acres of land under urban development increased by about 15 percent, and all categories of agricultural land decreased by the same amount. In 1974, approximately 87 percent of the county remained agricultural land. As of 1987, approximately 100 acres or less were being converted to urban uses, and this trend was expected to continue at a similar rate for several years (Furr, 1987).

The area to the west of the Site is open and used for agricultural purposes, and properties to the north, south, and east are wooded and sparsely populated, with residents situated on scattered, small farms. The primarily white, middle class population is involved in agricultural activities, with no notable distributions by age or gender. Land use consists of small farm and dairy operations. Groundwater is the primary source of potable water for the residents (Agency for Toxic Substances and Disease Registry, 1990).

During a U. S. Geological Survey (USGS) biota study conducted in January 1988, 64 residences and one church were noted on the land within 0.5 mile of the Site. Forty-five of these residences were occupied, and the other 19 appeared to be cottages used only during the summer months (GRA, CAP Task I, 1989). A plat survey and listing of owners of property adjacent to the Four County Landfill is presented in the CAP Task I report. According to this document, the property immediately north, south,

and east of the Site has been separated into many small plats that were never developed.

Potential future land uses in the vicinity of the Site would most likely consist of one or more of the following: open space, agricultural, residential (either seasonal or permanent), and small commercial developments (particularly near State Highway 14). Zoning ordinances, which may serve to restrict certain land uses, do not exist in Fulton County. However, socioeconomic factors would serve to limit the intensity of any particular use in the vicinity of the Site. For example, the area surrounding the Site is not likely to attract a large permanent residential population due to its relatively remote location and lack of significant industrial development with a large number of jobs. Moreover, the area lacks a sufficient number of major arterial thoroughfares for traffic and a large permanent population which may attract significant industrial development to the area.

2.4.2 Topography and Drainage

As a result of glaciation, the area surrounding the Site contains a number of small swamps, streams, and lakes, including 24 natural lakes within Fulton County (Harrell, 1935). The closest large water body, King Lake, which covers approximately 18 acres, is located approximately 0.25 mile east of the Site and has a north-flowing outlet to the Tippecanoe River (Figure 2.1). The Tippecanoe River flows in a generally northwesterly direction and is located approximately one mile north of the Site.

Based on a review of topographic maps of the area, the three major areas receiving runoff from the Site may include: (1) a wetland basin to the north of the Site, (2) forested wetlands and King Lake to the east of the Site, and (3) a series of connected wetlands and an unnamed stream/ditch to the south and west of the Site. The wetland basin to the north also receives surface drainage from small areas northwest of the landfill.

Surface water run-on enters the Site from the wooded southern boundary and is directed through a ditch to an area of natural

drainage off the western edge of the Site. Water from this area eventually drains to the unnamed, northwest-trending ditch that flows to the Tippecanoe River. Runoff that does not come into contact with the active portion of the landfill is collected in a series of ditches and drainage control ponds, stored in either the southwest retention pond or the northeast drainage control basin, and is ultimately discharged from the northeast drainage control basin in accordance with a National Pollutant Discharge Elimination System (NPDES) Permit (Figure 2.2). Water which collects in the northeast drainage control basin is discharged at the north end of the basin. The discharged water then drains into a culvert (located under County Highway 525 North) that empties into the wetland basin north of the Site.

2.4.3 Climate

The climatological information included in this subsection was obtained primarily from the document entitled "Soil Survey of Fulton County, Indiana" (Furr, 1987). According to Furr, the following climatic data was obtained from the Rochester, Indiana recording station for the period from 1951 to 1974:

i) The average winter temperature was 26 °F, and the average summer temperature was 68 °F.

ii) The lowest temperature on record (-23 °F) occurred on January 29, 1963, and the highest recorded temperature (101 °F) occurred on September 2, 1953.

iii) The average annual precipitation was approximately 37 inches. Approximately 23 inches of rain, or more than 63 percent of the annual total, usually fell between April and September. The heaviest one-day rainfall event during the period was 4.72 inches on April 29, 1956.

iv) Thunderstorms occurred on approximately 40 days each year. Occasional tornadoes and severe thunderstorms were local in

extent, lasted for only a short duration, and caused damage in scattered areas.

v) The average seasonal snowfall was about 25 inches, and the greatest snow depth at any one time was 11 inches. On average, 18 days of the year had at least one inch of snow on the ground; however, the number of such days varied greatly from year to year.

vi) The average relative humidity in mid-afternoon was about 60 percent. Humidity was higher at night, and the average at dawn was about 80 percent.

vii) During a typical 24-hour period, it was sunny approximately 70 percent of the day in the summer and 40 percent of the day in the winter.

viii) The prevailing wind direction was from the southwest, and the average wind speed was generally highest (i.e., 12 miles per hour) in the spring.

2.4.4 Ecology

As part of the landscape environmental evaluation completed by Christopher B. Burke Engineering, Ltd. (CBBEL), a survey of flora and fauna indigenous to the study area was completed and presented in the approved Environmental Evaluation Report. The Indiana Department of Natural Resources (IDNR) was also contacted to obtain a list of Federal- and State-classified endangered or threatened species that exist in the State of Indiana. This list was also provided in the Environmental Evaluation Report.

2.5 GEOLOGY AND HYDROGEOLOGY

2.5.1 Regional Geology

The information on regional geology included in this subsection was obtained primarily from the June 5, 1987 "Geologic Setting of the Four County Landfill, Fulton County, Indiana" report by GRA and the January 27, 1988 CME by Jacobs.

The bedrock in the area of the Site in Fulton County is covered by a mantle of unconsolidated glacial deposits. Area bedrock consists of middle Devonian Age carbonate rocks, which are part of the Muscatatuck Group. A bedrock core from a well located approximately 2.5 miles east of the Site is described in Doheny, et al. (1975). At that location, there are 67.1 feet of lithographic to bioclastic limestone and fine-grained to saccharoidal dolomite belonging to the Devonian Age Traverse and Detroit River Formations. These Devonian formations overlie 11.9 feet of vuggy Silurian dolomite, assigned to the Salina Formation, which, in turn, overlies 173.7 feet of fine-grained Silurian dolomite assigned to the Wabash Formation. A similar sequence of thick limestone and dolomite bedrock would be expected beneath the Site. A structure contour map of the top of the Detroit River Formation (Devonian) prepared by Doheny, et al. (1975) suggests that the bedrock units dip gently to the north or northeast at about 10 feet per mile, away from the Kankakee Arch and toward the Michigan Basin structural feature.

The bedrock in Fulton County is unconformably overlain by glacial deposits that range in thickness from 100 feet to more than 250 feet (Gray, 1982). Regionally, northwestern Fulton County is located between areas known to have been covered by the southwesterly portion of the Michigan Lobe ice and the southeasterly portion of the Huron-Erie Lobe ice. The resultant, complex stratigraphy is typical of interlobate glaciated areas. Wisconsinan Age glacial deposits in Indiana include ground moraine deposits, end moraine deposits, and ice-contact stratified drift of the Trafalgar, Lagro, and Atherton Formations (Schneider and Keller, 1970). The ground moraine is relatively flat lying and consists of till or unsorted gravel, sand, silt, and clay that was deposited by advancing and retreating glaciers. End moraine sediments, comprised primarily of till with smaller areas of stratified

sand and gravel, were deposited as ridges. These ridges mark the maximum extent of the ice or a pause in glacial retreat. The Maxinkuckee end moraine forms a prominent ridge in western Fulton County. Smaller areas of Wisconsinan Age, ice-contact stratified sand and gravel, which were deposited by running water at the margins of the ice, also occur throughout the region (Schneider and Johnson, 1967).

Additional glacial deposits include valley train and outwash sand and gravel, dune sands, and lake sediments of the Atherton Formation. Sand and gravel were deposited by melt water streams that flowed from the margins of the glacier and meandered back and forth creating outwash plains. As the ice continued to recede, wind reworked the outwash deposits into dunes. Layers of clay, silt, and fine sands were formed in areas where water was temporarily impounded in lakes or ponds. The general location of the Site relative to these deposits is shown in Figure 2.5. The Site is situated on the Delong end moraine, which overlies glacial outwash sand and gravel.

2.5.2 Site-Specific Geology

Unconsolidated sediments at the Site are up to 220 feet thick, consisting of four major lithostratigraphic units (Units A, B, C, and D), and overlie carbonate bedrock. Figure 2.6 is a generalized stratigraphic section of the Site, prepared by GRA. The Site-specific stratigraphy was characterized primarily by GRA in a memorandum report to RSC on January 11, 1988. The original framework was refined after extensive drilling work in 1988 and 1989 and presented in the two GRA "Memorandum Reports" (April 28, 1989 and December 15, 1989). The four relatively distinct stratigraphic units and the bedrock encountered at the Site are described in detail in the following subsections. Structure maps for the top of stratigraphic Units B and C and the base of Unit C are provided in Figures 2.7, 2.8 and 2.9, respectively.

2.5.2.1 Unit A

Stratigraphic Unit A consists of a sequence of four, distinct subunits of loam and silt loam glacial till that probably represent separate phases of glacial deposition (Figure 2.6). From top to bottom, the stratigraphy is comprised of: (1) a surficial, brown, weathered loam till (subunit A1); (2) a mixture of gray, silt loam and loam till (subunits A2 and A22); and (3) a brittle, hard, olive-gray silty till (subunit A3). Groundwater in the Unit A till sequence occurs in discontinuous perched zones within stratified intertill sand and gravel deposits. Several piezometers and an older series of monitoring wells have been installed in Unit A but these wells do not yield significant quantities of water and do not have consistent water level readings.

2.5.2.2 Unit B

Stratigraphic Unit B (a glacio-lacustrine sequence) underlies Unit A and is comprised of well-stratified, fine to medium-grained sand and interbedded silt. At most locations, a very sharp basal contact with the Unit A till sequence was observed (i.e., a thin weathering zone marked by an oxidized loam or a brown pebbly sand). Although the contact between Units A and B varies considerably in elevation across the facility, Unit B has a relatively uniform thickness of 28 to 42 feet and appears to contain three major silt beds: one near the top, a second in the middle portion, and a third marking the base. The silt bed in the middle portion of the unit appears to be continuous and serves as a marker horizon. The base of Unit B (i.e., the top of Unit C as illustrated on Figure 2.8) is also an irregular surface, with a pattern similar to the top of Unit B and is arbitrarily mapped at the bottom of the lowermost silt bed.

Unit B is interpreted as a subaqueous deposit associated with a prograding delta front. The water table generally lies within Unit B, at an elevation between approximately 725 and 730 feet amsl.

2.5.2.3 Unit C

Soil samples collected from borings completed through Unit C suggest that the unit consists of glacio-fluvial sediments composed of an upper (upward fining) sequence overlying a lower (upward coarsening) sequence that cuts unconformably and irregularly into an older glacial till (Unit D). The top of the upper sequence is gradational with the overlying Unit B and is arbitrarily placed at the base of the lowest silt bed in Unit B. The upper part of Unit C coarsens downward to a zone of coarse sand, sandy gravel, and gravel, designated as subunit C2.

Subunit C2 is comprised of a more permeable sand and gravel layer that occurs at elevations between 680 and 690 feet amsl. Below subunit C2, the top of the lower sequence is marked by a discontinuous pebbly loam ("diamict") or a zone of massive, gray, silty mud. Fine sands are also found in this interval. The pebbly loam contains abundant stratified material and is interpreted as a proximal mud flow adjacent to an advancing ice lobe. The gray, silty mud and fine sand units possibly represent lower energy deposition in ponded areas adjacent to and resulting from the mud flow(s). Regardless of their origin, the silty mud and fine sands are closely associated, and where present, separate Unit C into an upper and lower sequence.

Although Unit C wells installed in 1988 and 1989 are identified by subunit C1 to C4 designations (e.g., P-27C3), these subunits are not intended to be part of a formal stratigraphic hierarchy. Rather, they are informally defined and related primarily to the elevation of the coarser "C2" horizon, as well as the relative contacts with Units B and D.

The lower sequence of Unit C thins from north to south. In the northwest quadrant, over 100 feet of sand and gravel underlie the "muddy zone" of Unit C and directly overlie Devonian carbonate bedrock. At the southern margin of the southwest quadrant, the lower sequence of Unit C is approximately 5 feet thick and overlies glacial till (Unit D). The base of Unit C slopes steeply to the north, as illustrated in Figure 2.9. The thickness of Unit D at selected data points is also depicted in Figure 2.9.

2.5.2.4 Unit D

Stratigraphic Unit D consists of unconsolidated loam or finer-textured glacial till that has been entirely removed in certain areas, presumably by glacial meltwater scouring. Where present, the till unconformably overlies carbonate bedrock of Devonian Age. The maximum thickness of Unit D is 47 feet, in the southwest quadrant of the Site. The unit thins abruptly to the north and is cut out by sand and gravel in the lower part of Unit C. The basal portion of Unit D is appreciably more clayey and reddish than the upper portion. It is not known whether this is related to the incorporation of residual clay soil material into the basal portion of a single till unit, or whether two distinct till units exist. No geotechnical analyses of the basal till were performed because of the very mixed nature of the circulated mud-rotary samples from this depth.

2.5.2.5 Bedrock

Bedrock beneath the facility is comprised of carbonate (limestone and dolomite) bedrock of middle Devonian Age, probably of the Detroit River Formation. Approximately 4 feet of light-gray to dark-brown, fine-to coarsely-crystalline limestone and dolomite were penetrated at four separate locations at the Site. A detailed description of bedrock in Fulton County is provided in Section 2.4.1.

2.5.3 Regional Hydrogeology

The regional hydrogeology information included in this subsection was obtained primarily from the CME (Jacobs, 1988). According to Rosenshein and Hunn (1964), "... few water wells have been drilled into the rocks of Devonian [Age]," and "[a]lthough these limestone and shales are not extensively used as a source of water in Fulton County, they are a potential source of water of which quality and quantity available is uncertain." Reportedly, a well located in Richland Township (directly east of the Site) was installed in limestone and had a drawdown of 50 feet after being pumped for 2 hours at 10 gallons per minute (Rosenshein and Hunn, 1964).

Glacio-fluvial sand and gravel deposits are the chief sources of groundwater for domestic, livestock, industrial, and public supplies in Fulton County (Rosenshein and Hunn, 1964). Both confined and unconfined aquifers are present within the unconsolidated deposits. Wells that tap these aquifers are generally less than 150 feet deep and yield from 5 to 1,000 gallons per minute (gpm). Water hardness typically is between 200 to 450 parts per million (ppm), and iron content is generally higher than the secondary maximum contaminant level (SMCL) of 0.3 ppm established in the Safe Drinking Water Act of 1974. Examples of ionic species concentrations are: iron at 0.1 to 7.5 ppm, bicarbonate at 151 to 532 ppm, sulfate at 5 to 175 ppm, and hardness (as calcium carbonate) at 180 to 540 ppm (Rosenshein and Hunn, 1964).

Glacial till deposits in Fulton County are not a viable source of groundwater. These fine-grained, heterogeneous deposits typically are not sufficiently extensive and cannot transmit water at the rate necessary to sustain yields for even modest domestic supplies (Dames & Moore, 1988).

As reported in the "CAP Task I - Description of Current Conditions" by GRA, groundwater is used for domestic supply at some locations within a 0.5-mile radius of the Site. Appendix D of this RI Report contains private water well logs obtained by GRA from the files of the IDNR Division of Water. The groundwater supply in the general area appears to be derived from the glacio-fluvial aquifer corresponding to the stratigraphic Unit C (GRA, CAP Task I, 1989).

Based on regional topography and nearby surface water locations and elevations, the regional groundwater flow direction appears to be north and northeast, toward the Tippecanoe River. The hydraulic conductivity (permeability) of the glacio-fluvial and glacio-lacustrine aquifers could be expected to fall within the range of 10^{-1} to 10^{-5} cm/sec (Fetter, 1988).

2.5.4 Site-Specific Hydrogeology

Several rounds of water level data were collected by GRA in 1989 and tabulated according to separate "hydrostratigraphic" units (including Units B, C1, C2, C3, and C4). Water table contour maps generated from these data generally indicate a north to northeasterly groundwater flow direction with a very gentle horizontal gradient and a negligible vertical gradient.

As described in the "Hydrogeologic Assessment Report" (January 12, 1988), Dames & Moore completed slug tests in 1987 to determine the hydraulic conductivity at five monitoring wells installed in Units B and C. The hydraulic conductivity values, which were calculated by using two separate analytical solutions, ranged between 10^{-6} and 10^{-4} cm/sec (Table 2.2). By using the average hydraulic conductivity values derived from the field slug tests, the laboratory permeability tests of Unit B and Unit C aquifer material, and representative ranges of the Site hydraulic gradient and effective soil porosity, Dames & Moore estimated groundwater flow velocities between 4.8×10^{-8} and 1.6×10^{-5} cm/sec (0.05 to 17 feet per year).

2.6 SOIL

2.6.1 Regional

The regional soils information included in this subsection was obtained primarily from the U. S. Soil Conservation Service document entitled "Soil Survey of Fulton County, Indiana", which was completed by G. Franklin Furr, Jr., in July 1987. According to Furr, northwestern Fulton County is dominated by the Wawasee soil series, which consists of deep, well-drained, moderately permeable soils formed on glacial till plains and moraines. Slopes range from 2 to 18 percent. The thickness of the upper part of the profile, where soil formation processes are active, is approximately 28 to 40 inches. The A horizon is medium-acid to neutral and consists predominantly of fine, sandy loam and lesser amounts of sandy loam and loam. The B horizon is generally a loam or sandy clay loam, with strongly

acid to neutral reactions, and the C horizon is primarily composed of a fine sandy loam or loam. These soil horizons (i.e., A, B, and C) should not be confused with the stratigraphic Units A, B, C, and D.

2.6.2 Site Specific

During past drilling activities conducted at the Site, numerous Shelby tube and split-spoon soil samples were collected, inspected, and analyzed for geotechnical parameters. For example, the Dames & Moore "Hydrogeologic Assessment Report" dated January 12, 1988, presents the results of soil classification tests completed for samples collected during the 1986 and 1987 investigations from the Unit A till sequence (Table 2.3). The sample classifications were determined based upon sieve analysis, hydrometer testing, and/or Atterberg limits testing, and the soils were designated according to the U. S. Department of Agriculture's (USDA's) system and the Unified Soil Classification System (USCS).

The results of laboratory permeability testing for the samples collected by Dames & Moore between 1986 and 1987 are also shown in Table 2.3. In general, the falling head permeability tests indicate that the Unit A soils have permeabilities ranging from 10^{-8} to 10^{-5} cm/sec. Several representative soil samples were also analyzed for cation exchange capacity (CEC) and calcium carbonate equivalency. The CEC results ranged from less than 1 to a high of 18.3 milliequivalents (meq)/100 grams. The higher CEC values were generally measured in the upper glacial soils (Unit A), the interbedded silt layers, and the till material (Unit D) underlying the sand and gravel aquifer, all of which have moderate to low percentages of silt and clay-size material. The lower CEC values (less than 1 meq/100 grams) were measured in the predominantly sand deposits of the glacio-lacustrine sequence (Unit B) and the glacio-fluvial sequence (Unit C). The soil analytical results and the pH and acid reaction tests completed by Dames & Moore in the field indicated a "closed-environment condition," with no evidence of oxidized or weathered zones from previous soil development within the Unit A till sequence (Dames & Moore, 1988).

During the 1988 and 1989 investigations by GRA, selected soil samples were analyzed for CEC, calcium carbonate equivalency, and texture (including sieve and hydrometer testing). The results of these tests are summarized in Tables 2.4 and 2.5. The CEC values fell into a fairly narrow range, 2.3 to 5.9 meq/100 grams, probably because all of the GRA samples were collected from Unit A. The calcium carbonate equivalency values ranged from 18.8 to 28.8 percent, which are comparable to the data obtained by Dames & Moore during their investigation of Unit A.

3.0 PREVIOUS DATA

3.1 GENERAL

A substantial analytical database was compiled prior to the commencement of the RI at the Site. This section summarizes the analytical data compiled prior to the RI for the various environmental media including groundwater, soil, sediment and surface water, air and landfill gas, biota and residential wells. Prior to commencing the RI, these data were compiled and evaluated to identify data gathering requirements and establish a scope of work for the RI.

3.2 GROUNDWATER

Quadrant by quadrant summaries of the on-Site groundwater sampling data collected prior to the RI are provided in Appendix E. These tables contain data associated with monitoring wells and piezometers screened in stratigraphic Units A, B, and C, as referenced in the approved RI/FS Work Plan. The data indicate that the wells and piezometers installed at the Site were sampled over several different time periods for a variety of analytical parameters.

During previous investigations, the groundwater beneath the Site was found to contain chlorides in addition to various organic and inorganic species. Organic compounds which have been detected in collected groundwater samples during previous investigations included VOCs and base-neutral and acid extractable compounds (BNAs). VOCs detected in collected samples included non-halogenated aromatic compounds such as benzene, toluene, ethylbenzene and xylenes (BTEX); halogenated aliphatic compounds including chlorinated solvent-related compounds; chlorofluorocarbons such as fluorotrichloromethane; and ketones. BNAs commonly detected in collected groundwater samples included phenol and phthalate-related compounds.

Although numerous groundwater samples were collected during previous investigations, analytical results from a consistent network

of monitoring wells for a consistent list of analytes were not available. Furthermore, sampling and quality assurance procedures have been inconsistent. Therefore, one significant objective of the RI was to collect representative groundwater samples from the various stratigraphic units beneath the Site and analyze these samples for a consistent list of analytes under strict quality assurance procedures.

3.2.1 Existing Unit A Data

In general, the greatest number and magnitude of organic compound detections occurred in groundwater samples collected from wells and piezometers screened in Unit A. More specifically, the greatest number of organic compounds and magnitude of detections occurred in Unit A monitoring wells and piezometers located in the northwest quadrant (P-10, P-12A, P-14A, P-26A and P-34A) and southwest quadrant (P-2) where unlined landfill deposits are present. Various inorganic analytes including metals, nitrates, sulfates, and chlorides were detected in samples collected from Unit A monitoring wells.

3.2.2 Existing Unit B Data

Although some organic compounds were detected in groundwater samples from Unit B, the number of detected compounds and the magnitude of the detections are generally lower in Unit B than in Unit A. Concentrations of VOCs in the affected Unit B wells appeared to steadily decline with each subsequent sampling event. However, one Unit B well located in the northwest quadrant (MW-33B) showed consistent detections of 1,2-dichloroethane over time, with no indication of declining concentrations. Over the course of eleven sampling events between November 1988 and October 1990, this compound was detected at a maximum concentration of 1,100 micrograms per liter (μg/L). However, the analytical results of groundwater samples obtained from monitoring wells and piezometers screened within Unit B along the northern and northeastern margins of the property (MW-31B, MW-30B, MW-23B, P-8B, and P-7B) did not indicate the presence of VOCs in the downgradient direction.

3.2.3 Unit C Data

Only a few organic compounds were detected sporadically in groundwater samples collected from Unit C monitoring wells and piezometers. The concentrations of detected organic compounds are generally several orders of magnitude lower than the groundwater samples collected from monitoring wells completed within Unit A.

3.2.4 Gross Alpha and Gross Beta Data

The groundwater database compiled by ERM during the preparation of the SOW was reviewed for gross alpha and gross beta detections. During the period from December 1982 through September 1989, selected on-Site monitoring well/piezometers were sampled for gross alpha and gross beta activity. Groundwater samples were collected from monitoring wells screened in stratigraphic units A, B and C. A number of the monitoring wells sampled for gross alpha and gross beta were screened across multiple stratigraphic units. Results of these analyses are summarized on Table 3.1. The maximum contaminant level (MCL) for gross alpha is 15 picoCuries per Liter (pCi/L) and four millirems per year (mrem/yr) for gross beta (total body count or critical organ dosage).[4] Gross alpha detections exceeded the MCL sporadically at four monitoring wells (MW-20, MW-21S, MW-23S and MW-24L2). The reported concentrations for gross beta (in pCi/L) is not convertible to total body count or critical organ dosage. However, a concentration of 50 pCi/L gross beta is a screening level whereby the need to analyze for specific radionuclides is evaluated. The concentration of gross beta exceeded 50 pCi/L sporadically at seven locations (MW-20, MW-21S, MW-23S, MW-24L2, MW-27S, MW-28M and MW-28S).

During the period from September 1983 and December 1987, groundwater samples collected from MW-20 were collected and analyzed for gross alpha and gross beta activity on eleven occasions. The

[4]U.S. EPA Office of Water, Drinking Water Regulations and Health Advisories, May 1995.

concentration of gross alpha radiation marginally exceeded the MCL of 15 pCi/L only twice during this period (September 1983 and February 1985). Gross beta exceeded 50 pCi/L in groundwater samples collected from MW-20 during six sampling events conducted during the period of September 1983 to February 1985. The measured gross beta activity in samples collected from MW-20 ranged from 18.7 pCi/L to 200 pCi/L. However, during three subsequent sampling rounds conducted between September 1986 and December 1987, the concentrations of gross beta were substantially below the MCL and continued to decline steadily during this period ranging from 11 pCi/L in September 1986, down to 1.3 pCi/L in December 1987.

On the basis of the existing database pertaining to gross alpha and gross beta radionuclides in groundwater samples collected from on-Site monitoring wells and piezometers, characterization of the groundwater with respect to these analytes was conducted during the RI. These additional characterization activities are detailed in Section 4.5.2 and the results of these activities are reported in Section 5.4.5.

3.3 SOIL

Field screening measurements obtained by GRA in 1989 using a photoionization detector (e.g. HNu photoionizer) and the headspace technique suggest the presence of organic contamination in soil beneath the northern portion of the General Refuse Area. Headspace screening results obtained by GRA were reported in Appendix J of the GWAP (RSC, 1990). Headspace screening results obtained by GRA are provided in Table 3.2 and the locations of the boreholes where GRA headspace screening results were obtained are presented in Figure 3.1. Information regarding the specific field procedures and instruments used to perform headspace screening were not provided in the GWAP.

3.4 SEDIMENT AND SURFACE WATER

In August 1985, the ISBH collected sediment samples from King Lake for laboratory analyses of pesticides, PCBs, metals, and cyanide. Pesticides, PCBs and cyanide were not detected and the metals which were detected in sediment fell within the range of normal background concentrations (GRA, CAP Task I, 1989).

During the June 1986 U.S. EPA Task Force investigation, four surface water samples were collected at the following locations:

i) the inlet to the culvert beneath County Highway 525 North,

ii) the southwest retention pond,

iii) run-on at the southwest ditch, and

iv) runoff from the southwest ditch.

Collected surface water samples were analyzed for selected VOCs (toluene, acetone, chloroform, carbon tetrachloride, methylene chloride, benzene, 1,1,1-trichloroethane, 1,1-dichloroethane, trichloroethene and 2-butanone), selected SVOCs (phenol, nitrobenzene, bis(2-ethylhexyl)phthalate and benzoic acid), lindane, target analyte list (TAL) total and dissolved metals, purgeable organic carbon (POC), purgeable organic halogens (POX), total organic carbon (TOC), total organic halogens (TOX), total phenol, ammonia nitrogen, nitrate nitrogen, sulfate, chloride, cyanide, nitrite nitrogen and bromide. Analytes detected in surface water data acquired by the U.S. EPA Task Force during the 1986 evaluation of the Site are summarized in Table 3.3. Except for TOC and TOX, most of the analyte concentrations detected in samples collected from the southwest ditch were greater for the runoff than the run-on. Several VOCs were detected in the southwest retention pond surface water sample, including toluene at 430 μg/L and 1,1,1-trichloroethane at 160 μg/L. In addition, total chromium at 65 μg/L, total lead at 54.5 μg/L, total mercury at 0.3 μg/L, and total phenol at 22 μg/L were also detected. Additional analytes which were detected are summarized in Table 3.3.

The surface water data were acquired by the U.S. EPA Task Force prior to the issuance of the NPDES permit (No. 0048097 which was executed by IDEM's Assistant Commissioner of Water Management on September 24, 1986) for the outfall from the northeast retention pond. The NPDES permit specifies particular analytes, sampling frequencies and protocols for collecting samples from the approved outfall from the northeast drainage control basin under discharge conditions (i.e. during periods when water is being discharged from the northeast drainage control basin). Since the U.S. EPA Task Force investigation preceded the issuance of the NPDES permit, the U.S. EPA's surface water data are not directly comparable to the NPDES permit limitations since the surface water samples were not collected in a manner consistent with the NPDES permit requirements. However, the surface water sample collected in the northeast quadrant at the culvert beneath County Highway 525 North contained no significant concentrations of contaminants (U.S. EPA, 1987).

As described in the USGS administrative report entitled "Assessment of the Geology, Groundwater Flow, and Groundwater Quality at Four County Landfill, Fulton County, Indiana" (Greeman, 1988), IDEM tabulated the results for four surface water samples collected at the NPDES discharge point in 1986 and 1987. Although no organic chemicals were detected in three of these samples, one sample contained 17 VOCs detected at or above 100 μg/L (Greeman, 1988).

An evaluation of sediment and surface water both on- and off-Site sediment and surface water was conducted during the RI. Section 4.3 details the investigative activities performed to evaluate sediment and surface water quality and Section 5.2 summarizes the analytical data obtained as a result of these activities.

3.5 AIR AND LANDFILL GAS

In May 1988, Dr. Robert B. Jacko, Professor of Environmental Engineering at Purdue University, conducted an air emissions study of the landfill over an approximate 7-hour period, during a

typical operating day (GRA, CAP Task-I, 1989). Monitoring and analyses were conducted for suspended particulates, size distribution, particulate adsorbed organics, vapor phase organics, and metals. In a November 1988 report, Dr. Jacko concluded that pollutants were either not detected or were present at concentrations many times lower than established allowable air standards. Dr. Jacko also concluded that no pollutants exist in the ambient air downwind from the Site that would compromise the health of individuals working or residing in the area.

Investigative activities were conducted during the RI to further evaluate air emissions and landfill gas. These investigative activities are summarized in Section 4.4 and the results of these activities are presented in Section 5.3.

3.6 BIOTA

As described in the March 24, 1987 ISBH memorandum, the concentration of metals, total PCBs, pesticides, and pesticide degradation products in fish tissue samples collected from King Lake in August 1985 were below action levels established by the U. S. Food and Drug Administration.

The U.S. Fish and Wildlife Service's Indiana Field Office conducted a survey of contaminants in selected biota near the Site during the summer of 1987. The report, which was released in October 1988, contains the analytical results for whole-body tissue samples of fish, anurans (frogs and tadpoles), crayfish, and small mammals (mice and shrews). Analysis of the various tissues included organochlorine chemicals, PCBs, and metals. In addition, crayfish tissue was analyzed for polynuclear aromatic hydrocarbons (PAHs). All of the organisms were collected from areas receiving or potentially receiving surface water runoff from the Site, and the analyte values were compared with those measured in organisms collected from a control area to the northeast of the landfill (Lake Maxinkuckee).

The results of the study indicated that the prevalence and concentration of inorganic analytes (i.e., heavy metals) may be statistically

greater in tissue samples from biota collected from the wetland basin receiving flow from the NPDES outfall, and from the east-flowing, wooded drainageway to King Lake. Analytes specifically noted were manganese, aluminum, zinc, cadmium, mercury, and nickel.

3.7 RESIDENTIAL WELLS

The sampling and analysis of private water wells in the vicinity of the Four County Landfill began as early as 1981 (GRA, CAP Task I, 1989). In 1986, ISBH sampled domestic water wells near the landfill to address some of the local citizens' concerns. Although some of these wells contained heavy metals and bacteria, the contamination at several residences was attributed to improper well construction or localized sources of contamination such as septic systems or feed lots (ATSDR, 1990).

Since October 1986, several residential wells have been sampled by Fulton County approximately twice a year, using a fund established by EWC. The laboratory data (without a description of the sampling or analytical procedures) have been reported to the Hazardous Substance Committee of the Fulton County Auditor's office by:

i) Brookside Farms Laboratory Association, Inc. in Knoxville, Ohio between October 1986 and August 1987; and

ii) Environmental Health Laboratories in South Bend, Indiana beginning in March 1988 and continuing through the present.

The existing residential well data were compiled on a computer database which was transmitted to IDEM under cover of a memorandum dated December 18, 1995. This memorandum provided a brief summary of the existing data, the dates of the various monitoring events, the analytes monitored and analytical procedures employed by the laboratory. This memorandum and the associated residential well summary tables for the period from March 1988 through June 1995, are reproduced in Appendix F.

The residential well data compiled during the period of March 1988 to June 1995 indicate that there have been no exceedences of the maximum contaminant levels (MCLs) promulgated under the Safe Drinking Water Act for VOCs, SVOCs or gross alpha and gross beta radionuclides. One exceedence of the MCL for nickel was observed during a single sampling round at one residential well. However, the MCL for nickel was not exceeded in numerous subsequent samples collected at this location. An exceedence of the MCL for arsenic was observed at a residential well located at least 0.5 miles southwest of the Site. However, based on available groundwater flow data, this residential well is located upgradient of the Site. Additionally, exceedences of the MCL for arsenic were not observed in samples collected from on-Site monitoring wells and piezometers screened at similar depths as the residential well. Therefore, this detection of arsenic is not considered to be related to the Site. Exceedences of the secondary MCLs for iron and manganese were ubiquitous during regular monitoring events. This trend is attributable to the regional groundwater chemistry rather than being Site-related.

4.0 REMEDIAL INVESTIGATION

4.1 GENERAL

This Section summarizes the source characterization data compiled during the RI as well as describes the activities performed during the RI to date, to delineate the nature and extent of contamination. The investigative activities performed during the RI were conducted in accordance with the protocols detailed Sampling and Analysis Plan (SAP) presented in Appendix H, Section H.1 of the approved RI/FS Work Plan which included a Field Sampling and Analysis Plan (FSAP) and a Quality Assurance Project Plan (QAPP).

4.2 SOURCE CHARACTERIZATION

As indicated in the February 26, 1987 RCRA Part A Permit Application, the facility accepted RCRA-hazardous wastes consisting of heavy metals, wastewater treatment sludge, oven residues, petroleum refining wastes, steel mill emission control dust/sludge, lead smelting emission control dust/sludge, and corrosive materials. According to the June 1987 RCRA Part B Permit Application, the wastes accepted at the Site were generally: (1) listed as hazardous because of the inorganic constituents (heavy metals) present, (2) characterized as hazardous because of corrosivity or Extraction Procedure (EP) Toxicity, or (3) classified as F001 through F005 wastes. Ignitable, reactive, or incompatible wastes were generally not accepted for disposal (EWC, RCRA Part B Permit Application, 1987).

Prior to acceptance and disposal of wastes in Cell A, EWC stated that greater than 90 percent of the wastes accepted for disposal were characteristically nonhazardous (EWC, RCRA Part B Permit Application, 1987). However, the specific methods used to determine hazardous characteristics were not well documented. It is likely that materials containing heavy metals were co-disposed with wastes containing high pH materials (i.e., lime-stabilized treatment residues). Waste was delivered both in bulk and in drums (EWC, RCRA Part B Permit Application, 1987).

A detailed evaluation of the waste receipt records was performed to determine the specific types of waste delivered to the Site. These records include waste manifests, bills of lading, and landfill records. Consistent with the ruling handed down by the U.S. District Court, Northern District of Indiana (Cause No. S87-55), it was assumed that wastes delivered to the Site prior to August 20, 1986 were disposed of in the unlined areas of the Site and that waste which arrived on or after that date were disposed of in the engineered cells (lined cells). Table 4.1 summarizes specific waste streams delivered to the Site, an estimate of the volume of the shipments of each waste stream delivered and whether the waste was disposed of in the lined (after August 19, 1986) or the unlined disposal areas (prior to August 20, 1986). Table 4.2 presents a summary of hazardous wastes delivered to the Site and a description of these wastes.

Waste materials were transported to the Site by contracted haulers and generators in tandem, triaxle semitractor/trailer units and roll-off boxes. EWC stated that the approximate daily average was 10 truckloads per day, but ranged between 0 and 50 loads per day depending on weather, scheduling, and other factors. Net load weights generally ranged from 16 to 22 tons, with gross weights up to the legal maximum (EWC, RCRA Part B Permit Application, 1987). Vehicles formerly entered the Site from the southeastern corner, stopping at a laboratory for check-in and on-Site waste analysis before proceeding to individual cells for unloading. After June 1987, the office and laboratory were moved to the eastern parcel of property, across Indiana State Highway 17. Loads were then weighed and examined at that location before proceeding across State Highway 17 onto County Highway 525 North, to the entrance of the northwest quadrant of the facility.

4.3 SEDIMENT AND SURFACE WATER INVESTIGATIONS

As discussed in the approved RI Work Plan, sediment and surface water samples were collected to determine the impact of the waste deposits on Site, if any, on surface water and sediments in the vicinity of the Site. Sediment sampling points for eight on-Site locations and 12 off-Site

locations were identified as shown in Figures 4.1 and 4.2, respectively. Grab samples were analyzed for the compounds previously determined to be present or likely to be present including the U.S. EPA's Target Compound List (TCL) and the inorganic analytes on the U.S. EPA's Target Analyte List (TAL). Additionally, sediment samples were analyzed for TOC in order to assist with the determination of ecological risk factors. If surface water was present at any of the proposed locations, samples were collected and analyzed for the same constituents. Sample collection, handling and analytical protocols detailed in the approved RI/FS Work Plan were adhered to during sediment and surface water collection activities.

4.3.1 On-Site Sampling Locations

A total of eight locations were selected on the landfill property for collection of sediment and surface water samples. In general, these locations corresponded to areas of the landfill property which received surface water discharges from the landfilled areas. These areas included the southwest retention pond and the northeast drainage control basin.

One sediment and surface water sample was collected from the southwest retention pond adjacent to the unlined waste area (Figure 4.1). This sampling location was identified as being likely to contain sediment which has accumulated as a result of surface water runoff from the adjacent landfilled area.

Seven sampling locations were selected in the vicinity of the northeast drainage control basin. Five of these were located within the northeast drainage control basin and the remaining two were located near the outlet of the basin. The five samples within the basin were spaced at regular intervals around the perimeter of the basin. The purpose of these sampling locations was to determine the chemical quality of sediments which accumulated within the basin as a result of surface water runoff from adjacent areas. Two representative samples of were collected from the low area adjacent to the NPDES discharge point. These samples were representative of sediment accumulation as a result of discharge from the basin and as a result of runoff from adjacent land areas.

4.3.2 Off-Site Sampling Locations

Twelve locations off the landfill property were selected for the collection of sediment and surface water samples. Three separate drainage tributaries receive surface water runoff from the Site were outlined in the approved RI/FS Work Plan:

i) a low lying area located at the north of County Highway 525 North which receives runoff from the NPDES discharge point;

ii) a northwest-southeast trending drainageway which directs surface water from the eastern portion of the Site beneath Highway 17, toward King Lake; and

iii) a southeast-northwest trending drainageway which directs surface water across the southwestern portion of the Site toward the Tippecanoe River.

Four sampling locations were selected from the low-lying area receiving NPDES discharge as described in item i) above. One sample was obtained immediately adjacent to the culvert opposite the NPDES outflow. Two additional representative sampling locations were selected northwest of this culvert in the lowland area located between County Highway 525 North and County Road 1000 West. The final sample was collected from the upgradient (western) side of a culvert located beneath County Road 1000 West which allows water to drain into the lowland area between County Road 1000 West and County Highway 525 North.

Three sampling locations were selected in the northwest-southeast drainageway which directs surface water toward King Lake as described in item ii) above. Three samples were collected at regular intervals from the drainageway in the open area located west of the landfilled property to evaluate whether runoff from the Site has impacted this area.

Five sample locations were selected in the southeast-northwest trending drainageway which crosses the southwestern portion of the Site as described in item iii) above. Two sampling locations were selected at points far enough upgradient to avoid potential influence from a backup of the southwest retention pond. These two locations were selected as being representative of upgradient surface water and sediment quality in this area. The remaining three sampling locations were from areas receiving surface water runoff from the Site to the open area to the west of the landfilled property. These sampling locations were selected to evaluate impacts which may be present as a result of surface water runoff from the landfilled property.

4.4 AIR AND LANDFILL GAS SCREENING

Disposal of municipal wastes as well as hazardous waste occurred at the Site. Emissions of VOCs and airborne particulates may be of concern at any hazardous waste disposal site. At landfills, such as the Four County Landfill, where municipal solid wastes were disposed in addition to industrial and hazardous wastes, methane gas production resulting from the degradation of municipal solid wastes may result. However, VOCs and toxic metals were not detected at elevated levels during the 1988 air monitoring survey conducted during active operation of the landfill (see the discussion in Section 3.5).

On the basis of this information, emissions of methane gas, VOCs, hydrogen sulfide, and hydrogen cyanide were identified for further review during the RI. Additionally, whole air samples were collected during the RI for VOC analysis. Since particulate emissions under current Site conditions were expected to be a fraction of the particulate emissions from the Site under operating conditions, monitoring for particulate emissions was not conducted during the RI. As discussed in the approved RI Work Plan, the objectives of the air monitoring program were to screen for the compounds of concern and to provide data suitable for use in developing the baseline risk assessment.

4.4.1 Meteorological Conditions

Meteorological data collected during air monitoring activities included wind speed and direction, temperature, barometric pressure, and relative humidity. These data were collected at hourly intervals during air sampling activities using direct reading instruments. Additionally, general meteorological observations (overcast conditions, presence/absence of precipitation events, occurrence of fog and haze, etc.) were recorded regularly during the air sampling program.

Every effort was made to conduct the air monitoring under conditions of constant wind speed and direction and no significant meteorological changes were noted during these activities.

4.4.2 Site Inspection

In order to identify areas of the landfill where significant landfill gas emissions may occur, a detailed inspection of the landfill was conducted. The Site inspection was conducted on a 100 foot by 100 foot grid pattern. During the Site inspection, a portable combustible gas indicator was used in order to screen for the presence of combustible gases. Additionally, detailed observations were made in order to determine likely areas where landfill gas may be discharging to the surface. Such areas might be identified by lack of vegetation, the presence of deep cracks or fissures in the soil cover, gas bubbles in ponded areas, and unusual odors.

The only areas identified as a potential concern during the Site inspection were three locations where minor fissures in the soil cover were identified. These fissures were located in areas of relatively steep sideslopes on Cell A and the General Refuse Area. These minor fissures were observed in grid sections numbered 122, 128 and 131. Site grid locations are depicted on Figure 2.3. Gas emission monitoring using portable instrumentation was conducted at these areas and during the Site inspection to assess ambient conditions

4.4.3 VOC Monitoring

In order to evaluate VOC emissions which may be of concern to the population surrounding the Site, VOC monitoring was conducted. A total of 22 air samples were collected during two separate events (eleven samples per event). One event was conducted in June 1994 and the other in July of 1994. Six interior sampling locations and four perimeter sampling locations were selected during each sampling event. These sampling locations were selected on the basis of observations made during the Site inspection described previously and the observed wind direction on the days that sampling was conducted. The final sampling locations within the interior portions of the landfill were finalized on the basis of discussions between IDEM's project manager and CRA's project coordinator. During each sampling event, the perimeter samples were collected such that one sample was collected from an upwind location and the remaining three samples were collected from downwind locations.

Air samples were collected for VOC analysis using precleaned, evacuated stainless steel Summa® canisters equipped with pneumatic flow regulators. The flow regulators were adjusted to allow the Summa® canisters to gradually fill with air over a period of 12 hours. VOC determinations were performed in accordance with U.S. EPA Compendium Method TO-14. This VOC monitoring method identifies specific compounds at relatively low quantitation limits for use in assessing Site risk.

Every effort was made to locate sampling points as far away from outside VOC sources, such as the highway, as practical. Operation of equipment at the Site which may act as a VOC emission source was curtailed during the sampling events.

4.4.4 Hydrogen Sulfide, Hydrogen Cyanide and VOC Screening

Screening for hydrogen sulfide and hydrogen cyanide gas was conducted at the Site using portable, direct-reading instruments such as an HNu photoionization detector, a Passport™ LEL/O_2/H_2S meter and

Monotox hydrogen cyanide detector. These instruments provided real-time compound-specific data which was recorded in the field log at the time of monitoring. Typically, these instruments have a sensitivity of one part per million. During the two air sampling events, hydrogen sulfide and hydrogen cyanide were monitored and recorded hourly at 100-foot intervals during the perimeter walk.

4.4.5 Methane Gas Survey

A soil gas survey was conducted in order to assess the potential for landfill gas migration through the subsurface beyond the perimeter of the landfill. The soil gas survey was conducted at 100-foot intervals around the perimeter of the landfill near the fence line. This resulted in a total of 50 soil gas screening locations as depicted in Figure 4.3. The soil gas sampling procedure involved advancing a probe to a depth of approximately two feet below ground surface and application of a vacuum to draw a sample of soil gas through the probe which was subsequently removed. The concentration of methane was measured and recorded using a Gastech, Inc. Model NP-204 portable natural gas indicator.

4.5 GROUNDWATER INVESTIGATION

Prior to the RI, a significant database had already been compiled pertaining to geologic and hydrogeologic conditions beneath the Four County Landfill. However, additional investigative tasks were required to adequately determine the nature and extent of contaminants present beneath the Site, the location of any contaminant plumes, and to obtain further detail regarding hydrogeology of various stratigraphic units present beneath the Site. Although a detailed discussion of hydrogeologic conditions will be the subject of the OU2 RI report, a discussion of the activities conducted to characterize groundwater flow and on-Site groundwater quality is included herein for completeness.

4.5.1 Groundwater Sampling

In order to obtain a groundwater analytical database for a consistent list of parameters under strict QA/QC protocols to supplement the existing groundwater analytical database, groundwater samples were collected from a network of existing monitoring wells and piezometers. To date, groundwater samples have been collected on three separate occasions during the RI. The RI monitoring well network is summarized in Table 4.3. During each groundwater sampling event, water level and total depth measurements were obtained at each sampling point. Moreover, a photoionization detector was used to screen for the presence of VOCs at the well head. Analytical methodologies and procedures which were adhered to during the RI are provided in the FSAP summarized in Section 8.0 of the approved RI/FS Work Plan.

June 1994 Groundwater Sampling Event

The first round of groundwater samples were collected during June 1994. During this initial groundwater sampling round, monitoring well locations were selected to achieve extensive areal coverage of the Site and to collect representative groundwater samples from Units A, B and C, extending down to the more permeable subunit C2. To determine the extent of potential groundwater contamination attributable to the Site, one round of groundwater samples were collected and analyzed for constituents determined to be present on the basis of previous sampling data and constituents likely to be present on the basis of wastes disposed of at the Site. This comprehensive constituent list included TCL VOC, TCL semivolatile organic compounds (SVOC), TAL total and dissolved metals, TAL total cyanide, and the following landfill leachate indicator parameters:

i) pH,
ii) sulfate,
iii) chloride,
iv) nitrate,
v) ammonia,
vi) total dissolved solids (TDS),

vii) total suspended solids (TSS), and
viii) alkalinity.

A summary of the June 1994 groundwater sampling event is provided in Table 4.4.

April 1995 Groundwater Sampling Event

The second round of groundwater sampling occurred in April 1995. During the April 1995 sampling event, groundwater samples were collected from those monitoring wells where the complete list of analytes detailed above was not collected during the first sampling round due to the absence of groundwater in the wells (Unit A monitoring wells) or an insufficient volume of groundwater was available to collect the requisite sample volume for the complete list of analytes. Additionally, groundwater samples were collected from a few monitoring wells to confirm the detections of certain VOCs from the initial monitoring event. Two deeper monitoring wells, P-31C3 and P-31C4 were sampled for VOCs to determine if the VOCs detected in monitoring wells screened in the higher stratigraphic intervals were present in the deeper monitoring wells. A summary of the April 1995 sampling event is provided in Table 4.5.

4.5.2 Additional Groundwater Characterization

On the basis of the data developed during the initial sampling round conducted during June 1994 and the subsequent groundwater sampling event conducted during April 1995, additional on-Site groundwater sampling was proposed for 17 on-Site monitoring wells screened in the C3 and C4 stratigraphic units which have not been previously characterized during RI activities. Moreover, groundwater samples from a set of 42 monitoring wells were collected for characterization of gross alpha and gross beta radioactivity. The additional groundwater characterization activities were detailed in Addendum 1 to the RI/FS Work Plan. A summary of the October 1995 groundwater sampling event is summarized in Table 4.6.

Further Unit C Characterization

The lowermost stratigraphic unit investigated during the initial RI groundwater sampling round was Unit C2. During the subsequent RI groundwater sampling round conducted in April 1995, groundwater samples were collected from selected locations screened in the C3 and C4 units (P-31C3 and P-31C4) and selected Unit C piezometers where VOCs/SVOCs were detected during the initial sampling round (P-31C1, P-31C2, P-24C2, and P-5C2). Piezometers P-5C2, P-24C2, P-31C1 and P-31C2 were resampled in order to verify the presence of VOCs and SVOCs observed during the initial sampling round. Additionally, piezometers P-31C3 and P-31C4 were sampled to assess whether VOCs were present in the deeper stratigraphic units at this well cluster. Piezometer P-2C2 was not resampled since the elevated VOC detections at this location were consistent with analytical data obtained during numerous previous sampling rounds.

As discussed in the Groundwater Technical Memorandum, data developed during the previous sampling round indicated that VOCs were the most significant Site-related groundwater issue[5]. In light of the existing database for the Site, groundwater samples were collected from 17 C3 and C4 unit monitoring wells. These samples were analyzed for VOCs. Additionally, groundwater samples were analyzed for selected filtered and unfiltered TAL metals. The selected TAL metals were that suite of TAL metals displaying exceedences of the primary MCLs in any of the stratigraphic units investigated during the initial groundwater sampling round, namely; antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel and thallium.

Sampling protocols and analytical procedures which were summarized in the approved SAP (Appendix H of the RI/FS Work Plan) were adhered to during supplemental groundwater sampling of the remaining C3 and C4 monitoring wells.

[5]In general, due to the lower molecular weight and higher solubility (especially for ketones) characteristic of this contaminant group, they tend to be less effectively attenuated by geologic media and are, therefore, more mobile in the subsurface. Moreover, the subsurface concentration and greatest variety of contaminants found for any organic contaminant group were VOCs.

Gross Alpha and Gross Beta Radioactivity Characterization

In light of the historical data discussed previously in Section 3.2.4, additional groundwater sampling for gross alpha and gross beta radioactivity was undertaken to assist in the characterization of the Site with respect to these analytes. Monitoring wells selected for gross alpha and gross beta radioactivity monitoring included those locations where previous detections of gross alpha and gross beta radioactivity were noted, selected locations where elevated levels of organic contaminants were noted and other selected locations chosen to provide greater areal and vertical Site coverage.

A number of monitoring wells where historical exceedences of gross alpha and gross beta radioactivity regulatory criteria have occurred have since been abandoned. Consequently, monitoring wells and piezometers in close proximity to these locations which were screened at similar elevations were selected for sampling. A total of 44 on-Site monitoring wells were identified for gross alpha and gross beta sampling in Addendum 1 to the RI/FS Work Plan. However, two of the identified monitoring locations (P-26A and P-27A) were observed to be dry during the sampling event and, could not be sampled. Additionally, due to well construction concerns, monitoring location MW-5B was sampled instead of location P-1 during the sampling event. This change was made with the concurrence of IDEM oversight staff. In total, groundwater samples were collected from 42 on-Site monitoring wells and piezometers for gross alpha and gross beta radioactivity characterization.

An amendment to the QAPP was prepared to include these activities (as provided in Attachment B of Addendum 1). Analyses were conducted for gross alpha and gross beta activity. Groundwater sampling was conducted in a manner consistent with those protocols detailed in the approved the FSAP (Appendix H.1 of the RI/FS Work Plan).

4.6 GROUNDWATER FLOW

4.6.1 Hydraulic Monitoring

A significant database pertaining to groundwater flow was compiled during investigations previously conducted at the Site. These investigations have demonstrated that the general direction of groundwater flow in overburden deposits is toward the northeast. However, some variability exists in the interpretation of the data produced prior to the RI. This variability in the interpretation of the historic groundwater flow data (data produced prior to the RI) is primarily attributable to uncertainty introduced by the limited number and quality of groundwater monitoring points (particularly prior to 1989). For example, data generated in 1987 by Dames & Moore indicated that groundwater flow was towards the northeast beneath the Site except for a limited area located in the extreme northeastern corner of the Site where groundwater flow was towards the southwest. The southwestern groundwater flow pattern was attributed to the presence of a groundwater "trough" located in the northeast quadrant of the Site (Dames & Moore, 1987). However, this interpretation was based upon only nine monitoring wells screened near the water-table interface. This relatively small number of monitoring wells may have led to a misinterpretation of the actual groundwater flow pattern.

A considerably larger groundwater flow database was generated during 1989 from a greater number of monitoring wells and piezometers screened in multiple stratigraphic units. This information was reported in the 1989 Annual Ground Water Report (RSC, March 1989) A total of ten rounds of water level data were compiled during the period of June through December 1989 which indicated that groundwater flow beneath the Site is primarily north to northeast. These data are more consistent with the data generated during the RI as discussed in the following paragraphs.

During the RI, two rounds of hydraulic head data were collected from each of the 71 monitoring wells originally identified in the sampling network. Additionally, during the initial monitoring well inspection activities conducted in May 1994, and the April 1995 and October 1995 groundwater sampling events, water level data were obtained

from each of the piezometers screened in the B and C stratigraphic units. The collected groundwater elevation data are summarized in Table 4.7.

The elevation of a point at the top of the casing of each monitoring wells in the hydraulic monitoring network was established to the nearest 0.01 foot and referenced to mean sea level datum by a registered land surveyor. Data compiled during hydraulic monitoring tasks was used to prepare groundwater contour maps for stratigraphic units B and C. Additionally, the horizontal and vertical direction of groundwater flow beneath the Site was determined. Groundwater contour maps generated on the basis of these data are presented in Appendix G.

Stratigraphic Unit A

Unit A, the uppermost stratigraphic unit, consists of loam and silt loam glacial till. As reported in the RI Work Plan, groundwater in Unit A occurs in discontinuous perched zones within stratified intertill sand and gravel deposits. Piezometers and monitoring wells completed in Unit A do not yield significant quantities of water and do not have consistent water level readings.

During the initial sampling event, a total of ten Unit A piezometers were observed to be dry and another five piezometers produced insufficient water volume to permit sampling for the complete list of analytes. Two cross-sections have been generated depicting the screened intervals of selected Unit A and Unit B monitoring wells and piezometers (Figure 4.4 and 4.5). These cross-sections depict the water levels measured in the monitoring wells and piezometers during the RI. As shown in these figures, the occurrence of groundwater in Unit A is sporadic. Moreover, each of the Unit A piezometers is screened above the static water table. As shown in Figure 4.6, the static water table was observed to occur in Unit B and to a lesser extent, the lower portion of Unit A. This information is consistent with the information reported in the RI/FS Work Plan and previous Site investigations.

Stratigraphic Unit B

In spite of the drop in hydraulic head between May and July, the groundwater flow pattern within Unit B remained relatively constant. In general, groundwater flow in Unit B was observed to be towards the north to northeast across the Site. Groundwater mounding was observed in the vicinity of the northeast retention pond during both the May and July events. The mounding beneath the northeast retention pond was slight and amounted to between 0.2 and 0.3 feet during the study period. The mounding locally affected the groundwater flow direction in Unit B in the vicinity of the northeast retention pond.

The average horizontal hydraulic gradients observed across the Site were slight. The observed average horizontal hydraulic gradient in Unit B was approximately 0.0005 during May 1994 and 0.0004 during July 1994. The average hydraulic gradients were calculated by using the highest and lowest hydraulic head elevations observed in monitoring wells/piezometers during each sampling round in a direction approximately parallel to groundwater flow across the Site. Across the Site, the local hydraulic gradients varied. For instance, in the vicinity of the northeast retention pond where groundwater mounding was observed, local horizontal hydraulic gradients approached 0.002.

Stratigraphic Unit C

During the RI, hydraulic head data were collected from monitoring wells designated as C1, C2, C3 and C4 wells. Groundwater contour maps were generated using these data. The designation of the Unit C wells are not related to any formal stratigraphic hierarchy (see SOW Section 2.3.2.3, page 2-9). This lack of formality results in considerable variability in the elevation of the screened intervals between piezometers with similar subunit designations (e.g. C1, C2, C3 and C4) at different well nest locations. For instance, piezometer P-24C4 is completed at an elevation of approximately 655 feet while piezometer P-8C4 is completed at an elevation of approximately 575 feet. Piezometers with similar subunit designations do not appear to necessarily correlate to a particular stratigraphic unit or bed.

Additionally, piezometers with different subunit designations were found to be completed at nearly the same elevation. For example, piezometers P-4C2, P-29C2, P-28C2, P-5C3 and P-24C4 were all observed to be screened within ±3 feet of an elevation of 655 feet.

In order to minimize any uncertainty in the data which may result from significant variations in the screened interval and the presence of vertical gradients, wells screened at similar elevations were used as a basis to compile groundwater contour maps which are representative of Unit C. In general, four different elevation intervals within Unit C were selected. Piezometers screened in these intervals and which are appropriate monitoring points, were used to draw groundwater contour maps for the various elevation intervals within Unit C. These elevation intervals included 690 - 710 feet for the upper portion of Unit C, 665 - 685 feet and 635 - 655 feet for the middle portion of Unit C, and 580 - 625 feet for the lower portion of Unit C. The slightly greater elevation interval in the lower portion of Unit C was necessary to allow inclusion of enough points to compile groundwater contour maps for the lower interval. In some instances, due to the informal nature of the piezometer designations assigned previously, piezometers with different subunit designations appear on the same groundwater contour map since their screened intervals are at similar elevations. Piezometer elevation data appear on the Unit C contour maps provided in Appendix G.

Groundwater flow in each of these elevation intervals within Unit C was observed to be consistently towards the north to northeast during the study period. Average horizontal hydraulic gradients across the Site in Unit C were very slight, ranging from 0.0004 to 0.0007 during the RI.

4.6.2 Permeability Testing

Slug testing was conducted at the eight monitoring wells listed in Table 4.8. These monitoring wells are representative of monitoring wells screened in the B and C stratigraphic units in each of the quadrants of the Site. The purpose of conducting permeability testing was to determine

the range of in-situ hydraulic conductivities for various stratigraphic units and to compare these data to the existing data.

4.7 MONITORING WELL ABANDONMENTS AND MAINTENANCE

The approved RI Work Plan discussed the abandonment of a total of 20 existing groundwater monitoring wells and piezometers. However, in accordance with a Work Plan variance request (CRA memorandum to IDEM dated July 20, 1994), 17 wells were subsequently abandoned.

During the inspection activities, two monitoring wells (MW-1 and MW-7) could not be located. According to information supplied by Mr. Doyle Flory of Keramida Environmental, the monitoring wells at each of these locations had been plugged and buried during previous Site operations. Additionally, the Site inspection revealed that MW-8 was an active water supply well which, according to Mr. Flory, provides a non-potable water source required to perform Site maintenance activities. As requested by IDEM, a water sample was collected from this well and analyzed for the full list of groundwater target compounds identified in the RI/FS Work Plan. Analytical data for MW-8 indicated that TCL VOCs and SVOCs were not detected. Moreover, no exceedences of primary maximum contaminant levels (MCLs) for inorganic analytes were noted and only iron (total and dissolved) exceeded the secondary MCLs. On the basis of this information, it was concluded that MW-8 could serve as a suitable non-potable water source, and, therefore, was not abandoned.

All other monitoring well abandonments were conducted utilizing protocols approved by IDEM in a letter dated August 3, 1994. Monitoring wells and piezometers selected for abandonment included those with excessively long effective screen lengths (i.e. well screens and filter pack) which could facilitate hydraulic connection between distinct geologic units. In addition, monitoring wells and piezometers that were inappropriately constructed relative to existing standards were selected for abandonment.

A summary of monitoring well abandonments conducted during the RI is provided in Table 4.9. Monitoring wells and piezometers were abandoned consistent with State of Indiana regulations (310 IAC 16-10-2) in a manner which minimized the potential for continued cross-contamination between distinct geologic units beneath the Site. In general, and in accordance with the approved Work Plan, monitoring wells and piezometers were drilled out using a rotary drill rig or grouted with pure bentonite grout.

In addition to the well abandonments, four monitoring wells (P-2B, P-2C2, P-28A and P-5C4) were repaired during the RI.

5.0 NATURE AND EXTENT OF CONTAMINATION

5.1 DATA VALIDATION

Environmental samples collected during the RI were analyzed for the parameters detailed in the RI/FS Work Plan by Heritage Environmental Services, Inc. (HES) of Indianapolis, Indiana. Validation of the analytical data produced by HES was performed by the project QA/QC Officer based on the relevant criteria cited in the Site-specific QAPP. The evaluation of the analytical data for accuracy and precision was based on an assessment of QA/QC information which included field duplicate sample results, field (rinsate) blank data, laboratory method blank data, laboratory duplicate data, matrix spike/matrix spike duplicate surrogate compound spike and laboratory check sample recovery data. Based upon the results of the data quality assessments and validations, the analytical data are suitable for the intended use in this project with limited exceptions. Data qualifiers were assigned as appropriate and are included in each data summary table.

The laboratory analytical data and data validation reports for data generated since the submittal of the Groundwater Technical Memorandum are provided as Attachment I to this document.

5.2 SEDIMENT AND SURFACE WATER

The data from sediment and surface water samples compiled during the RI were initially reported in the document entitled "Environmental Evaluation Report, Four County Landfill Site, Fulton County, Indiana" (CRA, May 3, 1995). The Environmental Evaluation (EE) Report was prepared in accordance with Section 7.4.2 of the RI/FS Work Plan. The objective of the EE Report was to present a qualitative evaluation of the actual or potential ecological impact, if any, posed by chemicals of potential concern (COCs) on the ecosystem or parts of the ecosystems in and around the vicinity of the Site. Tabulated summaries of the sediment and surface water analytical data are provided in Appendix H.

5.2.1 On-Site Sediment and Surface Water

A total of eight on-Site sediment samples and seven on-Site surface water samples were collected during the RI.

5.2.1.1 Organic Compounds

A summary of organic compounds detected in on-Site sediments and surface water samples are provided in Figures 5.1 and 5.2, respectively. Only two VOCs (acetone and dichloromethane) were observed in collected on- Site sediment samples. Acetone was detected in five of the eight on-Site sediment samples collected during the RI. The detected concentrations of acetone observed in on-Site sediment samples ranged from 24J micrograms per kilogram (µg/kg) to 430 µg/kg. Dichloromethane (DCM), which is more commonly known as methylene chloride, was detected in four of the eight on-Site sediment samples. Detections of DCM ranged from an estimated concentration of 8 µg/kg to 15 µg/kg.

Only one SVOC (butylbenzylphthalate) was detected in sediment samples collected on-Site. Butylbenzylphthalate was detected in three of the eight on-Site sampling locations at concentrations ranging from 410 µg/kg to 1,100 µg/kg. Pesticides and PCBs were not detected in on-Site sediment samples collected during the RI.

Only one organic compound was detected in on-Site surface water samples collected during the RI. Specifically, acetone was detected at an estimated concentration of 16 µg/L in one sample collected from location S-6. However, acetone was not detected in a duplicate sample of surface water collected at that same location. Due to the absence of water, a sample of surface water was not collected at location S-7.

In general, only a few organic compounds were detected in on-Site sediment and surface water samples collected during the RI and none of the detected organic compounds exceeded applicable U.S. EPA or State of Indiana criteria.

5.2.1.2 Target Analyte List Metals and Cyanide

A summary of TAL metals and cyanide data in on-Site sediment samples collected during the RI is provided in Figure 5.3. A comparison of on-Site sediment metals data with published background levels is provided in Table 5.1. In general, the concentrations of metals analytes in on-Site sediment samples, collected from the northeast drainage control basin and the southwest retention pond, all fall within the expected normal background levels for soil. The concentration of total cyanide in on-Site sediment samples ranged from non-detectable to 1.8 mg/kg.

A summary of detected TAL metals and cyanide data for on-Site surface water samples is provided in Figure 5.4. Total cyanide was not detected in on-Site surface water samples collected during the RI. Only one metal, silver, was found to exceed the applicable ambient water quality criteria summarized in Table 5.2.

5.2.2 Off-Site Sediment and Surface Water

In total, 12 off-Site sediment samples and four off-Site surface water samples were collected during the RI. With the exception of the off-Site sediment and surface water samples collected at locations S-15 and S-16, the selected locations were in areas which receive runoff from the Site as described in Section 4.3.2. The remaining two locations, S-15 and S-16, were located far enough upslope of the Site to avoid potential influence resulting from a backup of surface water from the southwest retention pond (run-on drainage area). These locations would be representative of upgradient sediment and surface water quality.

5.2.2.1 Organic Compounds

A summary of the distribution of organic compounds detected in off-Site sediment and surface water samples is presented in

Figures 5.5 and 5.6, respectively. A review of the distribution of organic compounds indicates that only three VOCs (acetone, 4-methyl-2-pentanone and DCM) were detected in off-Site sediment samples collected during the RI. DCM was detected in six of the 12 off-Site sediment samples collected during the RI with detected concentrations ranging from 6 µg/kg to 22 µg/kg. DCM was also detected in the upgradient sediment sample collected at S-16 at a concentration of 15 µg/kg. Acetone was detected in three of the 12 off-Site sediment samples collected during the RI with detected concentrations ranging from 29 µg/kg to 49 µg/kg. There was only one detection of 4-methyl-2-pentanone at a concentration of 19 µg/kg. SVOCs and pesticides/PCBs were not detected in off-Site sediment samples.

Three VOCs, carbon disulfide, acetone and toluene were detected in off-Site surface water samples collected during the RI. Each of these three VOCs were detected in the sample collected from location S-15, the upgradient location in the run-on area. Acetone was detected in three of the four off-Site surface water samples at concentrations ranging from 12 µg/L to 27 µg/L. The highest concentration of acetone was detected in the off-Site surface water sample collected from the run-on area (S-15) south of the Site. Toluene was detected in two off-Site surface water samples at 6.1 µg/L (S-15 run-on area location) and 9.6 µg/L (S-10 location). Carbon disulfide was only detected in the run-on area sample collected at location S-15 at a concentration of 2.3 µg/L. Since each of these analytes were detected at similar concentrations in the upgradient and downgradient samples, these analytes are not considered to be a significant Site-related concern. SVOCs and pesticides/PCBs were not detected in off-Site surface water samples.

5.2.2.2 TAL Metals and Cyanide

A summary of TAL metals and cyanide data for off-Site sediment samples collected during the RI is provided in Figure 5.7. A comparison of off-Site sediment metals data with published background levels is provided in Table 5.3. In general, the concentrations of metals analytes in off-Site sediment samples each fall within respective expected normal background levels for soil. The concentration of total cyanide in off-Site sediment samples ranged from not detected to 0.31 mg/kg.

A summary of detected TAL metals and cyanide data for off-Site surface water samples is provided in Figure 5.8. In general, the widest variety of metals analytes were detected in the upgradient off-Site surface water sample collected at S-15, the upgradient location. With the exception of silver at location S-11, there were no exceedences of applicable ambient water quality criteria. Total cyanide was not detected in off-Site surface water samples collected during the RI.

5.3 AIR AND LANDFILL GAS

5.3.1 Volatile Organic Compounds

As discussed in Section 4.4, eleven air samples (ten samples plus one field duplicate sample) were collected during each of two separate sampling events. Six sampling locations were selected in the interior portions of the landfill. These locations were finalized on the basis of discussions between IDEM's project manager and CRA's project coordinator. Four perimeter sampling locations selected during each sampling event were configured such that one sampling point was located upwind and three sampling points were located downwind of the landfill. A summary of detected analytical data for the June 1994 and the July 1994 air sampling events are provided in Figures 5.9 and 5.10, respectively.

Acetone was the only VOC detected during the initial air sampling event conducted in June 1994. Acetone was detected at a concentration of 16 parts per billion (ppb) in the sample collected at AS-1, which was located near the northeast corner of Cell A. However, acetone was not detected in the field duplicate sample collected in a separate Summa® canister placed at this same location. VOCs were not detected in any of the samples collected at the perimeter of the landfill. Two VOCs, acetone and 1,1-DCE, were detected at concentrations slightly above the respective reporting limits during the second air sampling event conducted in July 1994. Acetone was detected at three locations including BG-5 (the upwind location), AS-12 and AS-15 at concentrations ranging from 12 ppb to 16 ppb. The second

VOC, 1,1-DCE was detected at AS-13 at a concentration of 2.7 ppb. However, 1,1-DCE was not detected in the field duplicate sample collected in a separate Summa® canister at this same location.

The air analytical data demonstrate that VOC emissions from the landfill are insignificant. The detections of acetone and 1,1-DCE are suspect due to the lack of data reproducibility demonstrated by the duplicate sample data.

5.3.2 Hydrogen Sulfide and Hydrogen Cyanide Screening Results

During the two air sampling events, direct readings for hydrogen cyanide (HCN), hydrogen sulfide (H_2S), total VOCs, lower explosive limit (LEL) and oxygen were obtained hourly during the perimeter walk of the Site. Readings were recorded at 100-foot intervals during the perimeter monitoring using direct-reading instruments during each of the two air sampling events. There were no detections of H_2S, HCN or combustible gases during perimeter air monitoring. Total VOCs were not detected above the instrument background readings and the oxygen concentrations recorded during each event were within the expected range (approximately 20.8 percent).

5.3.3 Methane Soil Gas Survey Results

As discussed in Section 4.4, probes were advanced to a depth of approximately two feet at 50 perimeter locations to monitor for the presence of methane gas. As depicted in Figure 5.11, detectable quantities of methane gas were noted at only two of these 50 locations. A 20 percent concentration of methane gas was noted at location GS-8 located adjacent to the general refuse area near the west property boundary. However, methane gas was not detected at probe locations advanced 50 feet to the north and 50 feet to the south of GS-8. Methane gas was also detected at GS-41 at a concentration of 10 percent. Location GS-41 is located in the northeast quadrant of the Site along the northern property boundary, approximately 200 feet from waste deposits.

Methane gas, attributable to the presence of waste in the landfill, was not observed near the property boundaries. Methane gas detections coincided with locations where peat was also present (GS-8 and GS-41). The presence of peat near the surface at each of the two locations was confirmed by a shallow excavation. Peat was not observed at the remainder of the perimeter probe locations where methane gas was not detected. Methane gas detections are most likely attributable to the ongoing decay of peat present at these locations rather than the decay of waste deposits in the landfill.

5.4 GROUNDWATER DATA

Tabulated summaries of groundwater analytical data compiled during the RI are provided in Appendix I. Analytical reports generated since the submittal of the Groundwater Technical Memorandum, are reproduced in Attachment I to this document.

5.4.1 Volatile Organic Compounds

A tabulated summary of VOCs detected in groundwater in samples collected from the Site are presented in Table 5.4. The following summarizes the groundwater VOC data compiled to date during the RI.

VOC Distribution - Unit A

The greatest number and magnitude of VOC detections occurred in groundwater samples collected from Unit A piezometers. Figure 5.12 presents the distribution of VOCs detected in Unit A piezometers. The piezometers exhibiting the greatest variety of VOCs are located near the west and northwest portions of the Site. As reported in the SOW and the Work Plan, borehole logs compiled during previous investigations indicate that several of these piezometers were installed within, or in close proximity to, waste deposits.

The most elevated VOC detections were observed at piezometers P-2A, P-10, P-12A, P-13A, P-14A, P-26A, P-32A, and P-33A located near the west boundary of the Site. VOCs detected in excess of 1,000 µg/L included acetone, benzene, chloroform, chloroethane, carbon tetrachloride, 1,2-dichloroethane (1,2-DCA), DCM, tetrachloroethene (PCE), toluene, 4-methyl-2-pentanone and 1,1,2-trichloroethane (1,1,2-TCA). Lesser concentrations of VOCs (generally less than less than 300 µg/L) were observed in piezometers P-11A, P-28A, P-29A, P-25A, P-31A and P-34*A. VOCs were not detected in groundwater samples collected from P-1A, P-8A, P-24A and P-27A. Piezometer P-28A, which was observed to be damaged, was repaired and redeveloped prior to sample collection.

Due to lack of sufficient water volume to permit sample collection, groundwater samples could not be collected from ten Unit A piezometers (including P-4A, P-5A, P-6A, P-21A, P-23A, P-27A, P-30A, P-31A, P-32A and P-34*A) during the initial sampling round. During the April 1995 sampling round, groundwater samples were collected for VOC analysis from piezometers P-27A, P-31A, P-32A and P-34*A. However, piezometers P-4A, P-5A, P-6A, P-21A, P-23A and P-30A were observed to be dry during the April 1995 sampling event.

VOC Distribution - Unit B

Twenty monitoring wells/piezometers screened in Unit B were sampled during the RI. A total of eleven VOCs were detected in groundwater samples collected from Unit B. However, only five of the 20 monitoring wells/piezometers sampled contained detectable concentrations of VOCs. Similar to the distribution noted for the Unit A piezometers, the greatest number and magnitude of VOC detections were near the west and northwest portion of the Site. However, at each well cluster, VOC detections were generally several orders of magnitude greater in the stratigraphically-higher Unit A piezometers than observed in the corresponding Unit B monitoring wells. Moreover, fewer VOCs were detected in the Unit B monitoring wells than in the Unit A piezometers. A

summary of VOCs detected in Unit B monitoring wells and piezometers is presented in Figure 5.13.

VOCs were detected in monitoring wells/piezometers P-1, P-2B, MW-26, MW-29B, and MW-33B. The most elevated concentrations (in excess of 100 µg/L) were noted at piezometer P-2B. One VOC (acetone) was detected at an estimated concentration of 210 µg/L in the sample from monitoring well MW-33B. Other VOCs detected above 100 µg/L included 1,2-DCA, benzene and DCM. Unit B generally marks the first occurrence of the water table beneath the Site. The variety of VOCs detected in the stratigraphically-lower Unit B are similar to those compounds detected in Unit A.

The areal extent of VOCs in Unit B is substantially restricted to a relatively small area which extends from piezometer P-2B northeast towards monitoring wells MW-26B and MW-33B. Additionally an isolated location of low-level VOC detections (less than 20 µg/L total VOCs) was observed at MW-29B. The source of these VOCs is likely the unlined waste deposits located near this well. On the basis of the data collected to date, it appears that VOC contamination in Unit B does not extend off Site.

VOC Distribution - Unit C

As stated earlier in this report and consistent with the approved RI Work Plan and Addendum 1 thereto, groundwater sampling of monitoring wells screened in Units C1, C2, C3 and C4 was conducted during the RI. A summary of VOCs detected in Unit C is presented in Figure 5.14.

The highest VOC concentrations (in excess of 1,000 µg/L) occurred at P-2C2 located near the west property boundary in the southwestern quadrant of the Site. Twelve VOCs were detected at P-2C2 but most of these were estimated concentrations. The VOCs which were present in the highest concentrations at P-2C2 included 1,2-DCA (estimated concentration of 2,000 µg/L) and benzene (estimated concentration of 600 µg/L). Other elevated (in excess of 100 µg/L) VOC detections occurred at monitoring wells P-31C2 and P-31C3 which are hydraulically downgradient of

P-2C2. These piezometers are also located structurally downgradient of the piezometer P-2C2 based on the structure map of the base of Unit C provided in Figure 2.9. The VOC detected at the most elevated level in piezometers downgradient of P-2C2 was 1,2-DCA which was detected in the groundwater samples collected from piezometers P-31C2 (at a concentration of 100 μg/L) and P-31C3 (at a concentration of 360 μg/L). The potential presence of VOCs at deeper levels within Unit C downgradient of the P-31 cluster, will be assessed as a component of the OU2 RI.

Acetone was detected at a concentration of 28 μg/L at piezometer P-24C2, an upgradient piezometer. However, acetone was not detected in the groundwater sample collected from P-24C2 during the second sampling round conducted in April 1995. The detection of acetone, a common laboratory contaminant, at piezometer P-24C2 is not necessarily indicative of the presence of groundwater contamination at this location.

Other low-level (less than 10 μg/L) VOC detections were noted at several C3 and C4 piezometers sampled during October 1995. Low-level detections in C3 and C4 piezometers included chloroform at upgradient piezometers P-24C3 (5.8 μg/L) and P-4C3 (2.2 μg/L); several detections of DCM at, or slightly above 1 μg/L (P-24C3, P-8C3, P-8C4, P-30C3, P-31C3, and P-31C4); and bromodichloromethane at 1.6 μg/L at P-24C3. The detections of chloroform and bromodichloromethane at the upgradient piezometers are suspect due to the lack of a known source for these constituents upgradient of these locations. Additionally, if the source of chloroform and bromodichloromethane at these upgradient well locations were the waste deposits, it would be expected that these constituents would be detected in piezometers and monitoring wells screened at higher elevations (i.e. the B, C1 and C2 wells/piezometers) at these same locations since these constituents would have to percolate downwards from the source area (the waste deposits) in order to be detected in the C3 piezometers. However, there were no detections of chloroform or bromodichloromethane in the other piezometers and monitoring wells at these upgradient well locations. Similarly, at the P-5 and P-30 well clusters, detections of DCM near 1 μg/L were observed in only the C3 piezometers and, at the P-8 cluster, detections of DCM near 1 μg/L were observed only in the C3 and the C4 piezometers. In the case of well clusters P-5, P-8 and P-30, these DCM detections appear to be

random since DCM was not detected in samples collected from the other piezometers at these same locations and the DCM detections occur at scattered locations across the Site. Additionally, the DCM detections were near the laboratory quantitation limit of 1 µg/L and, in some cases, the DCM detections were reported as estimated concentrations. In the event that a significant release of DCM occurred in the vicinity of the P-5, P-8 or P-30 well clusters, more elevated concentrations of these constituents at a larger number of number of wells and piezometers over a greater area of the Site would be expected. With the exception of DCM at the P-2 cluster of wells, the detections of bromodichloromethane, chloroform and DCM were below the maximum contaminant levels (MCLs), therefore, the levels of concern in Unit B and C monitoring wells and piezometers.

Further evaluation of off-Site groundwater quality will be conducted as a component of the OU2 RI.

5.4.2 Semivolatile Organic Compounds

Analytical data developed during the RI indicate that six SVOCs were detected in collected groundwater samples. As observed with the VOC data, the magnitude and number of detections were greatest in Unit A and occurred at monitoring wells and piezometers in which the most elevated concentrations of VOCs were observed. SVOCs were not detected in any of the monitoring wells or piezometers completed in Unit B and only one SVOC, bis(2-ethylhexyl)phthalate, was detected at relatively low levels in only two Unit C piezometers. The SVOC distribution data for Units A, B and C are presented in Figures 5.15 through 5.17, respectively.

Within Unit A, SVOCs were detected only in the northwest quadrant of the Site and at piezometer P-2A in the southwest quadrant. SVOCs detected in Unit A included 4-methylphenol, isophorone, nitrobenzene, hexachloroethane and phenol. Only nitrobenzene and phenol were detected at concentrations exceeding 1,000 µg/L in Unit A. SVOC detections were noted in five Unit A piezometers including P-2A, P-10, P-12A, P-13A and P-14A. SVOCs were not detected in eight other Unit A piezometers sampled. Samples for SVOC analysis could not be collected from

six Unit A piezometers (P-4A, P-5A, P-21A, P-23A, P-30A and P-34*A) due to insufficient water volume present within these piezometers.

SVOCs were not detected in the 20 Unit B monitoring wells/piezometers sampled during the RI. Within Unit C, detections of bis(2-ethylhexyl)phthalate occurred at P-24C2 (the upgradient well) and P-5C2. However, bis(2-ethylhexyl)phthalate was not detected in the groundwater sample collected from P-5C2 during the second sampling round conducted in April 1995. SVOCs were not detected at the 22 remaining Unit C piezometers sampled. Due to the lack of temporal or spatial SVOC trends (either horizontally or vertically) exhibited by the bis(2-ethylhexyl)phthalate detections, the presence of this compound in groundwater within Unit C is suspect. Most likely, the presence of bis(2-ethylhexyl)phthalate in samples collected from Unit C is due to random laboratory contamination.

5.4.3 Target Analyte List Metals

5.4.3.1 Overview

Filtered and unfiltered groundwater samples were collected from Site monitoring wells for TAL metals analysis. The target analyte list consists of 23 metals each of which occur, to a varying degree, in natural geologic deposits. Groundwater, which percolates through geologic deposits, tends to dissolve these metals and carry these species in solution. Therefore, naturally-occurring groundwater will contain measurable concentrations of metallic species in solution. The concentration of the various inorganic species that groundwater contains is dependent upon a number of factors including the geologic environment, groundwater chemistry (especially as a function of characteristic pH and redox potential) and the solubility product (Ksp) of the inorganic species with respect to the particular chemistry of the groundwater.

Geologic deposits of clay, sand and carbonate rock, as present beneath the Site, contain common minerals which are comprised, to a large extent, of elements such as sodium, magnesium, manganese, aluminum, potassium, calcium and iron; each of which appear on the list of

TAL metals. Other naturally occurring geologic deposits may tend to concentrate rarer elements. Likewise, deposition of waste materials containing metal analytes may tend to concentrate these analytes.

Another important factor which may impact the concentration of metals species in a sample is the presence of suspended solids within the collected sample. Suspended solids within the sample will tend to provide an extraneous source of metals to a water sample when the acid preservative is added to the sample. Acid dissolution of elements from suspended solids contained in the samples will provide a high bias to the actual concentration of metallic species in solution. In order to more accurately determine the concentration of dissolved species in groundwater, samples collected for TAL metals analysis included dissolved (filtered prior to preservation) and total metals (unfiltered prior to preservation). Suspended solids were removed from the sample by filtering the sample through a 0.45 micrometer (micron) filter in the field prior to addition of the nitric acid preservative. The concentrations of analytes in the unfiltered samples were compared against the concentrations of analytes in the filtered samples to obtain an accurate representation of these analytes in solution.

TAL metals data were compared to U.S. EPA's MCLs. The MCLs represent the maximum permissible levels of a contaminant which may be delivered to any user of a public water system. Primary MCLs represent health-based levels for analytes which are a primary public health concern. Secondary MCLs (SMCLs) are not health-based levels but represent concentrations of constituents above which the aesthetic value of the water (color, taste, etc.) and the potential use as a groundwater resource may be affected. The MCLs are summarized in the document entitled "Drinking Water Regulations and Health Advisories" published regularly by U.S. EPA's Office of Water.

Figures 5.18, 5.19 and 5.20 present a comparison of metals data with the MCLs and SMCLs for Units A, B, and C, respectively. Metals concentrations (both total and dissolved) which exceed an MCL or an SMCL are presented on these figures. Total suspended solids (TSS) data are also shown to facilitate a comparison of total metals data with TSS data. A summary of metals concentrations (both total and dissolved) and metals

concentrations exceeding U.S. EPA's primary drinking water standards are provided in Table 5.5.

5.4.3.2 TAL Metals Distribution - Unit A

A total of thirteen metals were found to exceed MCL or SMCL levels in unfiltered samples collected from Unit A piezometers while in the associated filtered samples, only five metals (cadmium, iron, lead, manganese and nickel) were found to exceed the respective MCL or SMCL. The levels of TSS in groundwater samples collected from Unit A piezometers were relatively high ranging from 290 to 24,000 mg/L, but generally exceeding 1,000 mg/L. Detections of metals in excess of the MCLs or SMCLs appear to correlate well with high concentrations of TSS. Furthermore, the number of metals in excess of MCLs/SMCLs in unfiltered samples far exceeds the number of MCL/SMCL exceedences in filtered samples at each location. Given the high levels of TSS and the ratio between detections of MCL/SMCL exceedences in unfiltered and filtered samples, it is likely that many of the exceedences in the unfiltered samples are attributable to the presence of metallic species leached from solids present in collected groundwater samples.

MCL exceedences for dissolved nickel, dissolved lead and dissolved cadmium were noted at only one location, piezometer P-13A. However, exceedences of the SMCL for both total and dissolved iron and dissolved manganese were relatively common. This finding is generally consistent with regional groundwater character as discussed in Section 2.5.3. Exceedences of the SMCLs for iron and manganese in unfiltered samples occurred at each sampling location. Nickel also was found to commonly exceed the MCL in unfiltered samples at seven of the eleven locations sampled. Each of these metals are relatively common in the subsurface environment and detections of these elements in excess of MCLs or SMCLs in groundwater may not be indicative of a Site-related contaminant source. The greatest number of metals analytes were detected in excess of MCLs or SMCLs at piezometer P-13A. At P-13A, twelve individual metal analytes were found in excess of the MCL or SMCL levels. However, only iron and manganese were found to exceed SMCLs in filtered samples and cadmium (0.0055 mg/L),

lead (0.028 mg/L) and nickel (0.13 mg/L) only marginally exceeded their respective MCLs of 0.005 mg/L, 0.015 mg/L and 0.1 mg/L in the filtered sample collected from P-13A.

5.4.3.3 TAL Metals Distribution - Unit B

Since Unit B marks the first occurrence of the water table beneath the Site, it is useful to compare the analytical data for metals in upgradient wells with the data from the downgradient sampling locations in order to ascertain the effect, if any, waste deposition at the Site may have had upon groundwater quality with respect to TAL metals. The data for TAL metals at upgradient wells would be representative of the concentrations of these analytes in unimpaired groundwater arriving at the Site (i.e. not affected by waste disposal activities). Examination of the groundwater flow data (discussed in Section 4.6) for Unit B indicates that metals data from monitoring wells/piezometers P-1, P-4B, MW-24B and MW-25B would be representative of the quality of groundwater entering the Site (not affected by waste disposal activities).

Metal analytes found to exceed MCLs or SMCLs for either filtered or unfiltered samples collected from the upgradient monitoring wells/piezometers include aluminum, arsenic, beryllium, chromium, iron, lead, manganese and nickel. The only metal analyte exceeding MCL or SMCL levels observed in the downgradient samples which did not appear in the upgradient groundwater samples was total cadmium which was detected at MW-33B. Cadmium was not detected above the MCL in the filtered sample collected from MW-33B indicating that its presence may be due to leaching from suspended solids present in the sample. Only two of metals analytes, iron and manganese, were found to exceed the SMCLs in the associated filtered samples.

In general, the maximum concentrations of metal analytes in excess of the MCLs or SMCLs in groundwater samples collected from downgradient sampling locations in Unit B were comparable to the maximum concentrations observed for the same metals analytes observed in the upgradient sampling locations. Therefore, data collected during the RI

indicate that the concentrations of metals observed in Unit B groundwater samples are likely the result of natural groundwater chemistry and the presence of suspended solids in collected samples rather than the result of past waste disposal activities. However, additional evaluation of metals analytes in groundwater will also be conducted as part of the OU2 investigation.

5.4.3.4 TAL Metals Distribution - Unit C

A total of seven metals were observed to exceed MCLs or SMCLs in groundwater samples collected from Unit C. Metallic analytes observed most commonly in Unit C groundwater samples included aluminum, iron and manganese. Other metallic analytes detected less frequently included beryllium, chromium, lead and nickel. With the exception of iron and manganese, none of the dissolved metals were observed to exceed MCLs in the collected filtered groundwater samples.

Exceedences of SMCLs for iron and manganese in both filtered and dissolved samples were ubiquitous in groundwater samples collected from both upgradient and downgradient locations. Moreover, exceedences of the SMCL for aluminum were also common in unfiltered samples collected. However, in filtered samples collected, only iron and manganese regularly exceeded the SMCLs. The iron and manganese exceedences are likely indicative of the natural chemistry of groundwater beneath the Site and not the result of waste disposal practices. This observation is consistent with the regional groundwater character. However, additional evaluation of metals analytes in groundwater will also be conducted as part of the OU2 investigation.

5.4.4 General Chemistry

General chemistry data gathered for groundwater during the RI included alkalinity, chloride, total cyanide, nitrogen (as ammonia and as nitrate) TDS, TSS and sulfate concentrations along with groundwater

hydrogen ion activity (pH). The general chemistry data compiled during the RI are summarized by Figures 5.21, 5.22, and 5.23.

In Unit A monitoring wells, total cyanide was the only analyte found to exceed the primary MCLs at piezometers P-2A and P-14A. However, the concentration of total cyanide at each location was less than 1 mg/L and only marginally exceeded the MCL of 0.2 mg/L. Exceedences of the SMCLs for TDS, chloride and sulfate were also noted. The most elevated chloride concentrations were noted at P-2A, P-11A, P-13A and P-31A. However, these chloride detections were not excessively high for a landfill environment. The pH of groundwater from Unit A was generally found to be near neutral (6.5 to 7.5). However, at P-2A, the pH level of 6.2/6.3 is below the recommended SMCL lower limit of 6.5. Due to a lack of available water volume, samples for the complete list of general water quality parameters could not be collected from seven piezometers (P-4A, P-5A, P-21A, P-23A, P-30A, P-33A and P-34*A).

In Unit B, exceedences of the MCL for total cyanide did not occur and SMCL exceedences were limited to chloride at one location (P-7B) and TDS at ten locations. The pH of Unit B groundwater was slightly above neutral ranging from 7.0 to 8.0. The highest pH was observed in piezometer P-1, an upgradient well. The pH of other upgradient Unit B wells ranged from 7.4 to 7.6 which is more representative of pH observed at downgradient wells.

General chemistry parameters were within MCL/SMCL limits at all sampling locations in Unit C with one exception. Total cyanide marginally exceeded the MCL of 0.2 mg/L in the groundwater sample collected at piezometer P-34*C2 (0.86 mg/L). The pH of Unit C groundwater ranged from 7.1 to 7.9.

5.4.5 Gross Alpha and Gross Beta Radioactivity

As discussed in Section 4.5, groundwater samples from a set of 42 monitoring wells were collected for gross alpha and gross beta radioactivity characterization and these data are summarized in Figure 5.24

and in Table 5.6. Gross alpha activity was detected in eight of the 42 monitoring wells/piezometers and gross beta activity was detected in seven of the 42 monitoring wells/piezometers. Gross alpha activity in all samples was below the MCL of 15 picoCuries per Liter (pCi/L) at each of the sampled monitoring wells and piezometers. The MCL for gross beta is 4 millirems per year which represents a total body dosage. Gross beta activity in all samples was below the 50 pCi/L evaluation threshold concentration at each of the sampled monitoring wells and piezometers.

5.4.6 Groundwater Data Summary

On the basis of the data generated during the RI, VOCs are the most important Site-related groundwater concern. The magnitude of VOC concentrations observed in groundwater samples from Unit A piezometers near the western boundary of the Site, indicate a close proximity to the contaminant source. Observed VOC concentrations in Unit A are likely indicative of leachate produced from the unlined waste deposits. Due to the intermittent nature of groundwater occurrence in Unit A, the predominant direction of groundwater flow within Unit A is downward, under the influence of gravity, toward the underlying saturated zone (water table). During previous investigations, the presence of thin sand seams and lenses were noted within Unit A. Limited lateral transport of contaminants may occur where thin, more permeable lenses occur within Unit A. The direction of lateral migration will depend on the slope of the permeable unit. Flow in the permeable layers will primarily occur in response to gravity.

Significant VOC detections in the saturated units (Unit B and Unit C) beneath the Site are primarily localized to a relatively narrow zone near the western Site boundary. The P-2 monitoring well cluster is located on the upgradient side but very close proximity to unlined waste deposits. Since groundwater flow is toward the northeast beneath the Site, monitoring wells P-2B and P-2C2 are receptors for groundwater from off-Site areas located to the southwest of the Site. This groundwater arriving at the Site should be relatively free of Site-related contaminants since no known landfilling was conducted southwest of the Site. However, the largest number and the most elevated levels of VOCs noted in Units B and C

occurred in monitoring wells in the P-2 cluster (specifically P-2B and P-2C2). Moreover, the suite of VOCs observed in the P-2 cluster of monitoring wells were similar in groundwater samples collected from each of the stratigraphic units investigated. The north-south and east-west trending cross-sections in Figure 5.25 and 5.26 show the concentrations of VOCs detected at selected Unit A and Unit B locations. These data are indicative of a limited contaminant source near the western property boundary.

RI data indicate that Unit A is acting to effectively inhibit the vertical migration of contaminants present near the surface to deeper saturated units, namely Units B and C. VOC concentrations in excess of 10,000 μg/L occurred in Unit A monitoring wells located in the western quadrants of the Site. However, relatively few locations screened in the deeper B and C units were found to be impacted with VOCs. Furthermore, concentrations of VOCs in the deeper stratigraphic units were generally several orders of magnitude less than in the overlying Unit A. In fact, the area of VOC occurrence in the saturated units beneath the Site is relatively small.

There are nine monitoring well clusters located downgradient of the waste deposits on the Site (P-8, P-23, P-25, P-27, P-28, P-29, P-30, P-31, and P-32). These downgradient well clusters are located near the northern and eastern Site boundaries. Since dissolved-phase contaminants will migrate laterally in a direction parallel to groundwater flow, these monitoring well clusters would act as downgradient receptors for VOCs released from the Site. In the event that Unit A was not acting to effectively inhibit the vertical migration of contaminants to lower stratigraphic units, VOC detections in these well clusters would likely have been more prevalent. Although low-level detections of chloroform, DCM and bromodichloromethane were observed in a few C3 and C4 piezometers, RI data indicate that only one downgradient well cluster, P-31, located in the northwest quadrant of the Site, has been significantly impacted with VOCs.

Data gathered during the RI suggests that a VOC point source exists in the vicinity of the P-2 monitoring well cluster. This is supported by the following observations:

i) As evidenced by the groundwater quality data, Unit A appears to significantly inhibit the downward migration of contaminants.

ii) The most elevated levels of VOCs in Units B and C occurred in groundwater samples collected from monitoring wells in the P-2 cluster, namely P-2B and P-2C2 which are located at the upgradient edge of the Site.

The possibility that certain monitoring wells/piezometers which had been previously installed at the Site (i.e. prior to the RI) may be acting as a conduit for vertical contaminant migration will be evaluated in the document entitled "Well Abandonment Technical Memorandum, Four County Landfill Site, Fulton County, Indiana".

6.0 HUMAN HEALTH RISK ASSESSMENT

The Human Health Risk Assessment (RA) is an evaluation of the risks, or potential risks posed to public health and welfare posed by the Site if the Site is left unremediated. The purpose of the risk assessment is to provide the required basis to proceed with the feasibility study. An RA for the elements of OU1 was prepared in accordance with the U.S. EPA guidance "Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part A)". This RA is presented in Appendix J of this RI Report.

A summary of the major findings of the RA are presented below.

a) Unit A, Perched Water - Construction Worker Exposure

- The estimated incremental cancer risk from incidental ingestion and dermal contact is 2.8E-06 (Mean) and 3.7E-05 (RME), while those for inhalation are 1.5E-06 (Mean) and 1.0E-05 (RME).

- The hazard indices from incidental ingestion and dermal contact is 2.1E-04 (Mean) and 2.4E-03 (RME), while those for inhalation are 5.9E-03 (Mean) and 3.7E-02 (RME).

- The construction worker incidental ingestion/dermal contact and inhalation pathways are additive. Thus the total estimated incremental cancer risk is 4.3E-06 (Mean) and 4.7E-05 (RME). These estimated risk levels fall within the target cancer risk range of 1.0E-06 to 1.0E-04 established by U.S. EPA. It is important to realize that this scenario assumes that Unit A is breached and standing water is contacted by some sort of unprotected construction activity on Site. However, this potential exposure route is unlikely since the Site is surrounded by a security fence and on-Site maintenance personnel patrol the Site regularly.

- The total hazard indices are 6.1E-03 (Mean) and 3.9E-02 (RME) which are below 1.0. An HI below 1.0 indicates a level of no concern. An HI

above 1.0 indicates a potential for noncarcinogenic effects and suggests further evaluation.

b) Units B and C Groundwater - Residential - Current Conditions

- The estimated incremental cancer risk is 1.3E-04 (Mean) and 5.0E-04 (RME). These estimated risk levels fall above the target cancer risk range of 1.0E-06 to 1.0E-04 established by U.S. EPA, but it is important to realize that this scenario is unlikely since it assumes that a residence is built and a well is installed within the fence at the downgradient property line.

- The hazard indices are 3.9E+00 (Mean) and 6.0E+00 (RME) which are above 1.0. An HI below 1.0 indicates a level of no concern. An HI above 1.0 indicates a potential for non-carcinogenic effects and suggests further evaluation. These exceedences relate to the presence of manganese in groundwater. Considering the conservative nature of the assumptions and the fact that groundwater usage evaluated is not likely to occur, this exceedence of HI is not a significant concern.

c) Units B and C Groundwater - Residential - Future Condition

- The estimated incremental cancer risk is 2.4E-04 (Mean) and 8.9E-04 (RME). These estimated risk levels fall above the target cancer risk range of 1.0E-06 to 1.0E-04 established by U.S. EPA, but it is important to understand that this scenario is equivalent to drilling a well through the landfill, in the center of the Site and using it to supply a residence. This exposure scenario is unlikely given the presence of perimeter fencing and regular patrolling by maintenance personnel and, in the future, deed restrictions.

- The hazard indices are 5.5E+00 (Mean) and 7.4E+00 (RME) which are above 1.0. An HI above 1.0 indicates a potential for non-carcinogenic effects and suggests further evaluation. These exceedences relate to the presence of manganese and arsenic in the groundwater. As noted

above, these minor exceedences of the HI are not significant under the conditions of the assessment.

d) On-Site Sediment - Occasional Visitors and Trespassers

- The estimated incremental cancer risk is 3.2E-08 (Mean) and 4.2E-07 (RME) for the NE Pond and no cancer risks in SW Pond. These estimated risk levels fall below the target cancer risk range of 1.0E-06 to 1.0E-04 established by U.S. EPA.

- The hazard indices are 2.1E-04 (Mean) and 7.7E-04 (RME) for the NE Pond, and 1.2E-04 (Mean) and 3.4E-04 (RME) for the SW Pond which fall below 1.0. An HI below 1.0 indicates a level of no concern. An HI above 1.0 indicates a potential for non-carcinogenic effects and suggests further evaluation.

e) On-Site Sediment - Industrial Worker

- The estimated incremental cancer risk is 1.6E-08 (Mean) and 2.4E-07 (RME) for the NE Pond and no cancer risks in SW Pond. These estimated risk levels fall below the target cancer risk range of 1.0E-06 to 1.0E-04 established by U.S. EPA.

- The hazard indices are 3.8E-05 (Mean) and 5.2E-04 (RME) for the NE Pond, and 2.3E-05 (Mean) and 2.3E-04 (RME) in SW Pond which fall below 1.0. An HI below 1.0 indicates a level of no concern. An HI above 1.0 indicates a potential for non-carcinogenic effects and suggests further evaluation.

f) Off-Site Sediment - Hikers and Hunters

- The estimated incremental cancer risk is 4.2E-08 (Mean) and 5.7E-07 (RME) for the North Sector; 6.2E-08 (Mean) and 1.0E-06 (RME) for the East Sector; and 8.3E-08 and 8.7E-07 for the West Sector. These

estimated risk levels fall below the target cancer risk range of 1.0E-06 to 1.0E-04 established by U.S. EPA.

- The hazard indices are 1.5E-05 (Mean) and 6.2E-05 (RME) for the North Sector; 2.2E-05 (Mean); and 1.1E-04 for the East Sector; and 3.0E-03 (Mean) and 1.2E-02 (RME) for the West Sector which fall below 1.0. An HI below 1.0 indicates a level of no concern. An HI above 1.0 indicates a potential for non-carcinogenic effects and suggests further evaluation.

g) Off-Site Sediment - Residential - Future Conditions

- The estimated incremental cancer risk is 1.2E-06 (Mean) and 3.4E-06 (RME) for the North Sector; 1.8E-06 (Mean) and 6.2E-06 (RME) in the East Sector; and 2.5E-06 (Mean) and 5.2E-06 (RME) in the West Sector. These estimated risk levels fall at the lower end of the target cancer risk range of 1.0E-06 to 1.0E-04 established by U.S. EPA.

- The hazard indices are 7.3E-04 (Mean) and 1.3E-03 (RME) in the North Sector; 1.1E-03 (Mean) and 2.4E-03 (RME) in the East Sector; and 1.5E-01 (Mean) and 2.6E-01 (RME) in the West Sector which fall below 1.0. An HI below 1.0 indicates a level of no concern. An HI above 1.0 indicates a potential for non-carcinogenic effects and suggests further evaluation.

h) On-Site Air - Worker

- The estimated incremental cancer risk is 6.6E-07 (Mean) and 4.0E-06 (RME). These estimated risk levels fall below or at the lower end of the target cancer risk range of 1.0E-06 to 1.0E-04 established by U.S. EPA.

- The hazard indices are 2.1E-05 (Mean) and 1.3E-04 (RME) which fall below 1.0. An HI below 1.0 indicates a level of no concern. An HI above 1.0 indicates a potential for non-carcinogenic effects and suggests further evaluation.

i) Off-Site Air - Resident

- The estimated incremental cancer risk is 3.5E-06 (Mean) and 1.4E-05 (RME). These estimated risk levels fall within the target cancer risk range of 1.0E-06 to 1.0E-04 established by U.S. EPA.

- The hazard indices are 4.5E-04 (Mean) and 8.8E-04 (RME) which fall below 1.0. An HI below 1.0 indicates a level of no concern. An HI above 1.0 indicates a potential for non-carcinogenic effects and suggests further evaluation.

j) Summation of Risk

- The estimated RME cancer risk for the present cumulative risk scenario for industrial workers is 4.2E-06. This estimated cancer risk is within the target cancer risk range of 1.0E-06 to 1.0E-04 as established by U.S. EPA. The hazard index is below 1.0, which is considered the level of concern.

- The estimated RME cancer risk for the present cumulative risk scenario for construction workers is 4.7E-05. This estimated cancer risk is within the target cancer risk range of 1.0E-06 to 1.0E-04 as established by U.S. EPA. The hazard index is below 1.0, which is considered the level of concern.

- The estimated RME cancer risk for the present cumulative risk scenario for residents (including residential sediment, air and visitor/trespass exposures) ranges from 1.8E-05 to 2.1E-05 depending on the location of residence. This estimated cancer risk is within the target cancer risk range of 1.0E-06 to 1.0E-04 as established by U.S. EPA. The hazard index is below 1.0, which is considered the level of concern.

- For the North Sector which is downgradient of the Site with regard to groundwater, the sum of residential total and current groundwater cancer risk is 5.2E-04 (RME). The RME hazard index for a resident in the North Sector with regard to groundwater is 6.0E+00 which is above

1.0, the level of concern. These exceedences relate to the presence of manganese and arsenic in the groundwater. As stated earlier, this scenario is unlikely. It is the equivalent to drilling a well through the landfill, in the center of the Site and using it to supply a residence. Considering the conservative nature of the assumption and the fact that groundwater usage evaluated is not likely to occur, these minor exceedences are not significant concerns.

A detailed discussion of the RA including the identification of chemicals of concern, an assessment exposure pathways and exposure scenarios, determination of risks and identification of uncertainties is provided in Appendix J.

7.0 ENVIRONMENTAL EVALUATION

The Environmental Evaluation (EE) was performed in accordance with U.S. EPA "RAGS, and Region V "Regional Guidance for Conducting Ecological Risk Assessments" (April 1992) and an Environmental Evaluation Report was prepared in accordance with Section 7.4.2 of the RI/FS Work Plan. The objective of the EE Report was to present a qualitative evaluation of the actual or potential ecological impact, if any, posed by chemicals of potential concern (COCs) on the ecosystem, or parts of the ecosystems, in and around the vicinity of the Site. The EE Report which summarized the findings of the EE was prepared and submitted to IDEM and the U.S. EPA on May 3, 1995 and was approved by IDEM. The conclusions of the EE which are quoted directly from the approved EE Report dated May 3, 1995, included the following:

- The EE demonstrates that on-Site conditions are not impacting the off-Site environment because the concentrations of the parameters studied are generally lower in on-Site sediments and surface water than the concentrations of these parameters in off-Site sediment and surface water (Tables 7.1 and 7.2). The presently available data indicate that the movement of sediments and surface water from on-Site locations to off-Site locations is not likely to lead to an increase in concentrations of most chemicals of concern in off-Site media.

  Where the above is not true and on-Site concentrations marginally exceed off-Site concentrations, the on-Site concentrations are generally below the Site-specific background concentrations. This is especially true for the surface water data.

- There appears to be a gradient where concentrations in samples taken near the Site exhibit higher concentrations than samples taken further from the Site. Since the relatively higher values in the closest samples off-Site are higher than on-Site concentrations, this gradient could not be caused by the existing on-Site concentrations reported. Therefore, the presence of a gradient off-Site is not particularly relevant to the evaluation of present Site conditions. Since metals are persistent in soils and sediment, their presence in either media, but especially

sediment, may reflect historic conditions. In other words, off-Site gradients may be indicative of some migration under surface water flow conditions that may have existed in the past but are not indicative of current conditions.

- The concentrations in off-Site samples were compared to Site-specific background, literature background conditions defined by the prevailing literature and available criteria for sediments and surface water, and were shown to be within expected ranges in natural soil and of minimal to low biological concern. Movement of sediments or surface water from the on-Site areas examined (those areas presently discharging off-Site) would be expected to lower existing off-Site concentrations due to dilution or flushing action.

The analysis of surface water and sediment data representative of on Site samples showed reported concentrations of inorganics primarily. The inorganic COCs that have available Federal and State criteria/guidelines showed no exceedences for sediment and one exceedence for surface water (silver). The on-Site ponds were not developed as fish habitat. Moreover, the ponds are not a water resource and are not known to sustain sizable fish. Therefore, reported concentrations of chemicals in these ponds are not expected to impact fish. The reported concentrations are also well below concentrations that would affect benthic organisms to a remarkable extent for ponds of this nature. Waterfowl that may frequent ponds in this area would also not be affected. Therefore, reported levels of inorganics in surface water and sediment are not expected to impact biota.

Due to their limited size and the intermittent nature of the shallow standing water pools, the surface waters in the off-Site wetland areas cannot sustain sizable fish or provide suitable habitat for fish reproduction and rearing. No impact on fish is expected. The concentrations are also considered well below concentrations that would affect benthic organisms.

Only a few organic chemicals were observed in sediment or surface water samples collected during the RI. All reported concentrations were low and none of the detected organic compounds exceeded applicable Federal or State of Indiana criteria.

In general, reported concentrations of chemicals in sediment and surface water in the identified drainage areas both on-Site and off-Site, are below background and/or available Federal and Indiana criteria. This indicates that these drainage pathways where potential contact with chemicals of concern by biota could occur are not adversely impacted by chemicals on the Site or by chemical migration from the Site.

8.0 CHEMICAL FATE AND TRANSPORT

8.1 GENERAL

Contaminant mobility, a factor in contaminant migration, depends upon the physical and chemical properties of both the contaminants and the environmental media. Properties which affect contaminant mobility include, but are not limited to, aqueous solubility, liquid density, vapor pressure and chemical affinity. The partitioning of chemicals between media is controlled by a variety of factors such as adsorption, absorption, volatilization, solubility and chemical affinity.

Chemicals released to a soil medium may be adsorbed by the soil until the adsorptive capacity of the soil is reached. Similarly, infiltration of precipitation or additional chemical release may cause the initial chemicals to migrate at a rate primarily controlled by the adsorptive capacity of the soil and by the solubility of the initial chemicals in the transport media. The sorption coefficient (Koc) indicates the tendency of a compound to partition between particles containing organic carbon and water. The sorption coefficient is inversely related to aqueous solubility such that a compound that binds strongly to aquifer carbon will have a low solubility. Compounds that adsorb onto organic materials are retarded in their movement in groundwater such that the compound migrates at a linear velocity that is less than the bulk groundwater flow velocity. Under continuing release conditions, the chemicals may migrate both horizontally and vertically, expanding the area of contaminated soils as the adsorptive capacity of the soil in the vicinity of the release is exceeded.

Chemicals which have migrated to the groundwater may dissolve in the groundwater to a concentration approaching the aqueous solubility limit of the chemicals. The dissolved chemicals may migrate with the groundwater and adsorb onto the aquifer matrix. Under conditions of continued release to groundwater from the soils in the vadose zone, the extent of groundwater contamination may expand as the adsorptive capacity of the aquifer matrix in the vicinity of the release is exhausted. Aqueous solubility is an important factor in estimating chemical fate and transport in

groundwater and surface water. Compounds with high aqueous solubilities have a tendency to desorb from soils and sediment, are less likely to volatilize from water and are susceptible to biodegradation. Compounds with high aqueous solubilities will generally enter the groundwater more readily than relatively less soluble compounds. Aqueous solubility is affected by inter alia temperature, pH and the presence/absence of other dissolved constituents.

When the solubility limit of a chemical in groundwater is exceeded, a separate non-aqueous phase liquid (NAPL) may be present. The migration of NAPL is governed by the volume of the release, the interfacial tension of the NAPL (the mutual attraction between like molecules on the surface to molecules in the bulk liquid), capillary pressure, permeability of the geologic media and the density of the chemical relative to water. Specific density is commonly expressed as a unitless value which represents the density of the chemical at 20°C relative to the density of water at 4°C. Since the density of water at 4°C is 1.000 g/mL, hydrophobic (low aqueous solubility) compounds with a specific density greater than 1.0 will generally tend to sink through groundwater while those compounds with a density of less than 1.0 will generally tend to remain near the top of the saturated zone.

If the density of a chemical is greater than 1.0, it may tend to migrate vertically downward under the influence of gravity, until a low-permeability geologic unit is encountered. Upon encountering a low-permeability layer, the chemical may tend to migrate horizontally in the direction of the surficial slope of the low-permeability geologic unit (also under the influence of gravity). Hydrophobic compounds with a specific density less than 1.0 will generally tend to remain near the top of the saturated zone and may migrate horizontally in the direction of groundwater flow (under the influence of the hydraulic gradient). The extent of NAPL migration above or below the water table, may expand as the sorption capacity of the geologic medium is reached or as a result of an ongoing release.

It should be noted that the metallic constituents are identified and quantified as total metals and cannot be speciated using conventional analytical techniques.

8.2 POTENTIAL ROUTES OF MIGRATION

8.2.1 Migration in Surface Water Runoff

As discussed in Section 2.4.3, surface water controls are in place at the Site and these controls are currently being maintained as required by the Agreed Order in a manner consistent with the approved RI Work Plan. Surface water run-on enters the Site from the wooded southern boundary and is directed through a ditch to an area of natural drainage off the western edge of the Site. In this manner, contact between run-on surface water and surface water which may potentially have been in contact with lined or unlined waste areas is minimized Run-on surface water from this area eventually drains to the unnamed, northwest-trending ditch that flows to the Tippecanoe River.

Runoff is collected in a series of ditches and drainage control ponds, stored in either the southwest retention pond or the northeast drainage control basin. Additionally, surface water which collects in the unfilled portion of Cell C is pumped to the northeast retention pond. These surface waters are ultimately discharged from the northeast drainage control basin in accordance with a National Pollutant Discharge Elimination System (NPDES) Permit. The on-Site discharge point allows water to accumulate in the northeast quadrant, then drain into a culvert (located under County Highway 525 North) that empties into the wetland basin north of the Site.

Due to lack of contact, landfill-derived constituents are not likely to be transported in run-on surface water. Landfill-related compounds may enter the surface water generated by precipitation which falls on the landfilled areas. The primary route of transport for landfill-derived constituents to surface water would likely be leachate seeps. During the Site inspection, seepage from the lined cells was observed to be minimal and no seeps were observed from the unlined deposits. Furthermore, landfill seeps are promptly repaired by the Site O&M contractor consistent with the requirements of the Agreed Order and the approved RI Work Plan. There were no areas identified during the Site inspection where refuse or other landfill wastes were identified at the surface. Therefore, dissolution of

landfill-related constituents through direct contact with surface water would be minimal.

Any landfill-derived constituents entering the surface water on-Site would be directed to the northeast retention pond. Surface water is discharged from the northeast retention pond on a periodic basis as warranted by the collected volumes. The concentrations of landfill-derived constituents would likely be significantly reduced as a result of dilution with other clean surface water which enters the pond. Once released from the northeast retention pond, surface water flows toward the north and northeast through a series of interconnected wetlands, small manmade lakes and drainageways. Significant impacts to either on- or off-Site surface water from the landfill deposits were not observed during the RI.

8.2.2 Migration in Groundwater

The permanent water table beneath the Site generally occurs at an elevation of approximately 728 feet amsl. Intermittent saturated zones were observed in Unit A. However, in general, the first occurrence of the permanent water table occurs within Unit B. Groundwater flow in the saturated zones beneath the Site was observed to be towards the north and northeast beneath the Site. Dissolved compounds in groundwater are transported primarily by advection, parallel to the direction of bulk groundwater flow, at a rate which is proportional to the groundwater flow velocity.

Any dissolved phase constituents present in groundwater beneath the Site would be transported towards the north to northeast beneath the Site. However, the rate of transport of these constituents would likely be minimal since the lack of any significant hydraulic gradients result in relatively slow average groundwater flow velocities. As reported in the Groundwater Technical Memorandum, average horizontal groundwater flow velocities lie in the range of 0.5 to 14 feet per year. The actual contaminant transport velocities would be significantly reduced by the natural attenuation mechanisms discussed in Section 8.3.

8.2.3 Migration in Air

The behavior of constituents in air is controlled by emission, dispersion, reaction and removal. Potential source areas for emissions to the air at the Site are the landfill deposits and leachate which may contain volatile constituents which may be released when the leachate is brought to the surface during O&M activities. In terms of air migration, those constituents of greatest concern at a landfill are methane gas, which is generated during the waste decomposition process, and non-methane organic compounds (NMOCs), which are present in the wastes deposited at the Site. Those NMOCs most likely to be present in landfill gas emissions are VOCs which have high vapor pressures high Henry's Law constants and low aqueous solubilities. However, activities conducted during the RI indicated that releases of landfill gas-related compounds were insignificant from an overall exposure standpoint. Nevertheless, specific data to determine the rate of landfill gas generation and landfill gas composition were not acquired during the RI and would, more appropriately, be acquired during the predesign phase.

8.3 PHYSICAL/CHEMICAL ATTENUATION MECHANISMS

The fate and transport of Site-related chemicals in environmental media is affected by a number of physical and chemical attenuation mechanisms which are summarized below.

8.3.1 Adsorption

Chemicals released may be adsorbed by the particles which comprise the soil matrix. Adsorption may occur both above and below the water table. The extent to which adsorption occurs is dependent upon the composition of the soil matrix (the percentage of organic carbon in the soil), geochemistry of the subsurface environment and the soil-water partitioning coefficient for the specific compound. The relative tendency of a compound

to remain in the dissolved state rather than be adsorbed onto a soil organic carbon is related to the n-octanol-water (Kow) partitioning coefficient for that compound.[6] The sorption coefficient (Koc) for a compound may be estimated from its Kow or water solubility. A low Koc value is indicative of low adsorption to soil organic carbon.

The surface of particles which form the aquifer matrix, particularly clayey soils, have an electrical charge. Charged ions present in groundwater may be adsorbed by these charged electrical surfaces through weak attractive forces known as van der Waals' forces. In addition, chemical bonding between the surface and charged ions may result in stronger adsorption. The adsorptive capacity of soils and sediments is a function of mineralogy, particle size, ambient temperature, soil moisture, surface tension, hydrogen ion activity (pH), reduction/oxidation potential (Eh) and activity of the dissolved ion.[7]

8.3.2 Dilution

Dissolved compounds in groundwater will be transported in a direction parallel to groundwater flow by a process known as advection. The rate of advective transport is related to the average linear groundwater velocity.[8] Dilution of the dissolved constituents in groundwater will occur as a result of mechanical mixing during advective transport and molecular diffusion. Molecular diffusion occurs as a result of concentration gradients which occur in the subsurface environment.

8.3.3 Biodegradation

Biodegradation is the process by which introduced or naturally occurring microorganisms degrade chemical compounds under either aerobic or anaerobic conditions. The structure of the compound will determine at what rate the compound will degrade in the presence of

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[6]Fetter, C. W., Applied Hydrogeology (New York: Macmillian Publishing Co., 1988), p. 401.
[7]Fetter, C. W., pp. 345-346.
[8]Freeze, A. R. and Cherry, J. A. Groundwater (New Jersey: Prentice Hall, Inc., 1979), p. 389.

microorganisms. Generally, biodegradation occurs in the presence of an electron acceptor. Electron acceptors include oxygen under aerobic conditions and nitrate, sulfate or carbon dioxide under anaerobic conditions[9].

8.3.4 Reduction/Oxidation

Chemical reactions which involve the transfer of an electron from one ion to another are known as reduction/oxidation (redox) reactions. The stability of certain ionic species is dependent on the pH and the Eh of an aqueous solutions. The pH and Eh are interdependent in groundwater systems.

8.3.5 Precipitation/Dissolution

Metallic species are present in minerals which form the aquifer matrix or may be introduced as a result of a chemical release. The solubility of metallic species is dependent of hydrogeologic conditions within the groundwater system. Metallic species in groundwater generally occur as dissolved ions or ionic complexes. Metallic species may precipitate from solution or dissolve into solution on the basis of a change in the pH/Eh conditions in groundwater.

8.3.6 Volatilization

The vapor pressure of a compound is used to determine a semi-quantitative rate at which volatilization will occur from soil and/or water to the atmosphere and/or soil gas. Vapor pressure is used to calculate the air/water partition coefficient known as the Henry's law constant. Henry's law constants provide an indication of the relative volatility of a compound. Henry's law constants are greatest for compounds with low aqueous solubilities and high vapor pressures such as VOCs.

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[9]Davis, A. and Olsen R. L. "Predicting the Fate of Organic Compounds" HMC (1990), July/August 1990.

8.4 ENVIRONMENTAL FATE

8.4.1 General

The environmental fate of Site-related organic metals and inorganic analytes detected in a significant number of environmental media samples are discussed in this section.

The probable behavior and environmental fate of all constituents can be assessed to some extent by evaluating the physical and chemical properties of the constituent. The mobility and persistence of these constituents are of primary importance in this evaluation. Mobility is the potential for a chemical to migrate away from the source. Persistence is a measure of how long a chemical will remain in the environment. Factors that affect the mobility and persistence of Site-related constituents include, but are not limited to:

1) physical properties,
2) chemical properties,
3) moisture levels,
4) microbial environment,
5) water chemistry, and
6) pH.

Water solubility is the maximum concentration of a compound that can dissolve in water at a specific temperature and pH. Compounds with high solubilities generally exhibit increased mobility. Vapor pressure and Henry's law constants provide an indication of the volatility of a compound. High vapor pressures and Henry's law constants indicate a greater tendency for a compound to volatilize. Compounds with high Henry's law constants and high vapor pressures generally do not persist in surface water or surface soil environments. Koc indicates the tendency of a compound to be adsorbed to organic matter in soils or sediments. High Koc values generally indicate lower mobility.

The chemical fate and transport of the significant parameters at the Four County Landfill Site are discussed in the following

subsections. The parameters have been grouped into the following categories to facilitate ease of discussion:

1. Volatile Organic Compounds

   a) Aliphatic Alkyl Halides

      Bromodichloromethane
      Chloroethane
      Chloroform
      1,1-Dichloroethane
      1,2-Dichloroethane
      cis-1,2-Dichloroethene
      Dichloromethane (Methylene chloride)
      1,1,2-Trichloroethane
      1,1,2,2-Trichloroethane
      Trichloroethene
      Vinyl Chloride

   b) Aliphatic Ketones

      Acetone
      2-Butanone (Methyl ethyl ketone)
      4-Methyl-2-pentanone (methyl isobutyl ketone)

   c) Aromatic Compounds

      Benzene
      Toluene
      Xylenes (total)

2. Semivolatile Organic Compounds

      bis(2-Ethylhexyl)phthalate
      Butylbenzylphthalate
      Hexachloroethane
      Isophorone
      4-Methylphenol (p-Cresol)

Nitrobenzene
Phenol

3. Metals

Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Mercury
Magnesium
Manganese
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

4. Inorganic Compounds and Non-Metallic Elements

Ammonia Nitrogen
Carbon Disulfide
Chloride
Cyanide
Nitrate Nitrogen
Sulfate

5. Radiologicals

Gross Alpha
Gross Beta

6. Indicator Parameters

Alkalinity
Total Solids
Total Suspended Solids

8.4.2 Volatile Organic Compounds

The primary VOCs detected in the study area consist of aliphatic alkyl halides, aliphatic ketones and aromatic compounds. The aliphatic alkyl halides include chlorinated alkenes which are generally colorless liquids with a sweet odor used primarily in various solvent applications. The aliphatic ketones are alkyl compounds containing a carbonyl group and are generally colorless liquids used as solvents.

The aromatic compounds consist of the aromatic hydrocarbons benzene, toluene, and xylenes. These compounds, derived from benzene, are generally colorless liquids with a sweet odor used in various manufacturing and industrial applications. The aromatic compounds detected in the study area are a significant component of automotive fuel, lubricants and engine exhaust which contributes to their widespread presence in the environment.

8.4.2.1 Aliphatic Alkyl Halides

The aliphatic alkyl halides detected in the study area have relatively high vapor pressures ranging from 20 mm Hg for tetrachloroethene to 2,600 mm Hg for vinyl chloride. Henry's law constants are also relatively high with values ranging from 9.8×10^{-4} atm-m^3/mole for 1,2-dichloroethane to 5.6×10^{-2} atm-m^3/mole for vinyl chloride. These high values for the vapor pressure and Henry's Law constants indicate that the primary transport mechanism for the aliphatic alkyl halides is volatilization to the atmosphere or to the soil gas in the vadose zone. In the atmosphere, these compounds will exist primarily in the vapor phase and will undergo photochemical reactions with hydroxyl radicals with half-lives ranging from 1.5 days for

vinyl chloride to 25 years for 1,1,1-trichloroethane. Aliphatic alkyl halides are water-soluble to varying degrees, and are scavenged by rainfall.

Aliphatic alkyl halides have generally low Koc values ranging from 2.4 for vinyl chloride to 363 for tetrachloroethene, resulting in a relatively weak adsorption to soils and a high potential for leaching to groundwater. Sediment adsorption and aquatic bioconcentration are generally insignificant for the aliphatic alkyl halides. Aliphatic alkyl halides may potentially be subjected to biodegradation under suitable conditions in soil, surface water and groundwater. The relative rate of biodegradation ranges from extremely slow to slow and may occur under anaerobic conditions for some compounds such as tetrachloroethene.

The primary fate mechanisms of the volatile aliphatic alkyl halides are volatilization from surface soil and slow biodegradation in subsurface soil and groundwater.

8.4.2.2 Aliphatic Ketones

The aliphatic ketones have vapor pressures ranging from 14.5 mm Hg for 4-methyl-2-pentanone to 231 mm Hg for acetone. Henry's law constant s range from 9.4×10^{-5} atm-m^3/mole for 4-methyl-1,2-pentanone to 1.05×10^{-5} atm-m^3/mole for 2-butanone. Volatilization to the atmosphere or to soil gas in the vadose zone is the primary transport mechanism for this compound. In the atmosphere, aliphatic ketones exist primarily in the vapor phase and will be degraded by photolysis and photochemical reactions with hydroxyl radicals with an average half-life of 22 days. Aliphatic ketones are generally water soluble and scavenged by rainfall.

Similar to the aliphatic alkyl halides, aliphatic ketones have relatively low Koc values resulting in a weak adsorption to soil and a relatively high rate of leaching to groundwater. Sediment adsorption and aquatic bioconcentration are insignificant for aliphatic ketones. Slow biodegradation is the primary fate mechanism for aliphatic ketones in the subsurface soils and groundwater in the study area.

8.4.2.3 Aromatic Compounds

Aromatic compounds have relatively high vapor pressures ranging from 6.6 mm Hg for o-xylene to 95.2 mm Hg for benzene and relatively high Henry's law constants ranging from 5.1×10^{-3} atm-m^3/mole for o-xylene to 7.68×10^{-3} atm-m^3/mole for m- and p-xylene. Volatilization of aromatic compounds from surface soil, surface water and groundwater to the atmosphere and vadose zone is the primary transport mechanism for these compounds.

In the atmosphere, aromatic compounds exist primarily in the vapor phase and will undergo photochemical reactions with hydroxyl radicals with half-lives of one day or less for toluene and xylene, and 13.4 days for benzene. The aromatic compounds are generally not susceptible to direct photolysis. The aromatic compounds detected are generally persistent in the atmosphere due to the high emission rates of these compounds associated with vehicular traffic.

Similar to the other volatile hydrocarbons, the aromatic compounds detected have relatively low Koc values, which range from 49 for benzene to 1,585 for m-xylene resulting in weak to moderate adsorption to soil with a relatively high rate of leaching to groundwater. Sediment adsorption may occur for ethylbenzene and xylene and bioconcentration may be expected for xylenes.

Biodegradation of the aromatic compounds detected may occur to varying degrees in soil, surface water and groundwater. In subsurface soil, biodegradation is significant for benzene and xylenes. Up to 70% degradation has been observed after 10 days. Slow biodegradation is possible in soil for toluene. In general, slow biodegradation may be expected for the aromatic compounds in surface water and groundwater.

The principal fate mechanisms for aromatic compounds are rapid volatilization from surface soil and biodegradation in subsurface soil and groundwater.

8.4.3 Metals

A number of metals were detected in the media at the Site. The following provides a general discussion of the environmental fate and transport of metals in environmental media.

In general, metals will persist in the environment since volatilization and biodegradation are not significant fate mechanisms for metals. However, mercury and select organometallic complexes (e.g. tetraethyl lead) exhibit significant vapor pressures which promote volatilization of these metals to the atmosphere and vadose zone. More important transport and fate mechanisms for metals include adsorption, dilution, redox reactives and precipitation/dissolution which were previously discussed in Section 8.3. Other factors affecting the mobility of metals from soil/sediment to groundwater and surface water include bulk density of the soil, surface area of the soil particles, particle-size distribution, ion-exchange capacity, organic matter present, type and amount of metallic oxides present and type and amount of clay minerals present.

Of the metals detected at the Site, numerous are commonly occurring and may be expected to be present in soil. These include aluminum, barium, calcium, chromium, copper, iron, magnesium, manganese, nickel, potassium, sodium and zinc. Depending of the specific mineralogy of the Site soils, beryllium, cadmium, lead, and vanadium may also be present. Other metals which may be present at lesser concentrations include arsenic, antimony, cobalt, mercury, silver, selenium and thallium.

Transport of the metals detected in the study area to surface water and groundwater is dependent on the metals' valence state and the chemistry of the Site soil and aqueous media. Since the analytical technique used to identify metals cannot speciate metals and the data developed during the RI was primarily intended to characterize the nature and extent of contamination at the Site, further evaluation of transport mechanisms is not possible.

8.4.4 Inorganic Compounds and Non-Metallic Elements

The inorganic compounds and non-metallic elements detected in the study area groundwater (ammonia, nitrate, chloride and sulfate) are typically associated with landfill operations and are not an issue at the Site. Carbon disulfide, which is classified as an inorganic compound, is a natural product of anaerobic biodegradation and is released to the atmosphere or soil gas through volatilization. Due to the high vapor pressure of carbon disulfide (297 mm Hg at 20°C) and Henry' Law constant (1.4×10^{-3} atm-m^3/mole), volatilization is a significant transport and fate mechanism. Biodegradation and abiotic degradation with photochemically produced hydroxyl radicals have also been also reported as fate mechanisms for carbon disulfide in soil.

Total cyanide was detected in sediment and groundwater in the study area. Similar to metals, the transport and fate of cyanide species is largely dependent on the chemistry of the media in which it is found. In addition, the cation present in the cyanide compound will have a significant effect on its transport and fate. The pH of the media and redox reactions are important to the transport and fate of most cyanide compounds. Low pH will generally convert cyanide compounds to hydrogen cyanide which is a gas. Oxidizing conditions will typically convert cyanide compounds to carbon dioxide and gaseous nitrogen at the proper pH conditions.

8.4.5 Radiologicals

The decay of radioactive isotopes emits radiation. Alpha and beta particles have been detected historically in groundwater samples collected at the Site as gross alpha and gross beta radioactivity. An alpha particle is a helium nucleus with an atomic mass of 4 and an atomic number of 2 and a beta particle is an electron.[10] The radioactivity of a radionuclide is characterized by the nature of the radiation, the energy and the half life of the process. The half life of a radionuclide is the time required for its activity to decay to half of its original value, that is for half the atoms to disintegrate.

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[10]Fetter, C.W., "Contaminant Hydrogeology", Macmillian Publishing Company, 1993.

The radioactive disintegration of a radionuclide results in a decay, to a daughter product which may be radioactive or stable. Ultimately, radioactive decay will result in the formation of a stable isotope.[11] The stability of radioactive isotopes vary widely (from a fraction of a second to millions of years) and the half life of an isotope is a measure of its relative stability. The radioactive decay process is unidirectional. In time, radionuclides will decay to isotopes of stable elements (elements which do not emit radiation).

Radionuclides which emit radiation occur naturally and are man made. Naturally occurring radionuclides include potassium, radon, radium, thorium, uranium, tritium, beryllium, carbon and sodium. Radioisotopes are also byproducts in the wastes of weapons manufacturing and the mining, research and medical industries and include nickel, cobalt, strontium, zirconium, iodine, cesium and others.[12] Since radionuclides occur naturally, gross alpha and gross beta will occur naturally in groundwater. The background concentrations of gross alpha and gross beta in a given location are dependent upon the relative abundance of naturally occurring radionuclides in natural geologic deposits.

The concentrations of gross alpha and gross beta observed during the RI were below MCL threshold levels. Due to the unidirectional nature of the radioactive decay process and since no additional wastes will be deposited in the landfill, it is not expected that concentrations of gross alpha and gross beta would exceed levels of concern at some point in the future. Groundwater samples collected from perimeter wells installed during the OU2 investigation will be analyzed for gross alpha and gross beta. This activity will determine the upgradient concentration of these constituents and investigate whether concentrations of gross alpha and gross beta in downgradient wells are of concern.

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[11]"Handbook of Chemistry and Physics", 69th Edition, CRC Press, 1988.
[12]Fetter, C.W., 1993.

9.0 SUMMARY AND CONCLUSIONS

9.1 SUMMARY

The Four County Landfill Site, located in Fulton County, Indiana, was operated from August 1972 until the U. S. District Court ordered facility operations closed on March 29, 1989. During the period the Site was operational, sanitary, industrial and hazardous wastes were accepted for disposal. Shortly after the U.S. District Court ruling, the Site owners declared bankruptcy and IDEM pursued PRPs under Indiana State Cleanup Law. An SOW was submitted to IDEM by a group of PRPs in support of a Good Faith Offer to IDEM put forth on April 27, 1992. Most of the non-de minimis respondents identified by IDEM formed the Four County Landfill Group. The SOW presented a summary of existing data previously collected at the Four County Landfill Site. In addition, a scope of work was included for performing Site stabilization activities and set out the basis for the work to be undertaken during the RI/FS. On August 13, 1993, an Agreed Order for an RI/FS and Site O&M was entered into between a group of PRPs and IDEM.

An RI/FS Work Plan was prepared and submitted to IDEM in accordance with Paragraphs 38 and 39 of the Agreed Order and the SOW (Exhibit II of the Agreed Order) and was consistent with Section 121 of CERCLA and U.S. EPA guidance documents. On May 3, 1994, the Work Plan was approved by IDEM. Initiation of investigative activities detailed in the approved Work Plan commenced on May 23, 1994. A Groundwater Technical Memorandum which summarized Site groundwater data acquired during the RI as well as historical data, the acquisition of which preceded implementation of the RI, was submitted to IDEM and approved by letter dated May 22, 1995. The Groundwater Technical Memorandum provided a comprehensive database of available groundwater information.

In light of the data generated during the RI, supplemental investigative activities necessary to adequately define the nature and extent of contamination at the Site were identified in Addendum 1 to the approved RI/FS Work Plan. Addendum 1 defined these tasks, set forth the rationale for these tasks and detailed data collection and analytical protocols which had not

been previously established by the approved RI/FS Work Plan. Addendum 1 was approved by IDEM, by letter dated September 27, 1995.

To date, a number of rounds of multimedia sampling and other data gathering tasks associated with the RI have been completed and sufficient data have been acquired to determine the nature and extent of contamination on-Site and to evaluate any potential Site risk. In order to expedite closure of the Site and minimize any ongoing potential risk to human health and the environment, the Four County Landfill Technical Committee proposed to divide the Site into two operable units. OU1 focuses primarily on the remediation of the landfill while the focus of OU2 is primarily on off-Site groundwater and subsurface soils. Dividing the Site into operable units allows the flexibility to close and stabilize the landfill on a separate timetable from the groundwater investigation which may require several phases to complete. The "operable units approach" was first proposed in a memorandum to IDEM dated February 10, 1995. In response, IDEM approved the "operable units approach" and clarified the components of each of the operable units. On this basis, operable unit OU1 consists of the landfill cap, leachate collection and treatment from both lined and unlined cells, landfill gas collection and treatment, institutional controls to supplement engineering controls, and source-area groundwater control and treatment.

RI activities have provided a detailed understanding of the physical characteristics of the Site and the nature and extent of contamination. Moreover, the data compiled during the RI to date are sufficient to identify remedial action objectives for the Site and evaluate remedial action alternatives and select a final remedy for Operable Unit 1. This Section summaries the significant findings of the OU1 RI as well as the activities associated with the OU2 RI which have been completed to date. The OU2 investigation will continue and the results of the OU2 investigation will be provided in a separate RI report upon completion of that investigation.

9.1.1 Nature and Extent of Contamination

Activities detailed by the Work Plan were designed to ensure strict compliance with the tasks outlined in the Agreed Order.

Sediment and Surface Water

In general, only a few organic compounds were observed in on- and off-Site sediment and surface water samples collected during the RI. Moreover, none of the detected organic compounds exceeded applicable Federal or State of Indiana criteria. In general, the concentrations of metals analytes in on-and off-Site sediment samples fall within the expected normal background levels for soil. Additional specific comments are provided in the following.

- Only two VOCs (acetone and dichloromethane), were observed in collected on-Site sediment samples. Acetone was detected in five of the eight on-Site sediment samples collected. Dichloromethane was detected in four of the eight on-Site sediment samples.

- Only one SVOC, (butylbenzylphthalate), was detected in collected on-Site sediment samples.

- Pesticides and PCBs were not detected in any on-Site sediment samples collected during the RI.

- Only one organic compound (acetone) was detected in on-Site surface water samples.

- In general, the concentrations of metals analytes in on-Site sediment samples fall within the expected normal background levels for soil.

- Only one analyte, silver, was found to exceed applicable ambient water quality criteria in on-Site surface water samples.

- Only three VOCs, acetone, 4-methyl-2-pentanone and DCM were detected at low concentrations in off-Site sediment samples collected.

- SVOCs and pesticides/PCBs were not detected in collected off-Site sediment samples.

- Three VOCs, carbon disulfide, acetone and toluene were detected in off-Site surface water samples. However, toluene and acetone were also detected in run-on areas south of the Site. Carbon disulfide was only detected in sample collected from the run-on area south of the Site.

- SVOCs and pesticides/PCBs were not detected in any off-Site surface water samples.

- The concentrations of metal analytes in off-Site sediment samples each fall within respective expected normal background levels for soil.

- The greatest variety of metals analytes were detected in the run-on off-Site surface water sample collected at S-15.

- With the exception of silver at one location, there were no exceedences of applicable ambient water quality criteria for metals analytes in off-Site surface water samples.

Landfill Gas

Landfill gas monitoring activities included whole air sampling for VOCs, monitoring of VOCs, combustible gases, hydrogen cyanide, hydrogen sulfide and oxygen content using direct-reading instruments and a perimeter soil gas survey for methane gas. The results of these activities are summarized below.

- Only two VOCs, acetone and 1,1-DCE, were sporadically detected in collected whole air samples. The whole air analytical data demonstrate that VOC emissions from the landfill are insignificant. Moreover, the detections of acetone and 1,1-DCE which were both close to the reported practical quantitation limit (PQL) were not found above PQLs in corresponding field duplicate samples.

- There were no detections of H_2S, HCN or combustible gases during perimeter air readings recorded by direct-reading instruments during each of the two air sampling events. Total VOCs were not detected above the background readings and the oxygen levels recorded were within the expected range.

- Data compiled during the soil gas survey indicated that significant quantities of methane gas resulting from the degradation of organic waste present in the landfill are not present near the property boundaries. Methane gas detected at two locations is attributable to the ongoing degradation of peat present at these locations rather than the decay of waste deposits in the landfill.

Groundwater

A detailed evaluation of groundwater conditions beneath the Site is beyond the scope of this document. However, a brief summary of the groundwater data compiled to date is provided below.

- The primary Site-related groundwater concern is the presence of VOCs. The groundwater contains VOCs of the chlorinated aliphatic hydrocarbon group (alkanes and alkenes), the aromatic group and aliphatic ketones.

- The greatest number and magnitude of VOC detections occurred in Unit A monitoring wells within, or adjacent to, unlined waste deposits located in the western portion of the Site.

- The number and magnitude of VOC detections were lower in the underlying stratigraphic units. VOCs do not appear to extend off Site within Unit B.

- Only a few SVOCs were detected in Unit A at concentrations which were several orders of magnitude less than observed VOC concentrations. SVOCs were not detected in Unit B groundwater

samples and were detected at low concentrations in groundwater samples collected at only two locations from Unit C.

- TAL metal concentrations were not found to be in excess of the concentrations observed in the upgradient well samples for the filtered groundwater samples. Moreover, the variety and concentration of detected metals are mainly attributable to the natural chemistry of the groundwater rather than the result of historic waste disposal practices.

- The concentrations of gross alpha and gross beta observed during the RI were below the MCL threshold values. Due to the unidirectional nature of the radioactive decay process and the fact that the landfill no longer accepts waste, it is not expected that concentrations of gross alpha and gross beta would exceed levels of concern in the future. Nevertheless, gross alpha and gross beta concentrations in groundwater will be further evaluated as part of the OU2 RI.

9.1.2 Fate and Transport

The potential routes of migration for Site-related compounds are summarized below.

Surface Water Runoff

On-Site surface water is managed in a series of ditches and holding ponds. These surface waters are directed to the northeast retention pond where there is a single managed outlet. The on-Site discharge point allows water to accumulate in the northeast quadrant, then drain into a culvert (located under County Highway 525 North) that empties into the wetland basin north of the Site.

Any landfill-derived constituents entering the surface water on-Site would be directed to the northeast retention pond. The concentrations of landfill-derived constituents would likely be significantly reduced as a result of dilution with other clean surface water which enters the

pond. Once released from the northeast retention pond, surface water flows slowly toward the north and northeast through a series of interconnected wetlands, small manmade lakes and drainageways. However, significant impacts to either on- or off-Site surface water from the landfill deposits were not observed during the RI.

Air and Landfill Gas

Potential source areas for vapor emissions are the landfill deposits and leachate which may contain volatile constituents which may be released when the leachate is brought to the surface during O&M activities. In terms of air migration, the constituent normally of greatest concern at a landfill is methane gas, which is generated during decomposition of the waste and NMOCs, which are present in the wastes deposited at the Site. NMOCs most likely to be present in landfill gas emissions are VOCs which have high vapor pressures, low aqueous solubilities (high Henry's Law constants). However, activities conducted during the RI indicated that releases of landfill gas-related compounds were insignificant from an overall exposure standpoint.

Groundwater

The permanent water table beneath the Site generally occurs at an elevation of approximately 728 feet amsl. Intermittent saturated zones were observed in Unit A. However, in general, the first occurrence of the permanent water table occurs within Unit B. Groundwater flow in the saturated zones beneath the Site was observed to be towards the north and northeast beneath the Site. Dissolved compounds in groundwater are transported primarily by advection, parallel to the direction of bulk groundwater flow, at a rate which is proportional to the groundwater flow velocity. The contaminant transport velocities would be further reduced by the natural attenuation mechanisms.

Landfill-related constituents present in groundwater beneath the Site would generally be transported towards the north and

northeast parallel to the groundwater flow direction. A breach of Unit A appears to have occurred as a result of the installation of several wells through source-area perched groundwater layers containing elevated levels of VOCs. Unit A appears to significantly impede the downward migration of contaminants to the underlying saturated zones (Units B and C).

9.1.3 Risk Assessment

Specific findings of the risk assessment are summarized below.

Source-Area Groundwater

- The estimated incremental cancer risk from on-Site construction worker exposure to Unit A perched water falls within the target risk range of 10^{-4} to 10^{-6} established by the U.S. EPA.

- The hazard indices for on-Site construction worker exposure to Unit A perched water are several orders of magnitude below 1.0, the level of concern.

- The estimated incremental cancer risk for residential exposure to Units B and C source-area groundwater fall above the target risk range of 10^{-4} to 10^{-6} established by the U.S. EPA.

- The hazard indices for residential exposure to Units B and C source-area groundwater are slightly above 1.0.

Surface Water

- There were no chemicals of concern identified in on- or off-Site surface water. Therefore, surface water was not evaluated as part of the RA.

Sediment

- The estimated cancer risk related to worker and occasional visitors/trespassers sediment exposures on-Site are at the lower end or below the target risk range of 10^{-4} to 10^{-6} established by the U.S. EPA. The hazard indices for non-cancer risk under present and future Site conditions are several orders of magnitude below 1.0, which is considered the level of concern.

- The estimated cancer risk from off-Site sediment exposures for current and future conditions are below, or at the lower end of the target risk range of 10^{-4} to 10^{-6} established by the U.S. EPA. The hazard indices for non-cancer risk under present and future Site conditions are several orders of magnitude below 1.0.

Air

- The estimated cancer risk related to worker inhalation exposures on-Site are at the lower end or below the target risk range of 10^{-4} to 10^{-6} established by the U.S. EPA. The hazard indices for non-cancer risk under present and future Site conditions are several orders of magnitude below 1.0.

- The estimated cancer risk related to inhalation exposure of residents near the Site are within the target risk range of 10^{-4} to 10^{-6} established by the U.S. EPA. The hazard indices for non-cancer risk under present and future Site conditions are several orders of magnitude below 1.0.

Summation of Risks

- The estimated RME cancer risk for the present cumulative risk scenario for industrial workers is within the target cancer risk range of 10^{-6} to 10^{-4} as established by U.S. EPA. The hazard index is below 1.0, which is considered the level of concern.

- The estimated RME cancer risk for the present cumulative risk scenario for construction workers is within the target cancer risk range of 10^{-6} to 10^{-4} as established by U.S. EPA. The hazard index is below 1.0, which is considered the level of concern.

- The estimated RME cancer risk for the present cumulative risk scenario for residents is within the target cancer risk range of 10^{-6} to 10^{-4} as established by U.S. EPA. The hazard index is below 1.0, which is considered the level of concern.

- For the North Sector which is downgradient of the Site with regard to groundwater, the sum of residential total and current groundwater RME cancer risk is slightly above the target risk range of 10^{-6} to 10^{-4}. The RME hazard index for a resident in the North Sector with regard to groundwater is slightly above 1.0, the level of concern. As stated earlier, this scenario is unlikely since it is the equivalent to drilling a well through the landfill, in the center of the Site and using it to supply a residence. Considering the conservative nature of the assumption and the fact that groundwater usage evaluated is not likely to occur, these minor exceedences are not significant concerns.

9.2 CONCLUSIONS

RI activities have provided a detailed understanding of the physical characteristics of the Site and the nature and extent of contamination. Moreover, the data compiled during the RI to date are sufficient to select a final remedy for Operable Unit 1. A separate RI will continue to further investigate groundwater in the vicinity of the Site. The results of the OU2 investigation will be provided in a separate RI report upon completion of that investigation.

9.2.1 Data Limitations and Future Work

An extensive database pertaining to the Site operational history, physical conditions and nature and extent of contamination were developed during previous investigations and during the OU1 RI. These data are sufficient to proceed with the feasibility study for OU1. Additional data will likely be required in order to proceed with the detailed design of the selected remedy for OU1. The final remedy will be selected by IDEM, with input from the U.S. EPA, upon submittal of the final OU1 FS Report and following a public review process. However, at a minimum, the data which is typically required to proceed with detailed design of the selected remedy are briefly summarized below:

i) detailed site surveys including property boundaries and topography;

ii) confirmation of the actual footprint of the landfill;

iii) determination of emission rates and chemical characterization of landfill gas; and

iv) evaluation of the thickness and geotechnical characteristics of landfill cover soils.

The potential need for additional design-related data will be dependent upon the final remedy which is selected for the Site and will be assessed upon selection of the final remedy.

9.2.2 Recommended RAOs

Specific remedial action objectives (RAOs) must consist of medium-specific or operable unit-specific goals for protecting human health and the environment.[13] The RAOs must not be so specific as to overly limit the range of remedial alternatives. Rather, these RAOs are a set of performance standards by which to compare the remedial alternatives.

[13]"Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA", (EPA, October 1988)

Consistent with the operable units established for the Site, recommended RAOs for OU1 address the following environmental media on the Site:

i) soil and landfill contents,

ii) air and dust,

iii) landfill gas,

iv) surface water,

v) sediment, and

vi) leachate and source area groundwater.

A summary of the RAOs for these media are presented in Table 9.1.

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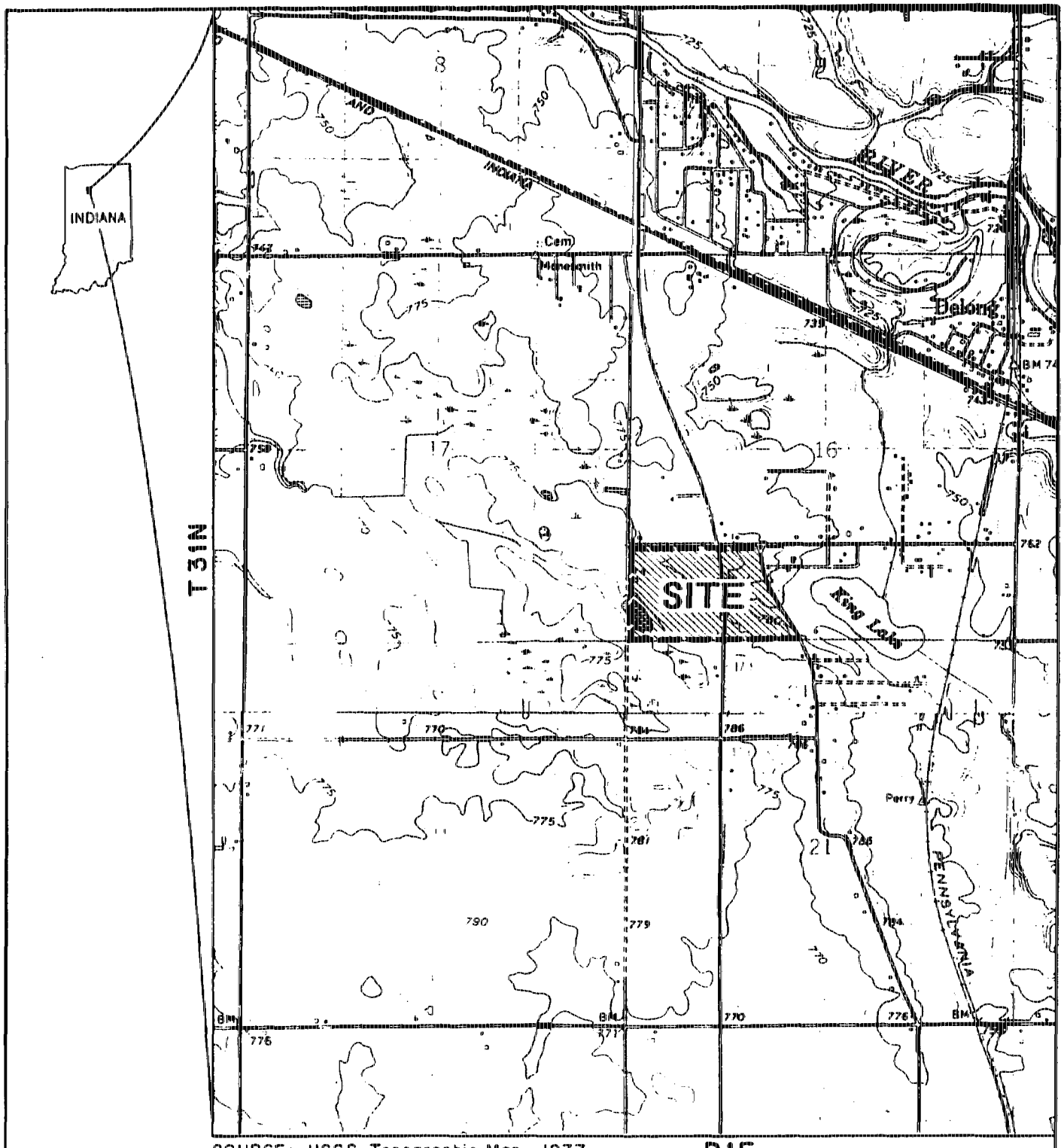


SOURCE: USGS Topographic Map, 1977
Culver (1980) and Kewanna (1977), Ind.

0 1/4 1/2 mile
Contour Interval = 5 feet

CRA

figure 2.1

SITE LOCATION
FOUR COUNTY LANDFILL
Fulton County, Indiana

5369(11) – JAN. 11, 96 – REV. 0 – (C)

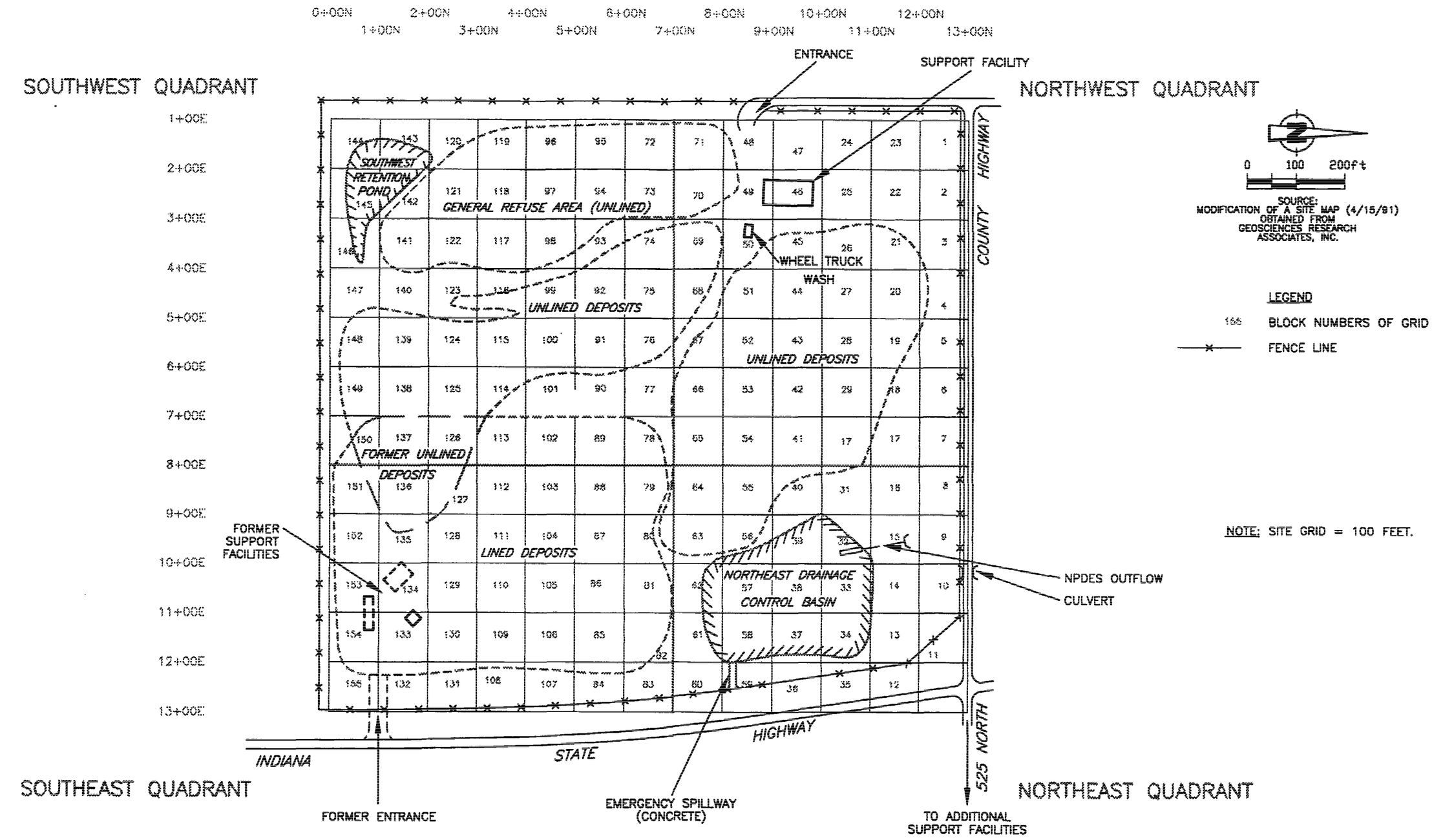


figure 2.2
SITE PLAN
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)–JAN. 11, 96–REV.0–(C)(P–85)

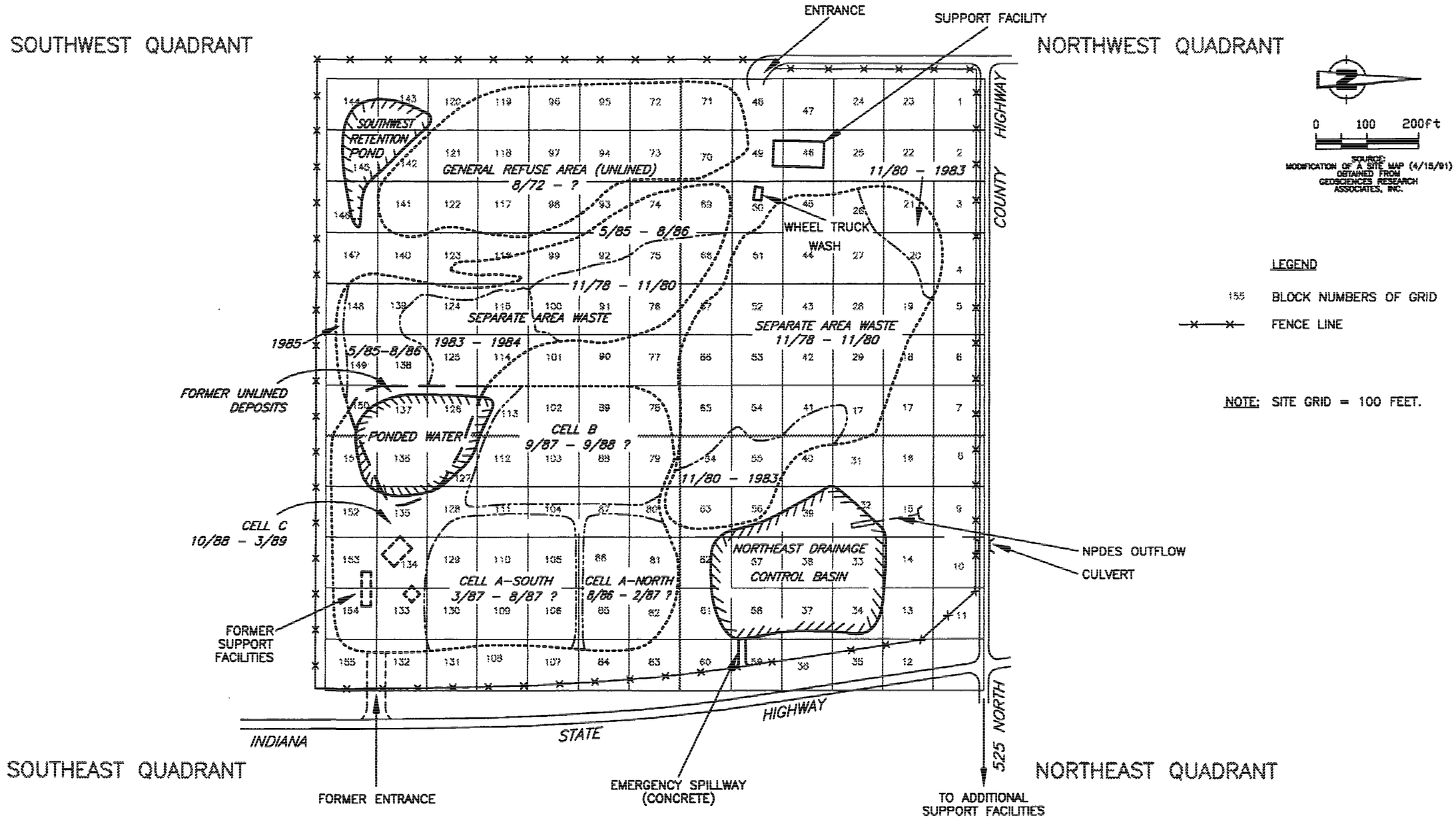


figure 2.3

WASTE DEPOSIT BOUNDARIES AND DEPOSITIONAL HISTORY
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 8, 96-REV.0-(C)(P-87)

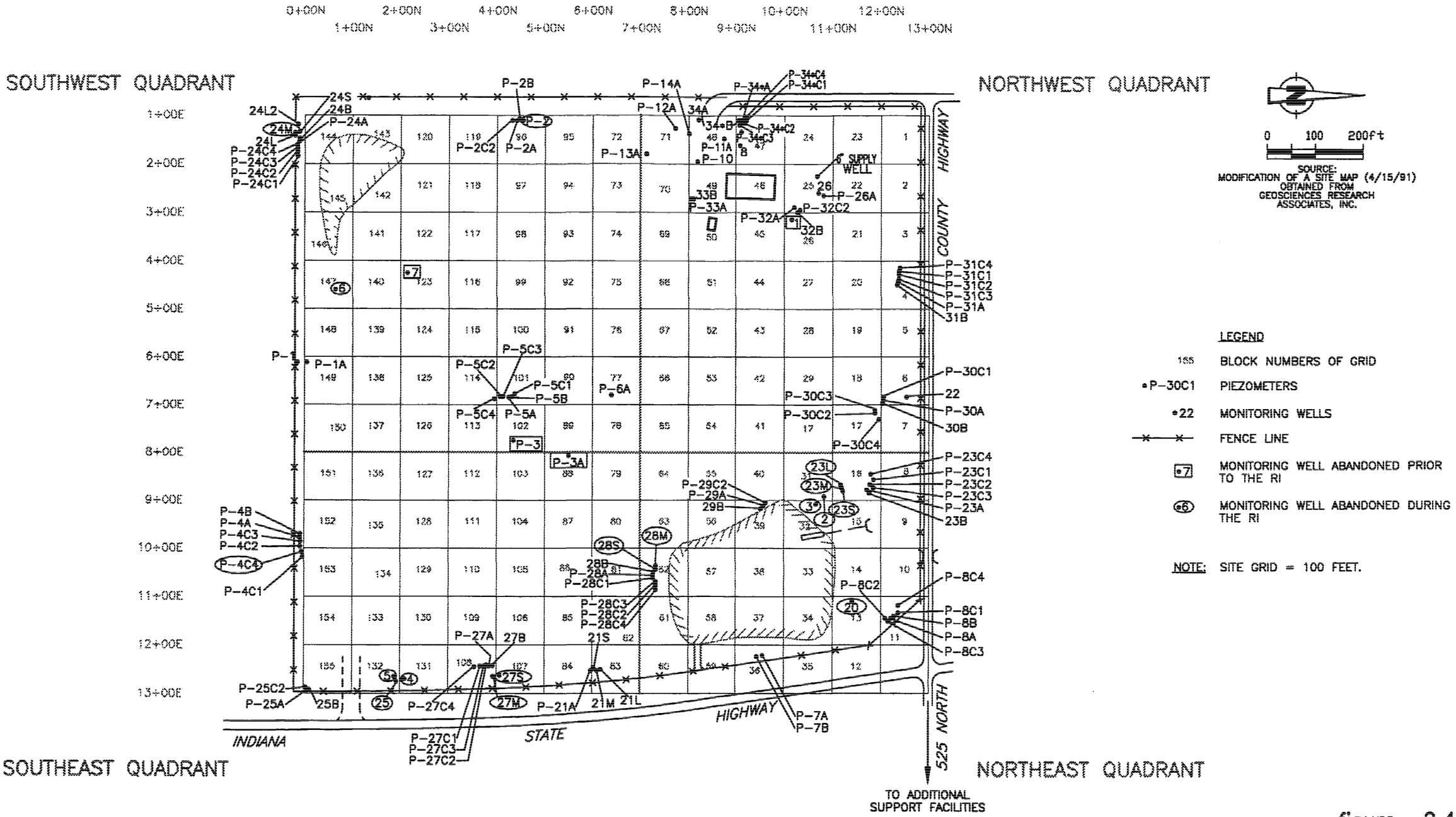


figure 2.4

MONITORING WELL LOCATIONS
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 8, 96-REV.0-(C)(P-86)

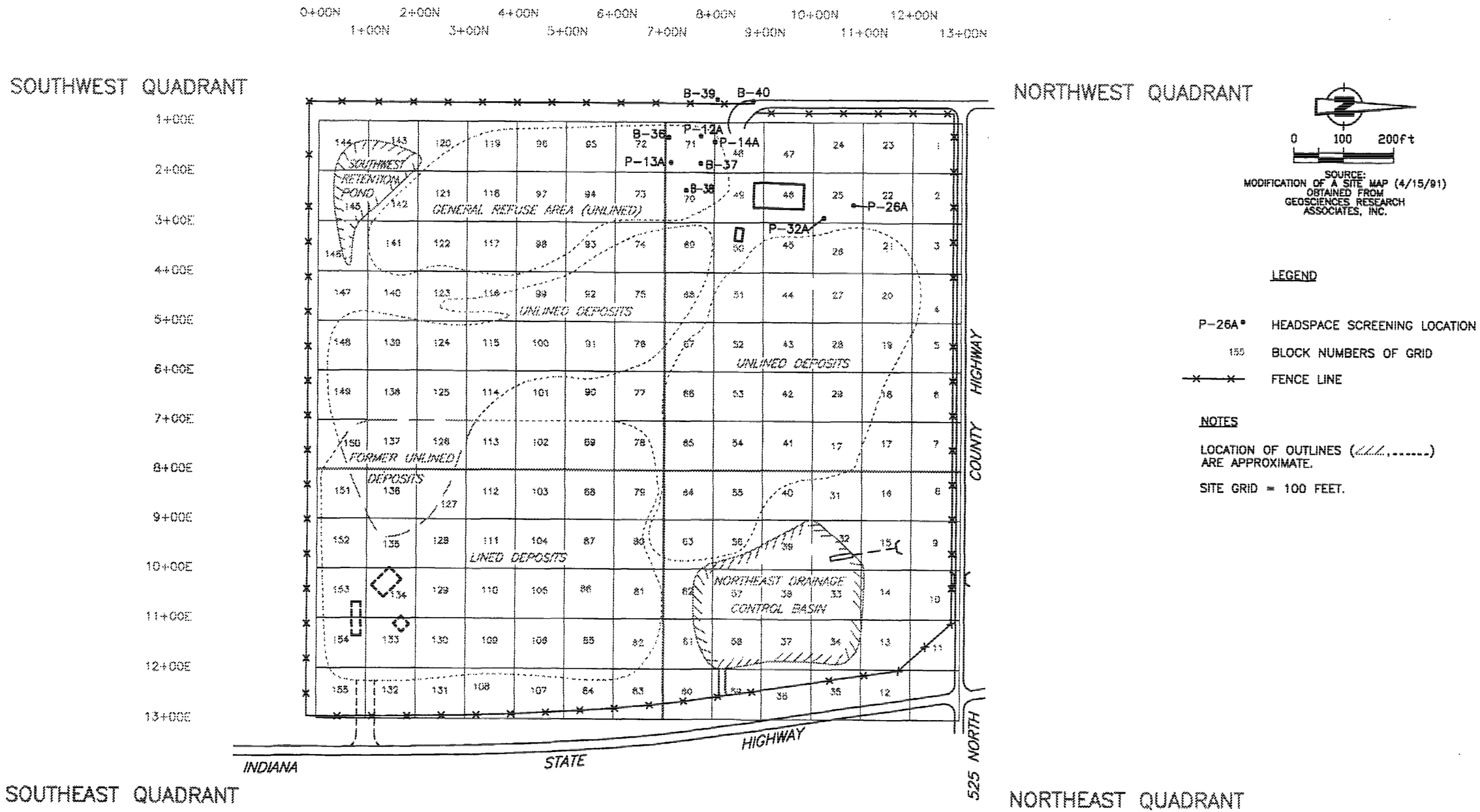


figure 3.1

GRA HEADSPACE SCREENING LOCATIONS
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-MAY 1, 96-REV.1-(C)(P156)

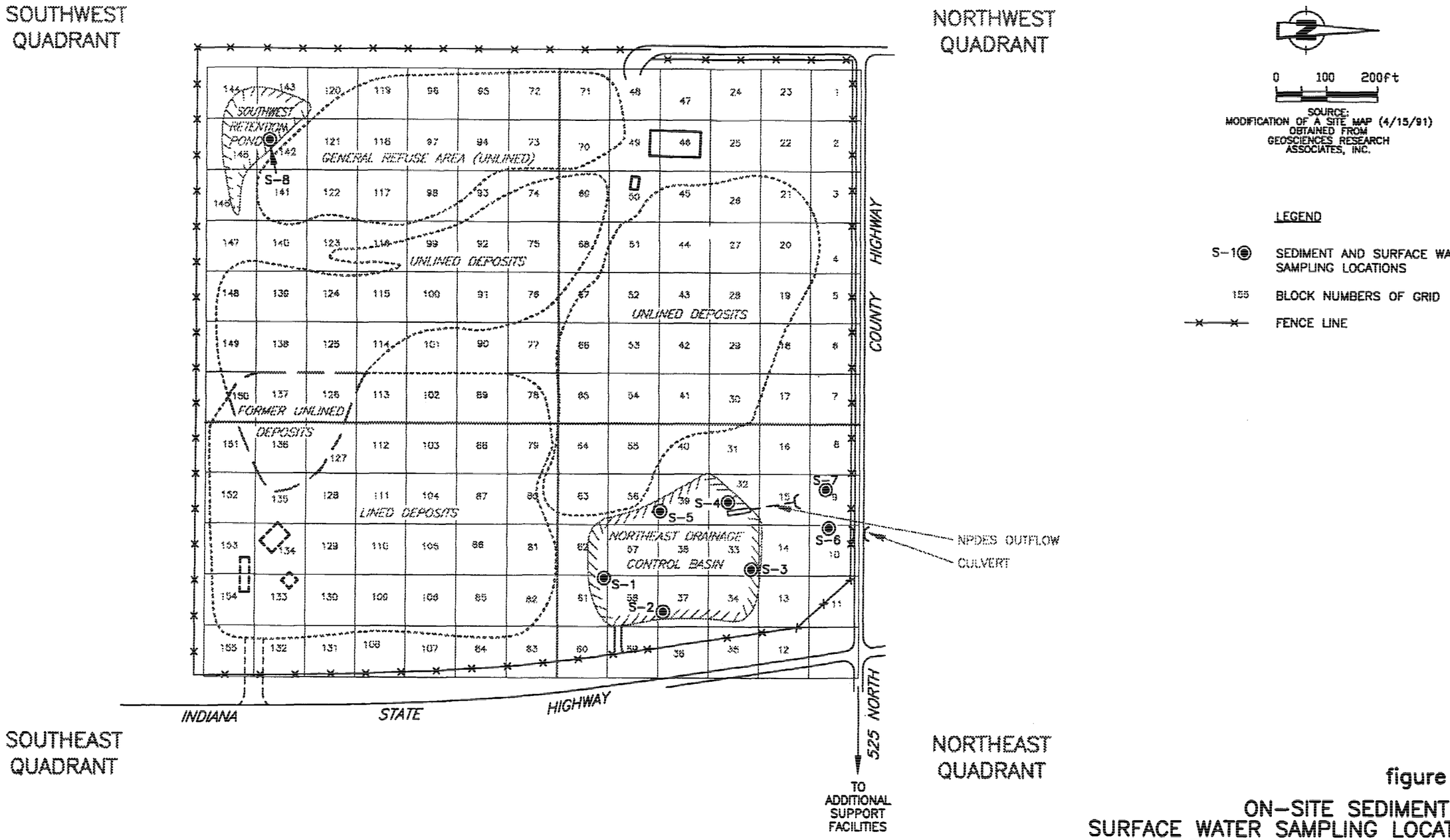


figure 4.1

ON-SITE SEDIMENT AND SURFACE WATER SAMPLING LOCATIONS
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 8, 96-REV.0-(C)(P-88)

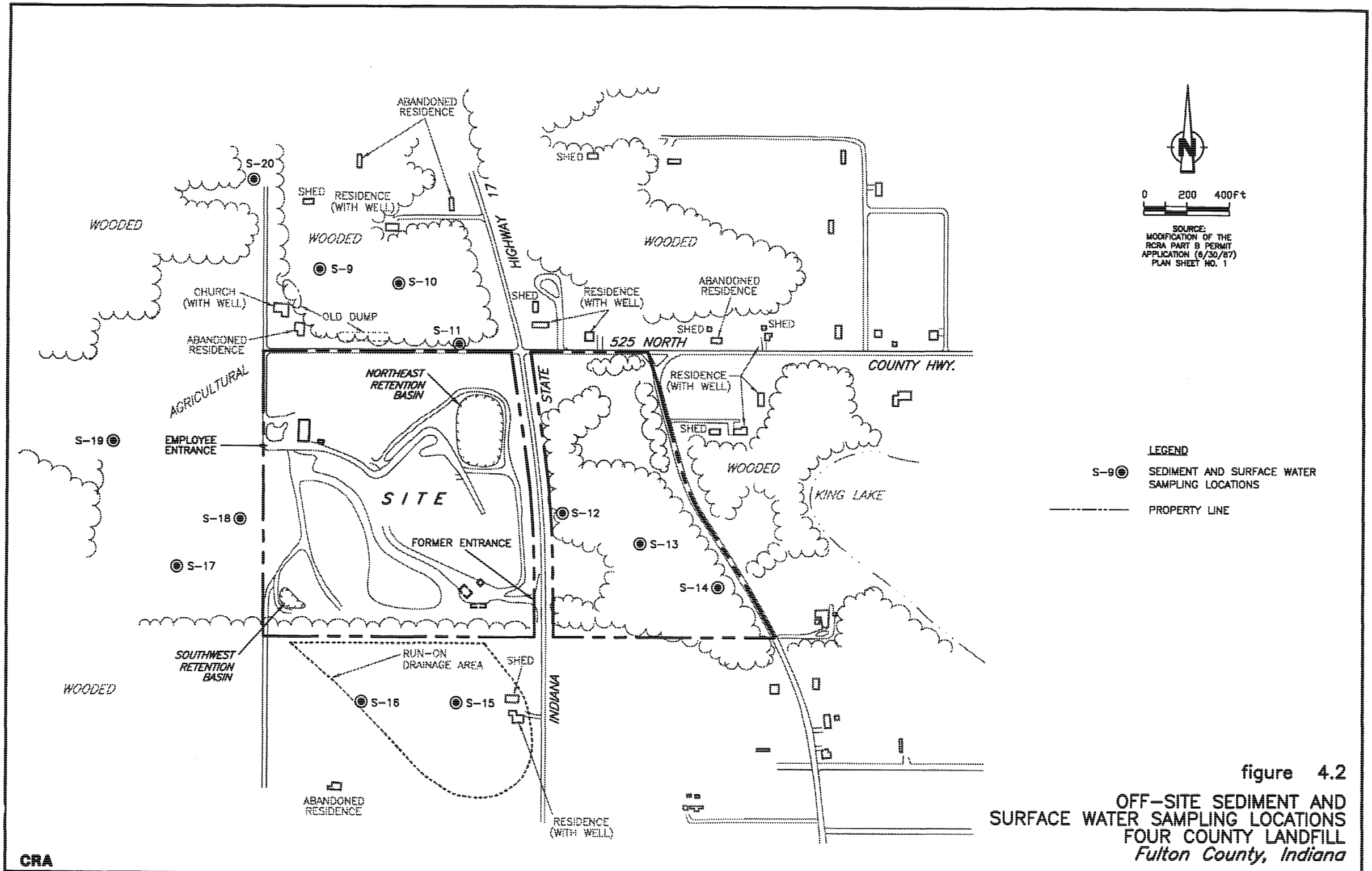


figure 4.2

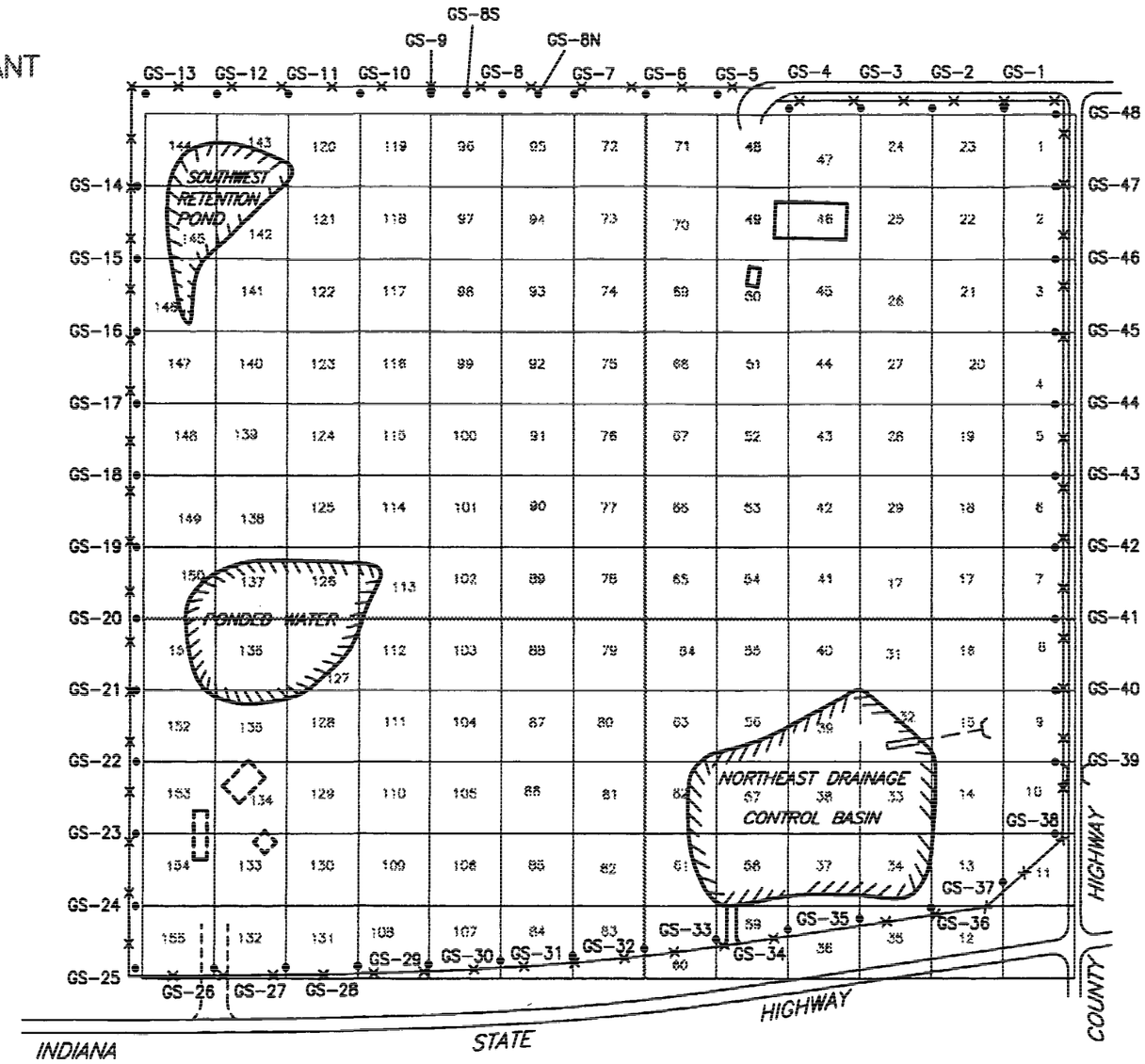
OFF-SITE SEDIMENT AND SURFACE WATER SAMPLING LOCATIONS
FOUR COUNTY LANDFILL
Fulton County, Indiana

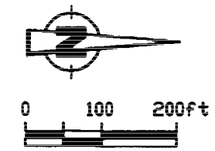
CRA

5369(11) JAN. 8, 96-REV.0-(C)(P-89)

SOUTHWEST QUADRANT

NORTHWEST QUADRANT





SOURCE:
MODIFICATION OF A SITE MAP (4/15/91)
OBTAINED FROM
GEOSCIENCES RESEARCH
ASSOCIATES, INC.

LEGEND

155	BLOCK NUMBERS OF GRID
—×—×—	FENCE LINE
GS-48 •	SOIL GAS MONITORING LOCATION AND IDENTIFIER

NOTE: SITE GRID = 100 FEET.

SOUTHEAST QUADRANT

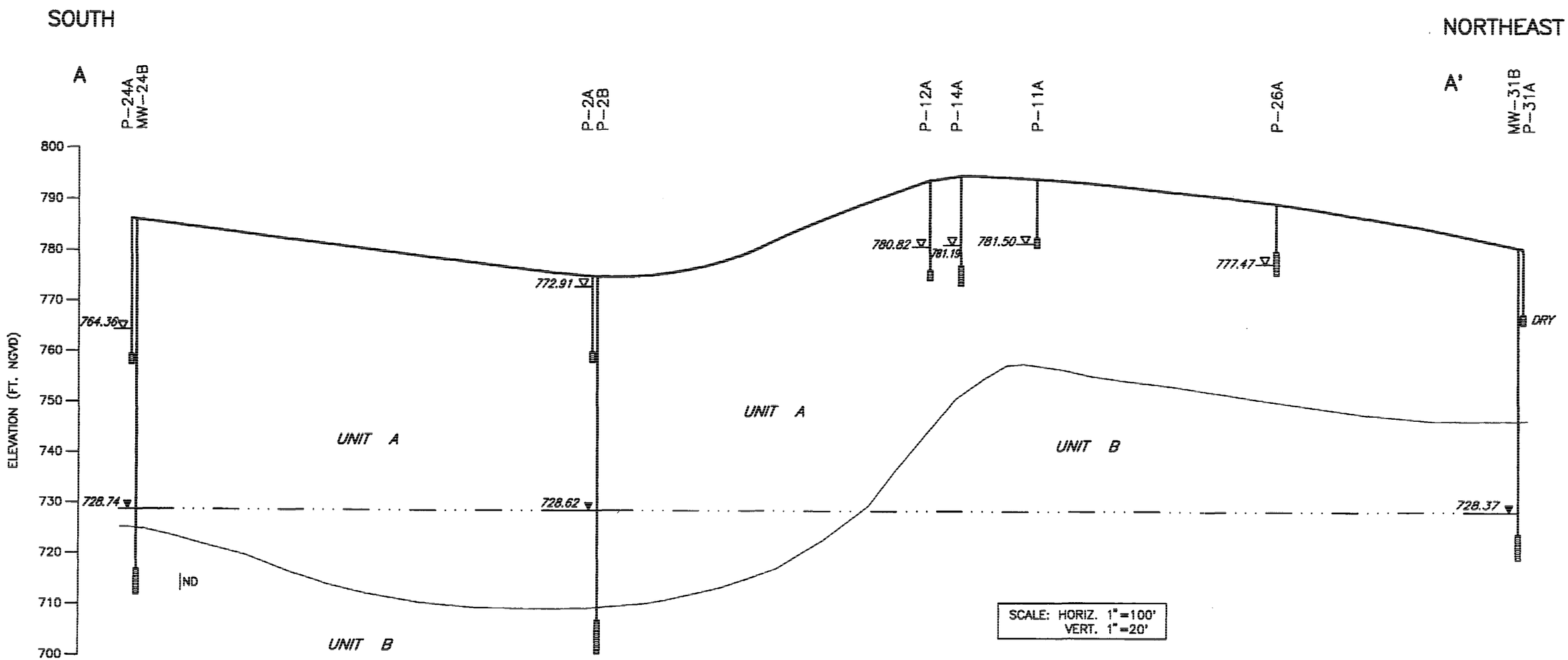
NORTHEAST QUADRANT

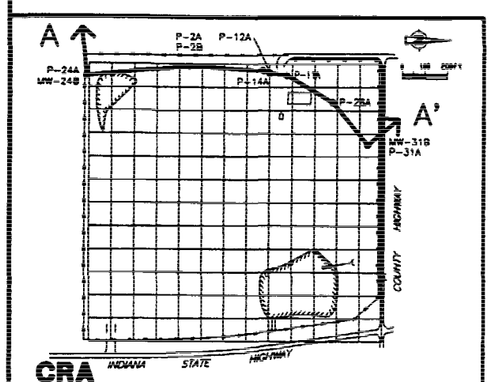
figure 4.3

SOIL GAS MONITORING LOCATIONS
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)–JAN. 9, 96–REV.0–(C)(P–90)





NOTES:

UNIT A GLACIAL TILL, PREDOMINATELY LOAM AND SILT. SUBUNITS ARE BASED ON VARIATIONS IN TEXTURE, PEBBLE COMPOSITION AND OCCURENCE OF THIN OXIDIZED ZONES AND INTERTILL CLASTIC UNITS.

UNIT B WELL STRATIFIED SEQUENCE OF FINE TO MEDIUM GRAINED SAND AND SILT, COMMONLY CAPPED BY A THIN PEBBLY SAND AND PEBBLY LOAM WHICH IS STRONGLY OXIDIZED IN THE UPPER PART.

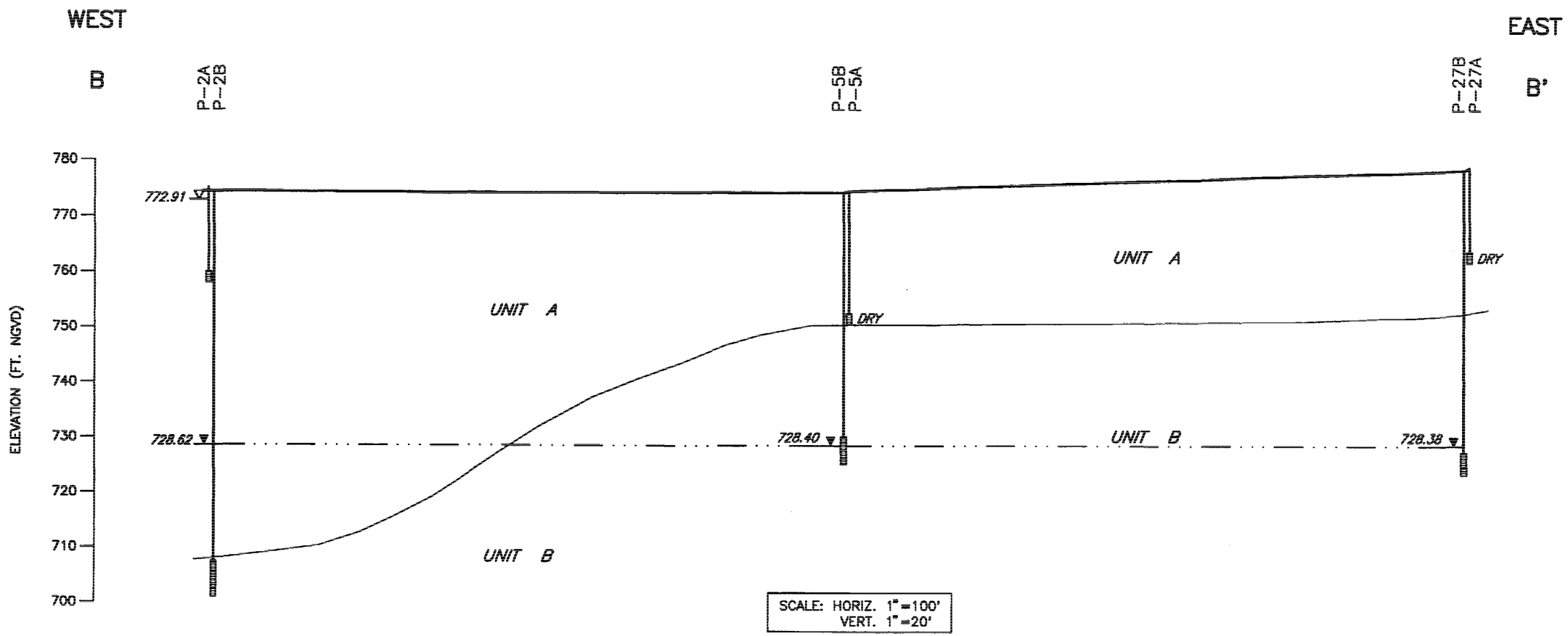
772.91▽ PERCHED GROUNDWATER ELEVATION IN JULY 1994.

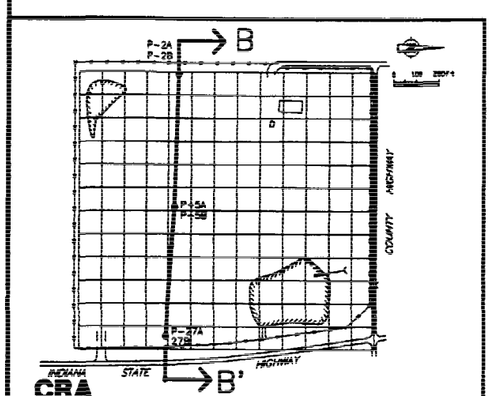
728.62▼ GROUNDWATER ELEVATION IN JULY 1994.

figure 4.4

GEOLOGICAL CROSS SECTION A–A'
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

5369(11) JAN. 15, 96 REV.0 (C)(X-11)





NOTES:

UNIT A GLACIAL TILL, PREDOMINATELY LOAM AND SILT. SUBUNITS ARE BASED ON VARIATIONS IN TEXTURE, PEBBLE COMPOSITION AND OCCURENCE OF THIN OXIDIZED ZONES AND INTERTILL CLASTIC UNITS.

UNIT B WELL STRATIFIED SEQUENCE OF FINE TO MEDIUM GRAINED SAND AND SILT, COMMONLY CAPPED BY A THIN PEBBLY SAND AND PEBBLY LOAM WHICH IS STRONGLY OXIDIZED IN THE UPPER PART.

772.91 ▽ PERCHED GROUNDWATER ELEVATION IN JULY 1994.

728.62 ▼ GROUNDWATER ELEVATION IN JULY 1994.

figure 4.5

GEOLOGICAL CROSS SECTION B–B'
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

5369(11) JAN. 15, 96 REV.0 (C)(X-12)

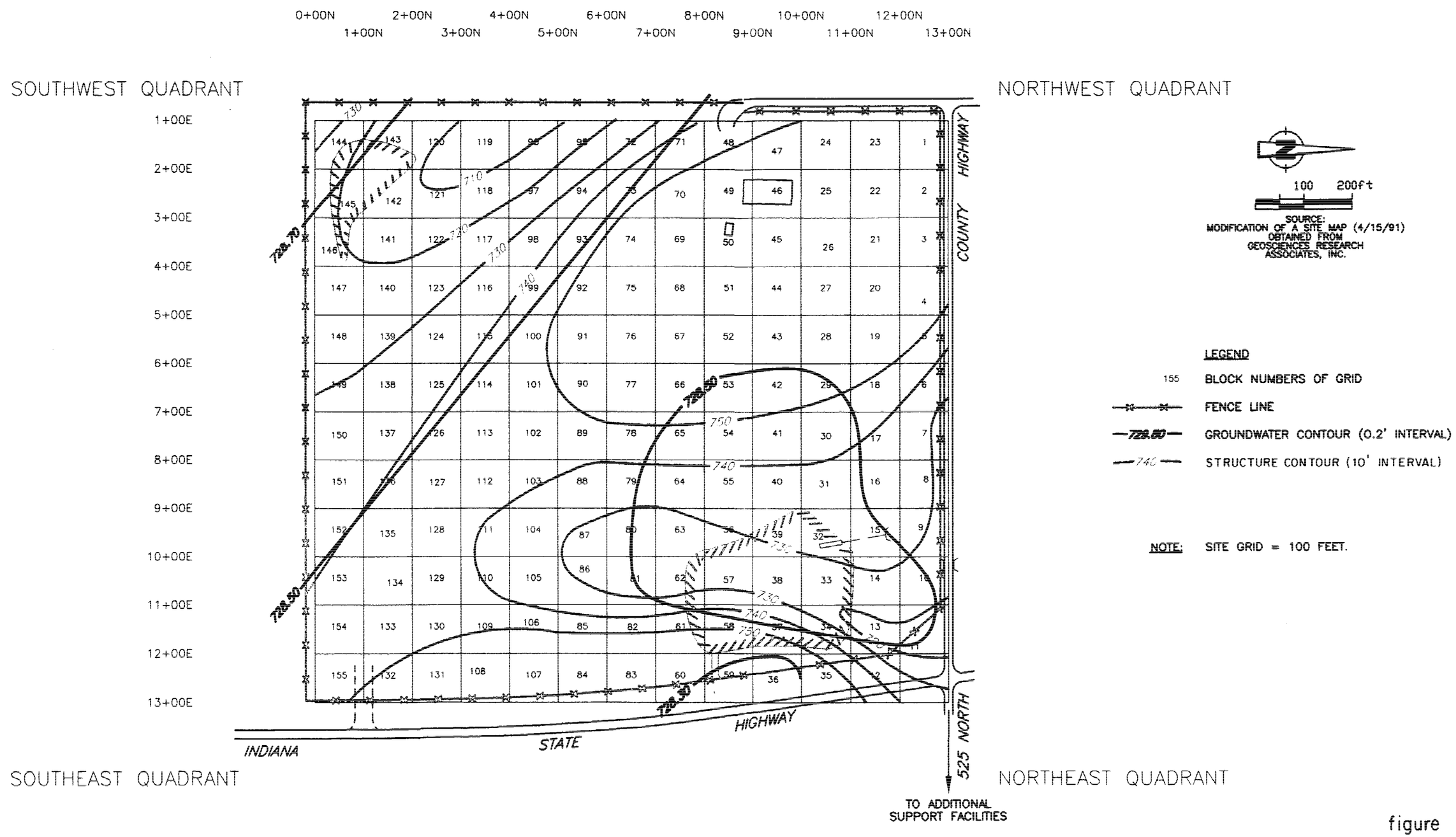


figure 4.6

UNIT B GROUNDWATER ELEVATIONS (JULY 1994) AND STRUCTURE CONTOUR MAP SHOWING TOP OF "B" UNIT
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 11,96-REV.0-(C)(P-51)

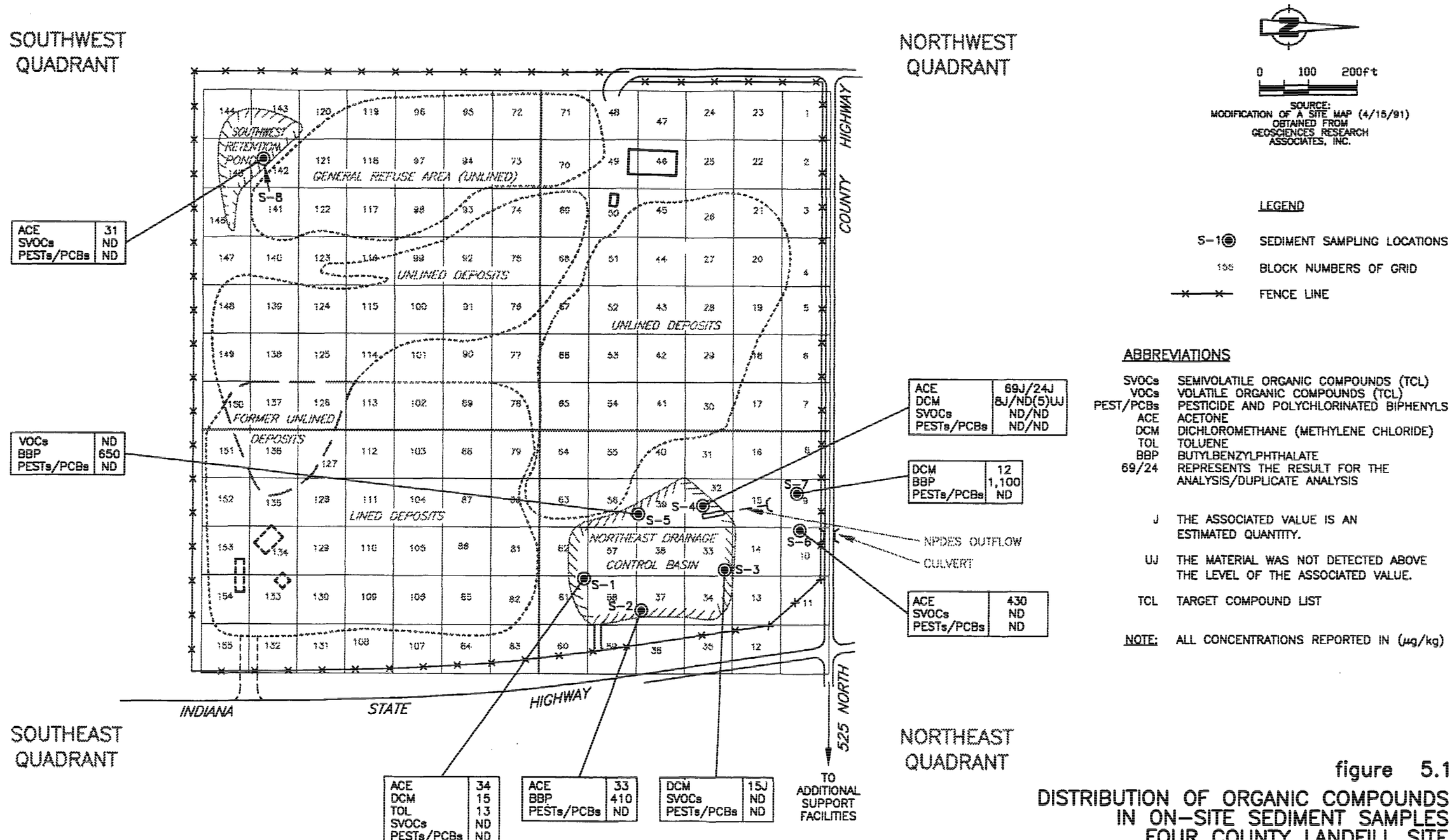


figure 5.1

DISTRIBUTION OF ORGANIC COMPOUNDS IN ON-SITE SEDIMENT SAMPLES FOUR COUNTY LANDFILL SITE

Fulton County, Indiana

CRA

5369(11)-JAN. 9, 96-REV.0-(C)(P-91)

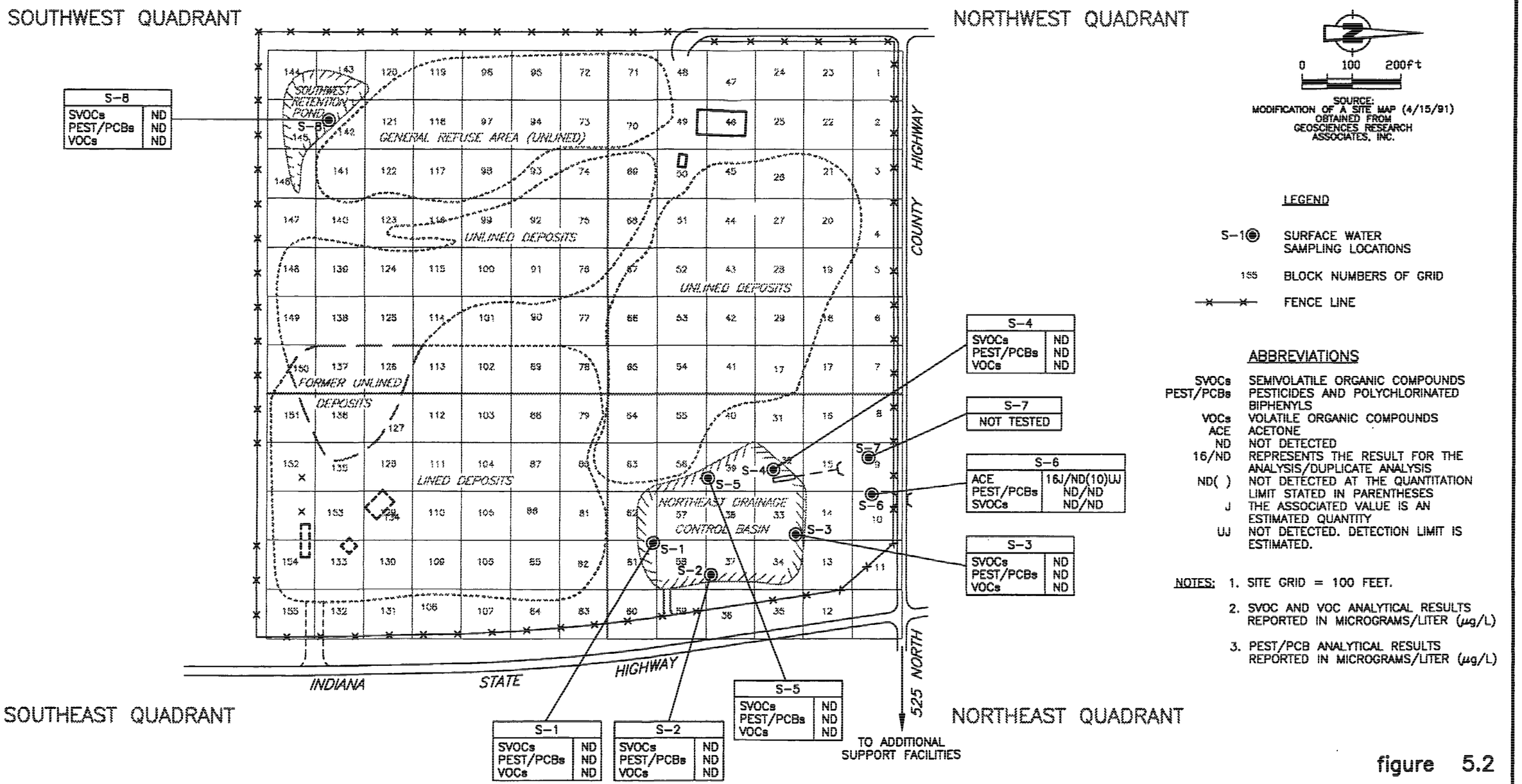
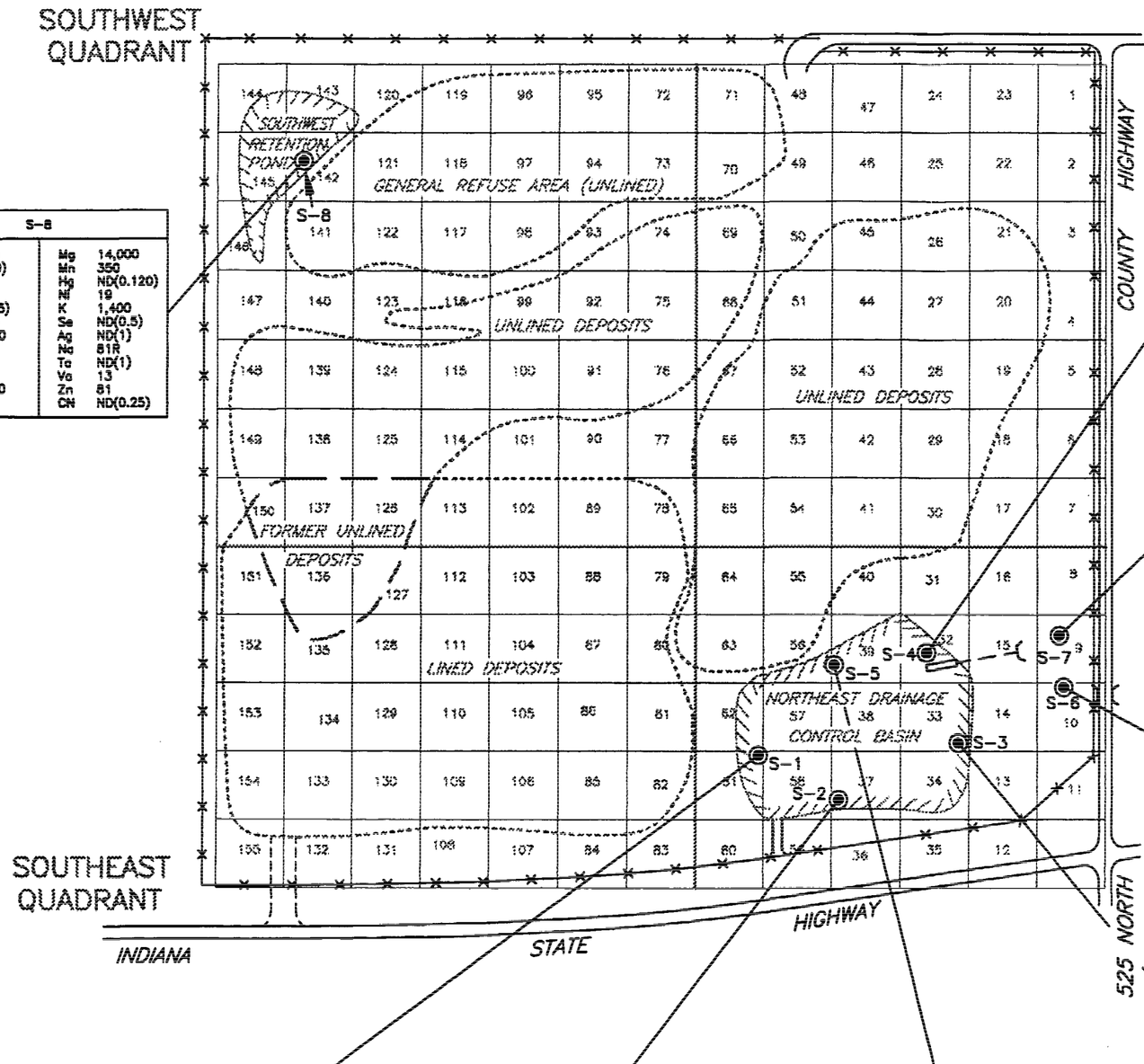


figure 5.2

DISTRIBUTION OF ORGANIC COMPOUNDS IN ON-SITE SURFACE WATER SAMPLES
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 9, 96-REV.0-(C)(P-92)



S-8			
Al	6,900	Mg	14,000
Sb	ND(30)	Mn	350
As	5.3	Hg	ND(0.120)
Ba	28	Ni	19
Be	ND(0.5)	K	1,400
Cd	ND(5)	Se	ND(0.5)
Ca	28,000	Ag	ND(1)
Cr	13	Na	81R
Co	5	Tl	ND(1)
Cu	16	Va	13
Fe	17,000	Zn	81
Pb	16	CN	ND(0.25)

S-4			
Al	11,000/9,900	Mg	16,000/15,000
Sb	ND(30)/ND(30)	Mn	320/330
As	5.6/5.7	Hg	ND(0.120)ND(0.120)
Ba	38/39	Ni	34/30
Be	ND(0.5)/ND(0.5)	K	3,200J/2,200J
Cd	ND(2.5)/ND(2.5)	Se	ND(0.5)/ND(0.5)
Ca	31,000/29,000	Ag	ND(1)/ND(1)
Cr	28/22	Na	120R/100R
Co	6.5J/10J	Tl	ND(1)/ND(1)
Cu	27/25	Va	20/17
Fe	21,000/21,000	Zn	130/130
Pb	22/23	CN	0.67/0.57

S-7			
Al	4,100	Mg	12,000
Sb	ND(30)	Mn	340
As	2.8	Hg	ND(0.120)
Ba	22	Ni	12R
Be	0.79	K	940
Cd	ND(2.5)	Se	ND(0.5)
Ca	21,000	Ag	ND(1)
Cr	8.8	Na	120R
Co	9.2	Tl	ND(1)
Cu	12	Va	19
Fe	8,700	Zn	70
Pb	10	CN	ND(0.25)

S-6			
Al	10,000	Mg	11,000
Sb	ND(30)	Mn	150
As	4.8	Hg	ND(0.120)
Ba	41	Ni	17
Be	ND(0.5)	K	2,300
Cd	ND(2.5)	Se	ND(0.5)
Ca	21,000	Ag	ND(1)
Cr	20	Na	71J
Co	4.3	Tl	ND(1)
Cu	18	Va	8.9
Fe	15,000	Zn	130
Pb	30	CN	ND(0.25)

S-1			
Al	5,800	Mg	24,000
Sb	ND(3)	Mn	360
As	4.3	Hg	ND(0.120)
Ba	20	Ni	15R
Be	ND(0.5)	K	1,500
Cd	ND(2.5)	Se	ND(0.5)
Ca	52,000	Ag	ND(1)
Cr	13	Na	100R
Co	6.3	Tl	ND(1)
Cu	14	Va	12
Fe	13,000	Zn	120
Pb	21	CN	1.8

S-2			
Al	11,000	Mg	19,000
Sb	ND(30)	Mn	400
As	6.5	Hg	ND(0.120)
Ba	34	Ni	30
Be	0.530	K	2,500
Cd	ND(2.5)	Se	ND(0.5)
Ca	38,000	Ag	ND(1)
Cr	25	Na	100R
Co	10	Tl	ND(1)
Cu	24	Va	19
Fe	23,000	Zn	150
Pb	28	CN	1.1

S-5			
Al	13,000	Mg	20,000
Sb	ND(30)	Mn	380
As	6.0	Hg	ND(0.120)
Ba	26	Ni	41
Be	0.530	K	3,700
Cd	ND(2.5)	Se	ND(0.5)
Ca	39,000	Ag	ND(1)
Cr	22	Na	170R
Co	8.7	Tl	ND(1)
Cu	22	Va	22
Fe	20,000	Zn	130
Pb	23	CN	0.58

S-3			
Al	12,000	Mg	19,000
Sb	ND(30)	Mn	380
As	6.3	Hg	ND(0.120)
Ba	38	Ni	30
Be	0.530	K	3,300
Cd	ND(2.5)	Se	ND(0.5)
Ca	36,000	Ag	ND(1)
Cr	28	Na	130R
Co	10	Tl	ND(1)
Cu	24	Va	21
Fe	22,000	Zn	130
Pb	24	CN	0.74

0 100 200ft

SOURCE:
MODIFICATION OF A SITE MAP (4/15/91)
OBTAINED FROM
GEOSCIENCES RESEARCH
ASSOCIATES, INC.

LEGEND

S-1 SEDIMENT SAMPLING LOCATIONS

BLOCK NUMBERS OF GRID

FENCE LINE

11,000/9,900 REPRESENTS THE RESULT FOR THE ANALYSIS/DUPLICATE ANALYSIS

ND(0.25) ANALYTE NOT DETECTED AT CONCENTRATION IN ( )

Al ALUMINUM
Sb ANTIMONY
As ARSENIC
Ba BARIUM
Be BERYLLIUM
Cd CADMIUM
Ca CALCIUM
Cr CHROMIUM
Co COLBALT
Cu COPPER
Fe IRON
Pb LEAD
Mg MAGNESIUM
Mn MANGANESE
Hg MERCURY
Ni NICKEL
K POTASSIUM
Se SELENIUM
Ag SILVER
Na SODIUM
Tl THALLIUM
Va VANADIUM
Zn ZINC
CN CYANIDE

J THE ASSOCIATED VALUE IS AN ESTIMATED QUANTITY.

R THE PRESENCE OR ABSENCE OF THE ANALYTE HAS NOT BEEN VERIFIED.

NOTES: 1. SITE GRID = 100 FEET.

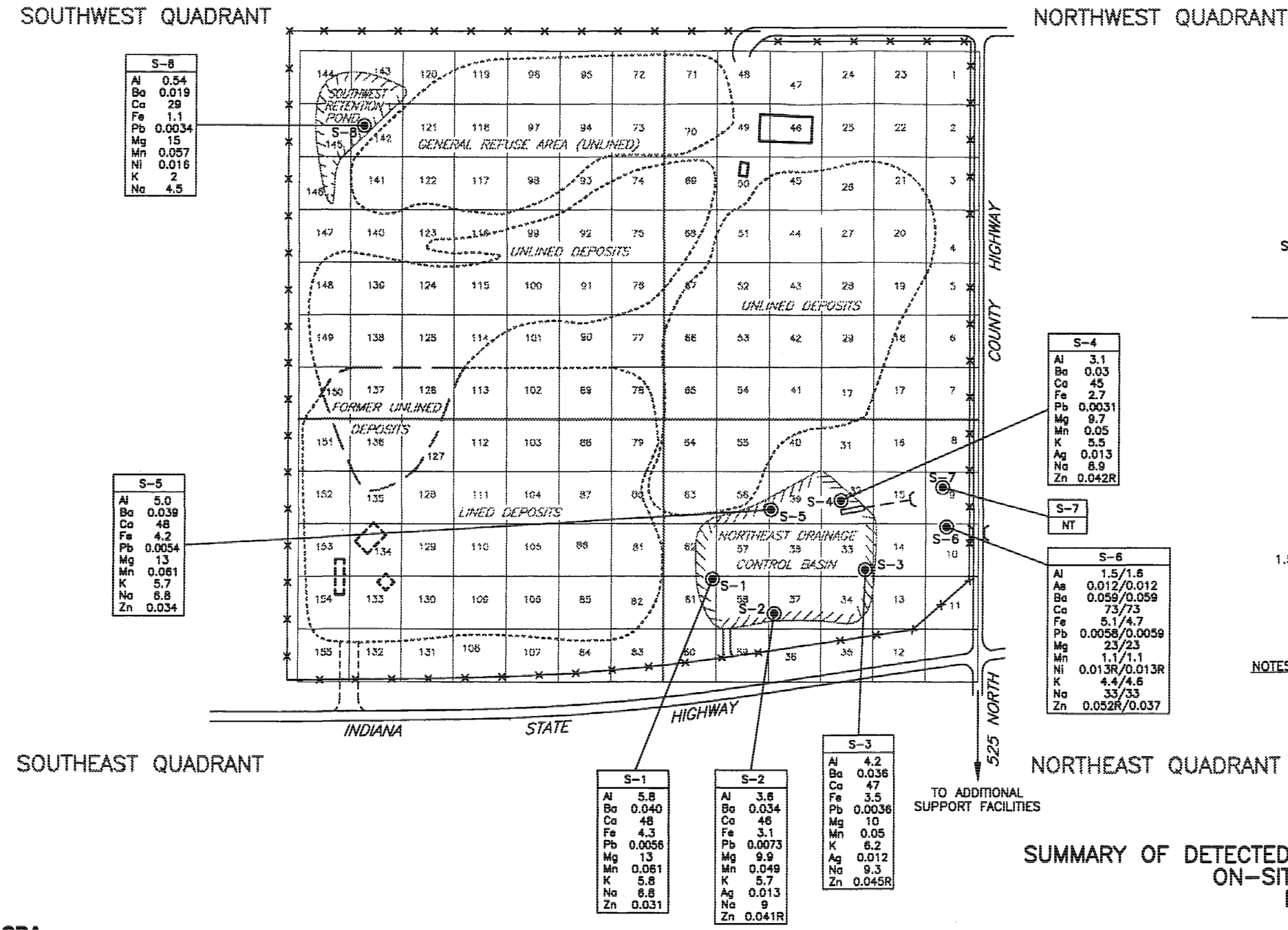
2. ALL CONCENTRATIONS REPORTED IN (mg/kg)

figure 5.3

DISTRIBUTION OF METALS AND CYANIDE IN ON-SITE SEDIMENT SAMPLES
JUNE 1994
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 9, 96-REV.0-(C)(P-93)



S-8	
Al	0.54
Ba	0.019
Ca	29
Fe	1.1
Pb	0.0034
Mg	15
Mn	0.057
Ni	0.016
K	2
Na	4.5

S-5	
Al	5.0
Ba	0.039
Ca	48
Fe	4.2
Pb	0.0054
Mg	13
Mn	0.061
K	5.7
Na	6.8
Zn	0.034

S-1	
Al	5.8
Ba	0.040
Ca	48
Fe	4.3
Pb	0.0056
Mg	13
Mn	0.061
K	5.8
Na	6.8
Zn	0.031

S-2	
Al	3.6
Ba	0.034
Ca	46
Fe	3.1
Pb	0.0073
Mg	9.9
Mn	0.049
K	5.7
Ag	0.013
Na	9
Zn	0.041R

S-3	
Al	4.2
Ba	0.036
Ca	47
Fe	3.5
Pb	0.0036
Mg	10
Mn	0.05
K	6.2
Ag	0.012
Na	9.3
Zn	0.045R

S-4	
Al	3.1
Ba	0.03
Ca	45
Fe	2.7
Pb	0.0031
Mg	9.7
Mn	0.05
K	5.5
Ag	0.013
Na	8.9
Zn	0.042R

S-7
NT

S-6	
Al	1.5/1.6
As	0.012/0.012
Ba	0.059/0.059
Ca	73/73
Fe	5.1/4.7
Pb	0.0058/0.0059
Mg	23/23
Mn	1.1/1.1
Ni	0.013R/0.013R
K	4.4/4.6
Na	33/33
Zn	0.052R/0.037

0 100 200ft

SOURCE:
MODIFICATION OF A SITE MAP (4/15/91) OBTAINED FROM GEOSCIENCES RESEARCH ASSOCIATES, INC.

LEGEND

S-1 SURFACE WATER SAMPLING LOCATIONS

156 BLOCK NUMBERS OF GRID

FENCE LINE

ABBREVIATIONS

Al	ALUMINUM
As	ARSENIC
Ba	BARIUM
Ca	CALCIUM
Fe	IRON
Pb	LEAD
Mg	MAGNESIUM
Mn	MANGANESE
Ni	NICKEL
K	POTASSIUM
Ag	SILVER
Na	SODIUM
Zn	ZINC
NT	NOT TESTED
1.5/1.6	REPRESENTS THE RESULT FOR THE ANALYSIS/DUPLICATE ANALYSIS
R	THE PRESENCE OR ABSENCE OF THE ANALYTE HAS NOT BEEN VERIFIED.

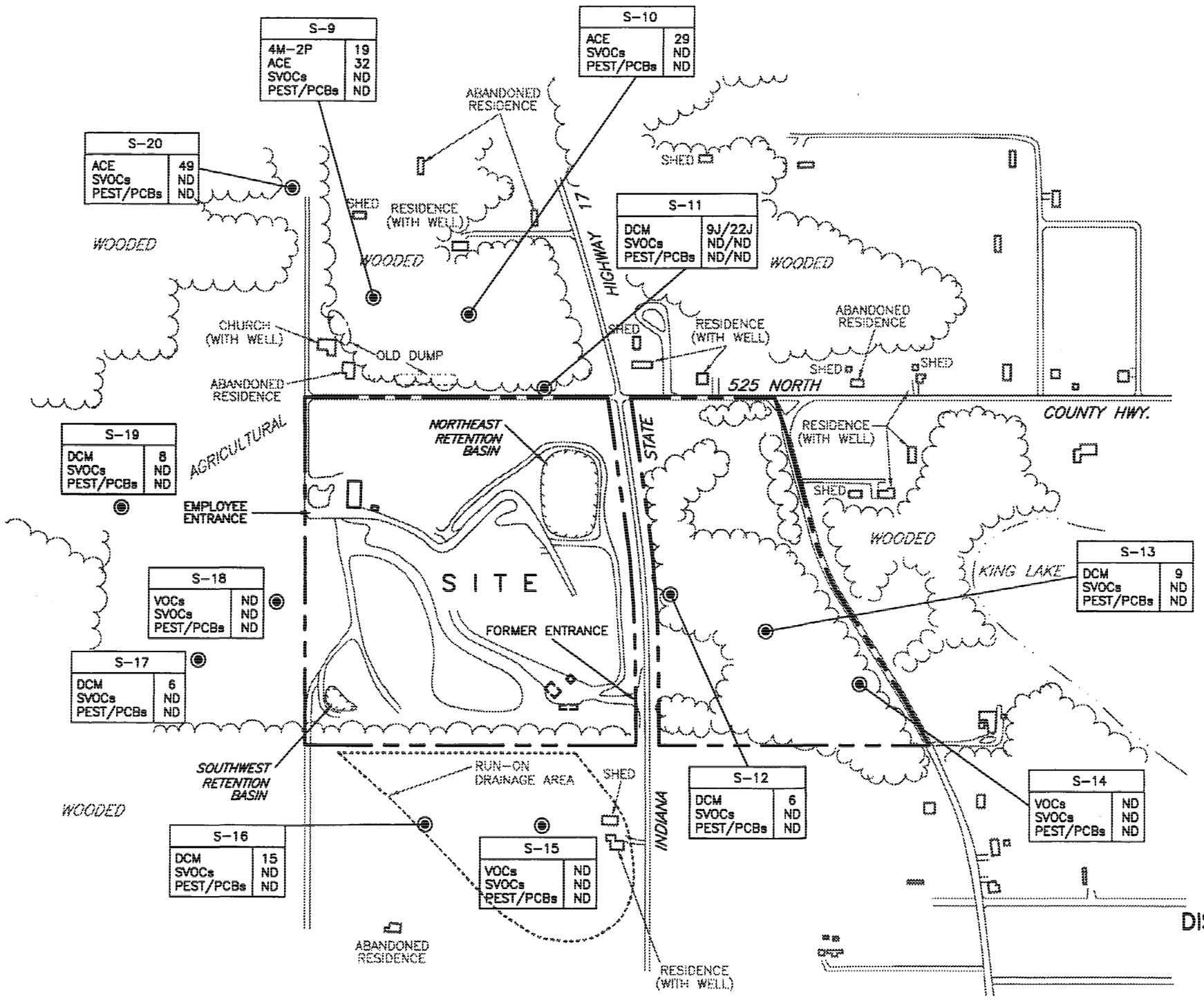
NOTES:
1. SITE GRID = 100 FEET.
2. ALL CONCENTRATIONS REPORTED IN (mg/L)
3. CYANIDE WAS NOT DETECTED IN THE COLLECTED ON-SITE SURFACE WATER SAMPLES.

figure 5.4

SUMMARY OF DETECTED METALS AND CYANIDE DATA
ON-SITE SURFACE WATER SAMPLES
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 10, 95-REV.0-(C)(P-94)



LEGEND

S-9	SEDIMENT SAMPLING LOCATIONS
———	PROPERTY LINE
9/22	REPRESENTS THE RESULT FOR THE ANALYSIS/DUPLICATE ANALYSIS
ND	NOT DETECTED
VOCs	VOLATILE ORGANIC COMPOUNDS (TCL)
SVOCs	SEMIVOLATILE ORGANIC COMPOUNDS (TCL)
PEST/PCBs	PESTICIDE AND POLYCHLORINATED BIPHENYLS (TCL)
DCM	DICHLOROMETHANE (METHYLENE CHLORIDE)
ACE	ACETONE
4M-2P	4-METHYL-2-PENTANONE
J	THE ASSOCIATED VALUE IS AN ESTIMATED QUANTITY.
TCL	TARGET COMPOUND LIST

NOTES:
1. SVOC AND VOC CONCENTRATIONS REPORTED IN (µg/kg)
2. PEST/PCBs CONCENTRATIONS REPORTED IN MICROGRAMS PER KILOGRAM (µg/kg)

figure 5.5

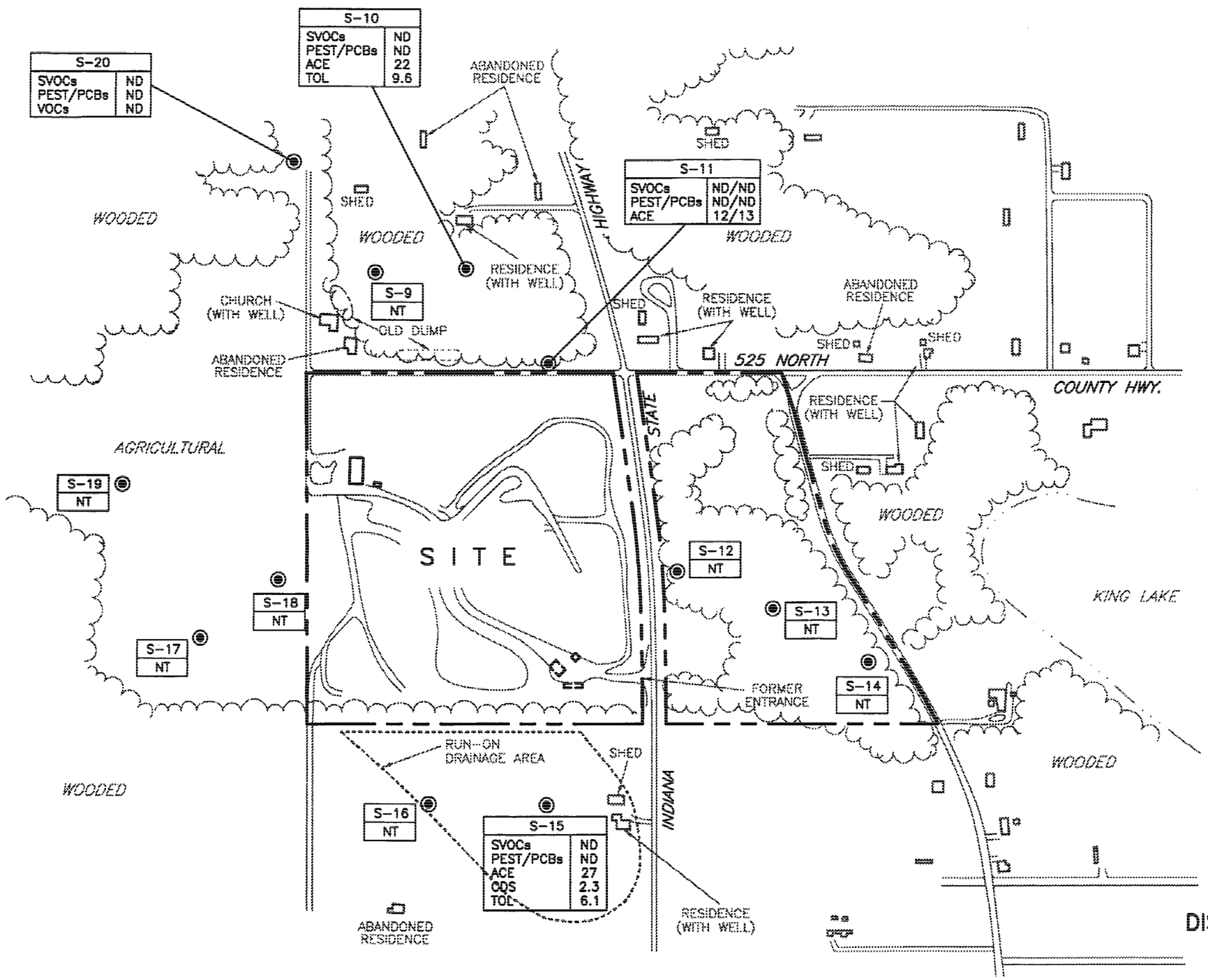
DISTRIBUTION OF ORGANIC COMPOUNDS IN OFF-SITE SEDIMENT SAMPLES JUNE 1994

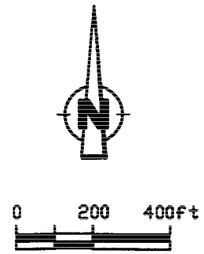
FOUR COUNTY LANDFILL

Fulton County, Indiana

CRA

5369(11)-JAN. 10, 96-REV.0-(C)(P-95)





SOURCE:
MODIFICATION OF THE RCRA PART B PERMIT APPLICATION (6/30/87) PLAN SHEET NO. 1

LEGEND

S-9 SURFACE WATER SAMPLING LOCATION

PROPERTY LINE

ABBREVIATIONS

SVOCs	SEMIVOLATILE ORGANIC COMPOUNDS
PEST/PCBs	PESTICIDES/PCBs
VOC	VOLATILE ORGANIC COMPOUNDS
ACE	ACETONE
CDS	CARBON DISULFIDE
TOL	TOLUENE
ND	NOT DETECTED
NT	NOT TESTED (NO SURFACE WATER PRESENT)
12/13	REPRESENTS THE RESULT FOR THE ANALYSIS/DUPLICATE ANALYSIS

NOTES:
1. SVOC AND VOC ANALYTICAL RESULTS REPORTED IN MICROGRAMS/LITER (μg/L).
2. PEST/PCB ANALYTICAL RESULTS REPORTED IN MICROGRAMS/LITER (μg/L).

figure 5.6

DISTRIBUTION OF ORGANIC COMPOUNDS
OFF-SITE SURFACE WATER SAMPLES
FOUR COUNTY LANDFILL
Fulton County, Indiana

CRA

5369(11)-JAN. 10, 96-REV.0-(C)(P-96)

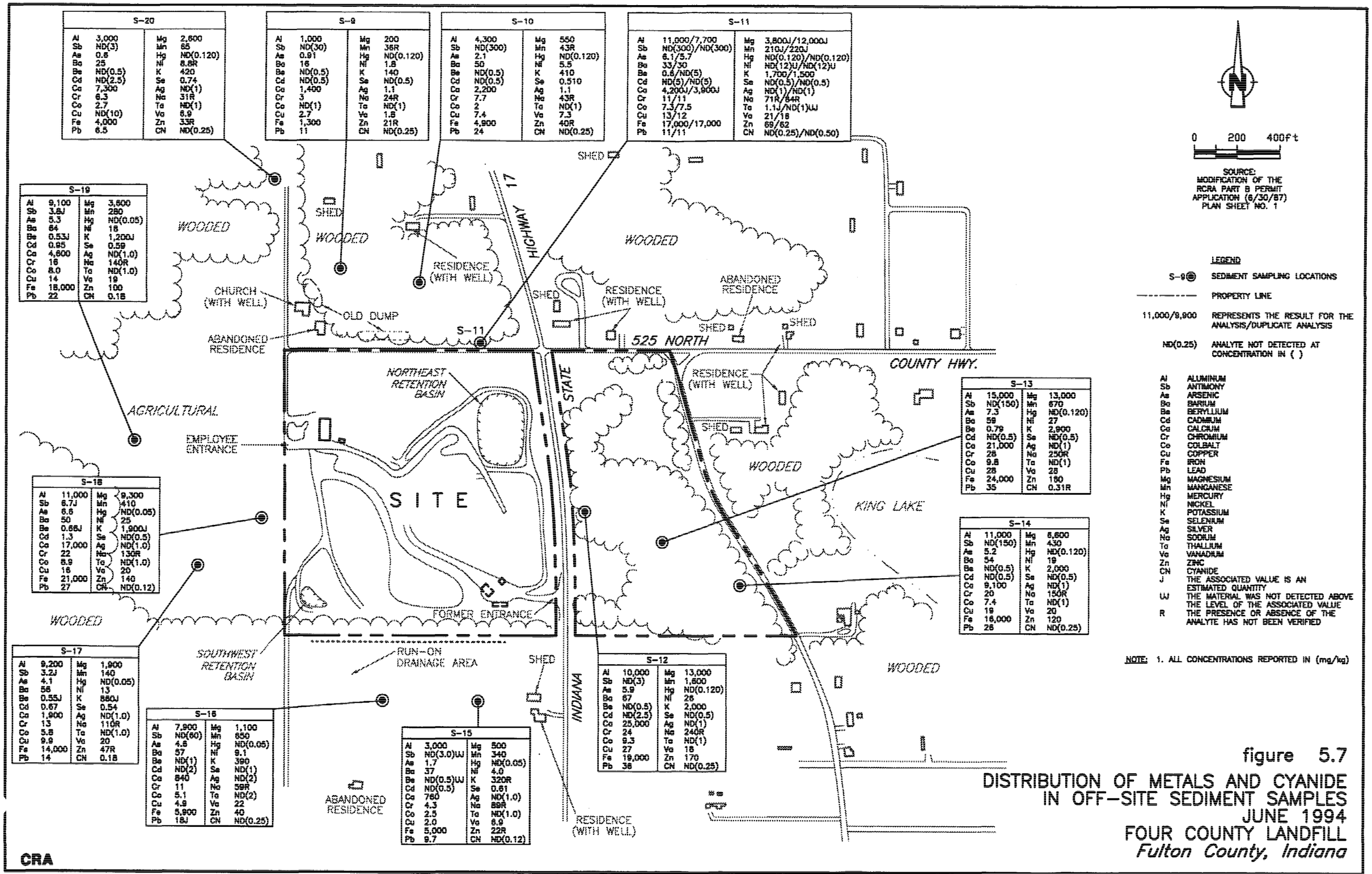
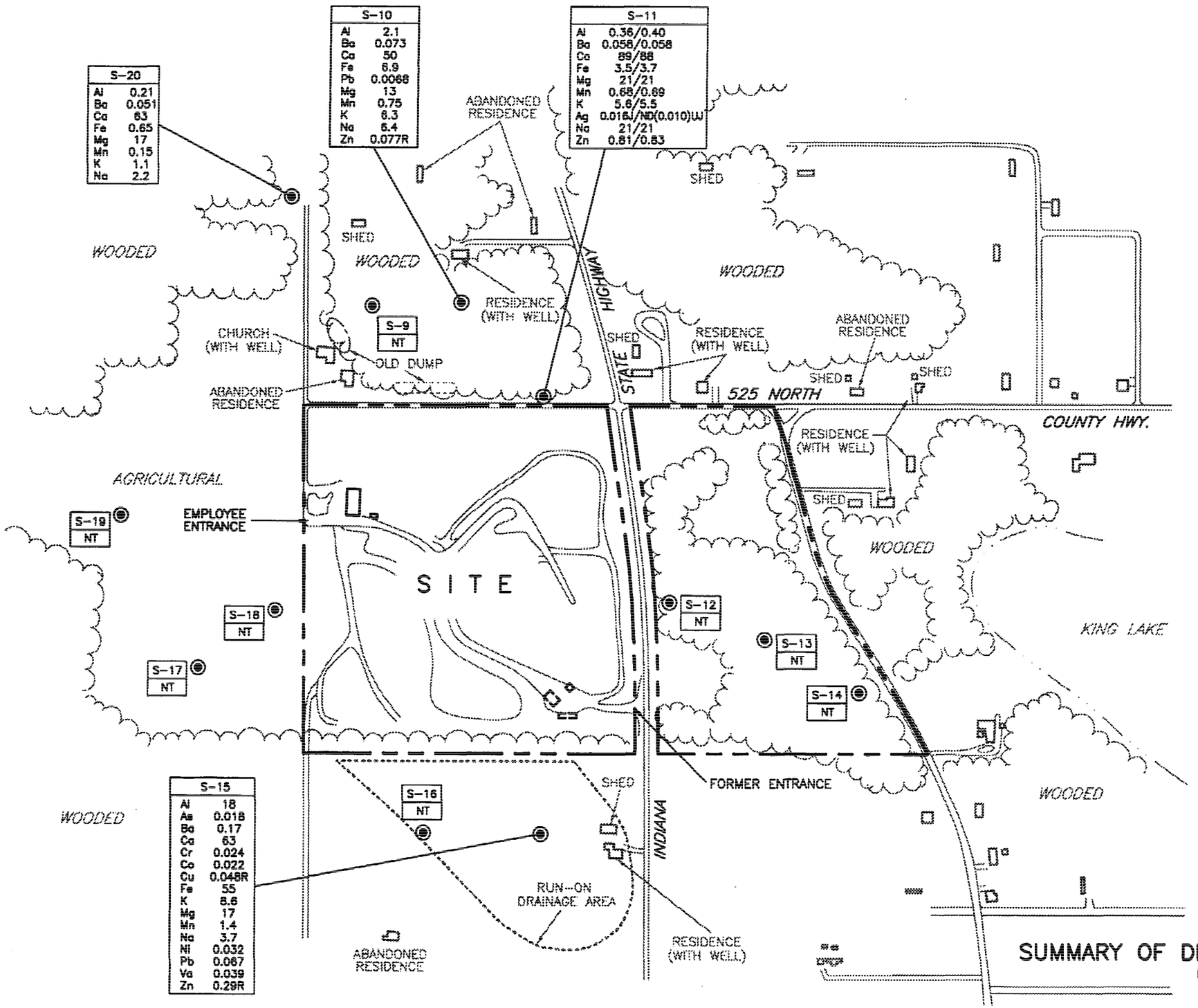


figure 5.7

DISTRIBUTION OF METALS AND CYANIDE IN OFF-SITE SEDIMENT SAMPLES
JUNE 1994
FOUR COUNTY LANDFILL
Fulton County, Indiana

5369(11)-JAN. 10, 96-REV.0-(C)(P-97)



LEGEND

S-9 SURFACE WATER SAMPLING LOCATION

PROPERTY LINE

ABBREVIATIONS

Al	ALUMINUM
As	ARSENIC
Ba	BARIUM
Ca	CALCIUM
Co	COBALT
Cr	CHROMIUM
Cu	COPPER
Fe	IRON
Pb	LEAD
Mg	MAGNESIUM
Mn	MANGANESE
Ni	NICKEL
K	POTASSIUM
Ag	SILVER
Na	SODIUM
Va	VANADIUM
Zn	ZINC
NT	NOT TESTED
0.36/0.40	REPRESENTS THE RESULT FOR THE ANALYSIS/DUPLICATE ANALYSIS
ND	NOT DETECTED
ND( )	NOT DETECTED AT THE QUANTITATION LIMIT STATED IN PARENTHESES
J	THE ASSOCIATED VALUE IS AN ESTIMATED QUANTITY.
R	THE PRESENCE OR ABSENCE OF THE ANALYTE HAS NOT BEEN VERIFIED.
UJ	NOT DETECTED. DETECTION LIMIT IS ESTIMATED.

NOTE:
1. ALL CONCENTRATIONS REPORTED IN (mg/L) ARE APPROXIMATE.
2. CYANIDE WAS NOT DETECTED IN COLLECTED OFF-SITE SURFACE WATER SAMPLE.

figure 5.8

SUMMARY OF DETECTED METALS AND CYANIDE DATA
OFF-SITE SURFACE WATER SAMPLES
FOUR COUNTY LANDFILL
Fulton County, Indiana

CRA

5369(11)-JAN. 10, 96-REV.0-(C)(P-98)

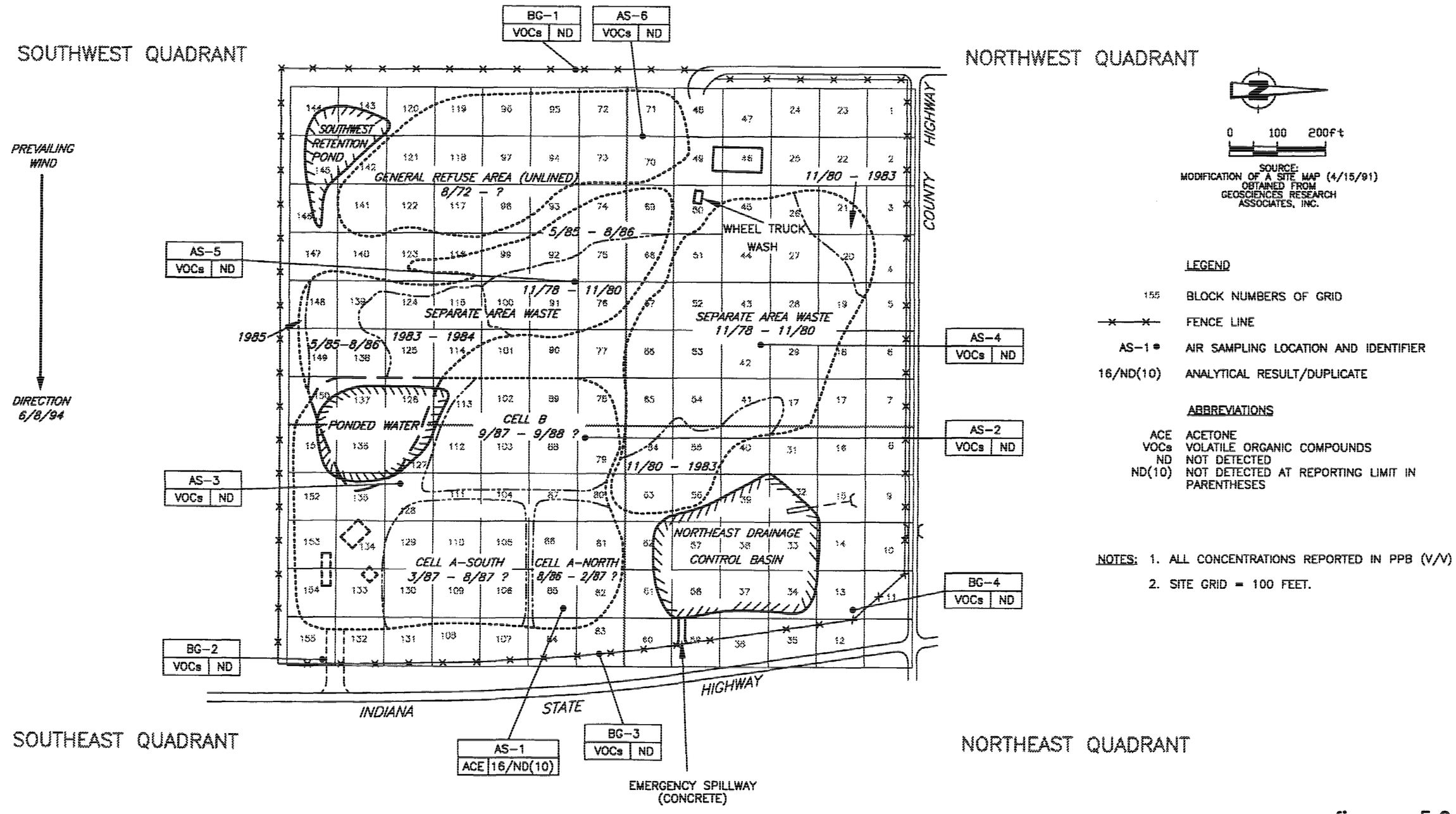
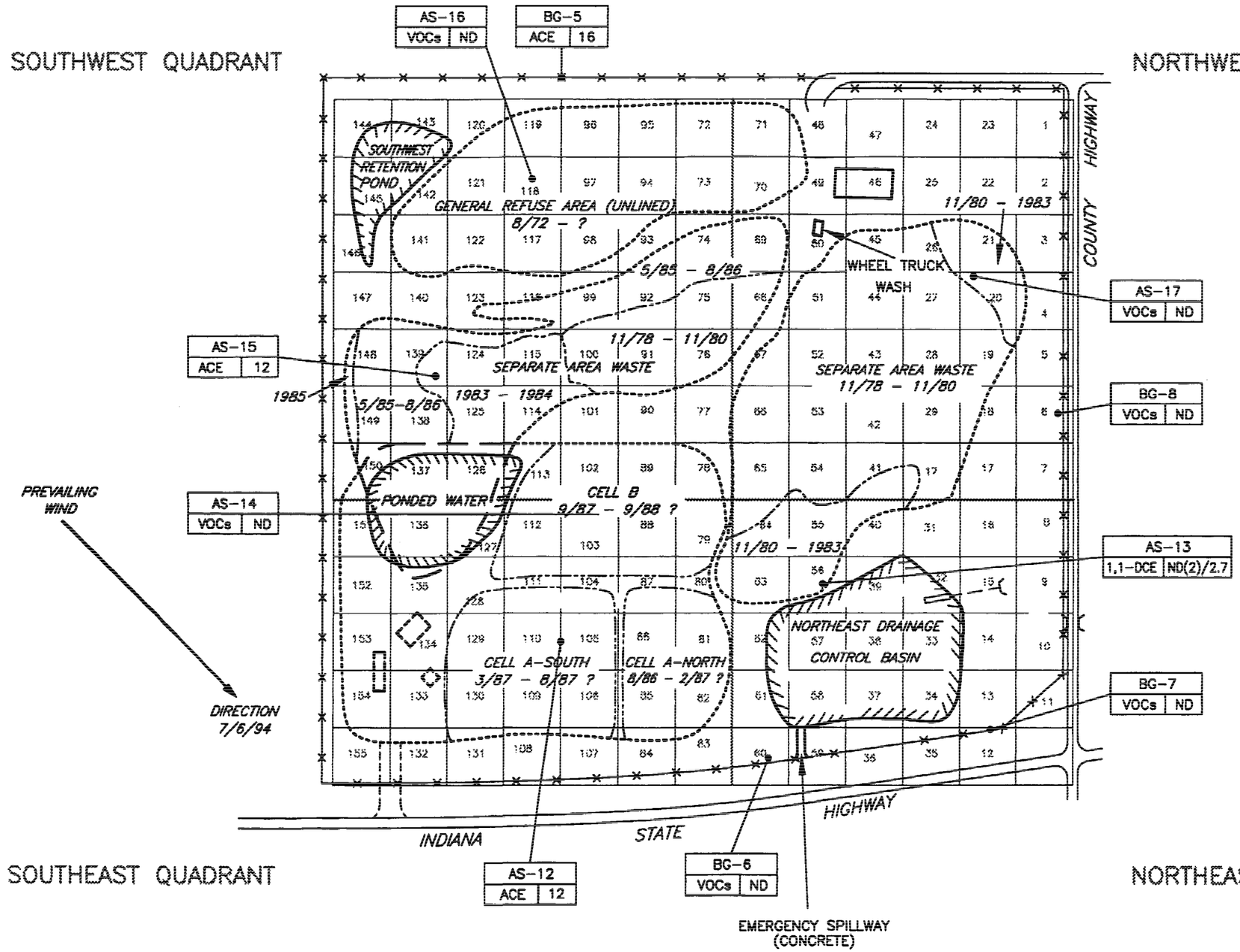


figure 5.9

AIR SAMPLING DATA–JUNE 1994
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11) JAN. 10, 96–REV.0–(C)(P–99)



LEGEND

155	BLOCK NUMBERS OF GRID
—×—×—	FENCE LINE
AS-1 ●	AIR SAMPLING LOCATION AND IDENTIFIER
ND(2)/2.7	ANALYTICAL RESULT/DUPLICATE

ABBREVIATIONS

ACE	ACETONE
1,1-DCE	1,1-DICHLOROETHENE
VOCs	VOLATILE ORGANIC COMPOUNDS
ND	NOT DETECTED
ND(10)	NOT DETECTED AT REPORTING LIMIT IN PARENTHESES

NOTES:
1. ALL CONCENTRATIONS REPORTED IN PPB (V/V)
2. SITE GRID = 100 FEET.
3. AIR SAMPLING ACTIVITIES AT LOCATION AS-14 WERE CONDUCTED IN AUGUST OF 1994.

figure 5.10

AIR SAMPLING DATA-JULY 1994
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11) JAN. 10, 96-REV.0-(C)(P100)

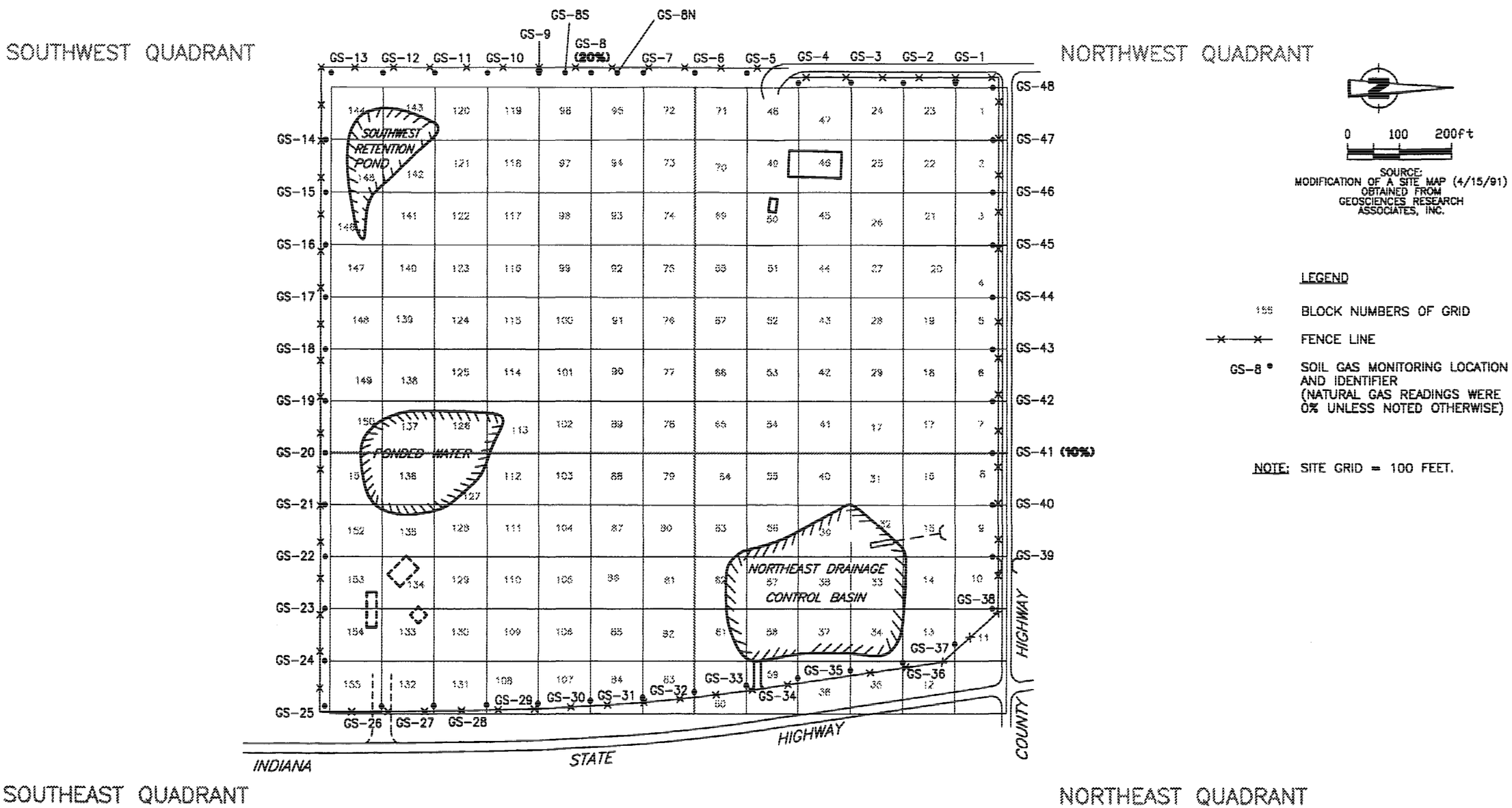


figure 5.11
SOIL GAS MONITORING RESULTS
MAY 26, 1994
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)–JAN. 10, 96–REV.0–(C)(P101)

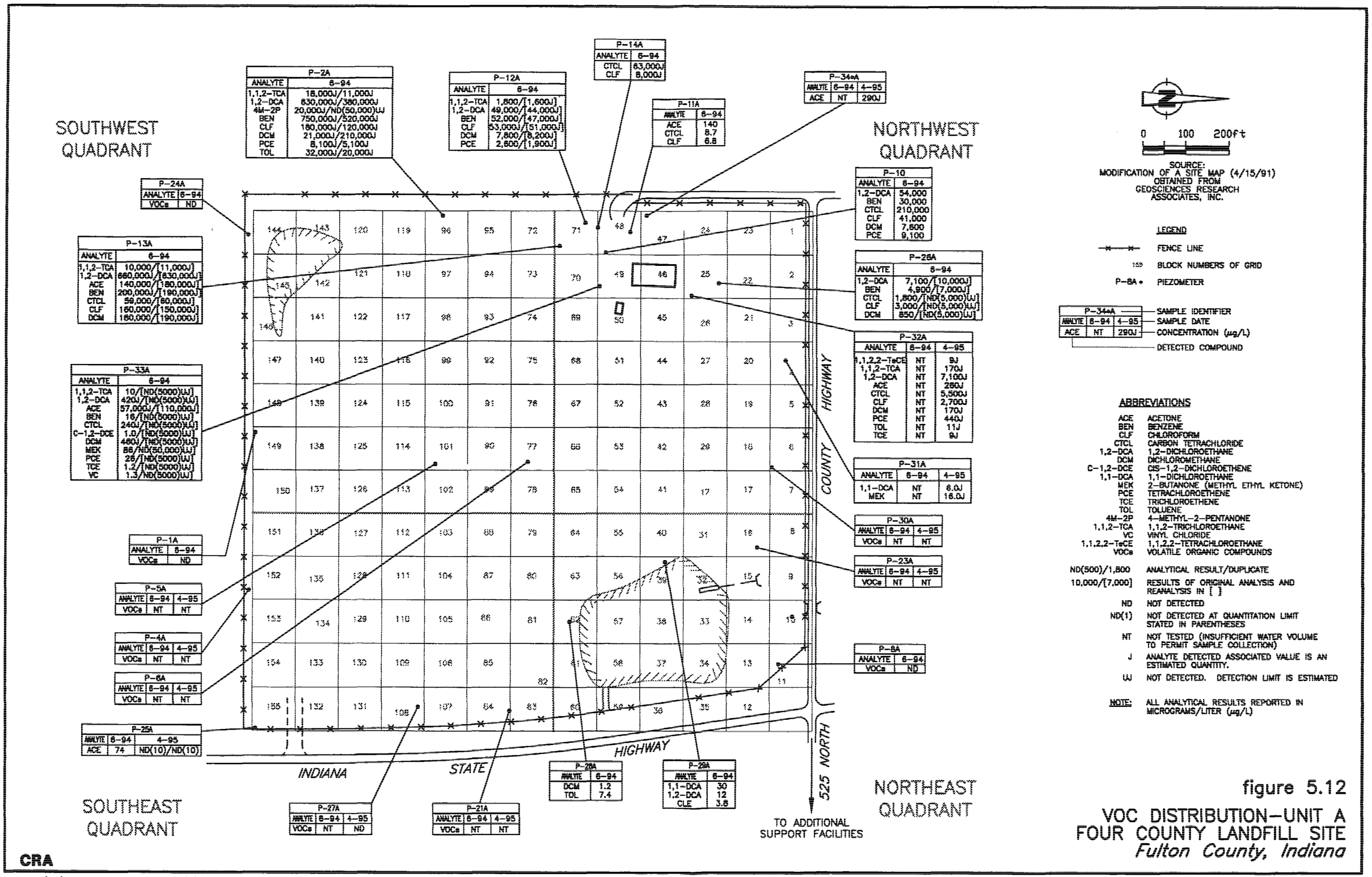
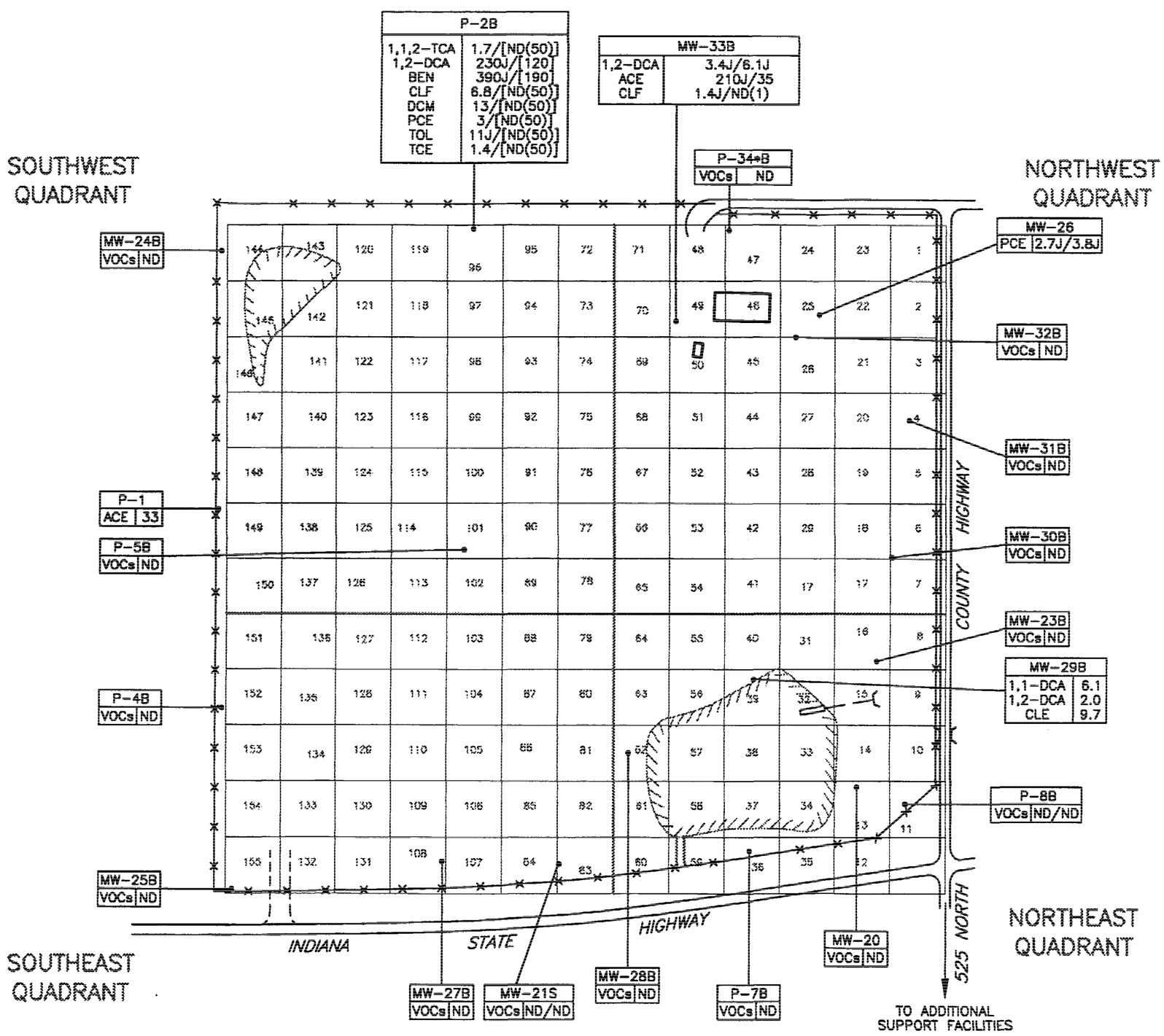


figure 5.12

VOC DISTRIBUTION–UNIT A
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)–JAN. 10, 96–REV.0–(C)(P102)



0 100 200ft

SOURCE:
MODIFICATION OF A SITE MAP (4/15/91)
OBTAINED FROM
GEOSCIENCES RESEARCH
ASSOCIATES, INC.

LEGEND

—×—×—	FENCE LINE
155	BLOCK NUMBERS OF GRID
P-8B •	PIEZOMETER
MW-26 •	MONITORING WELL

ABBREVIATIONS

1,2-DCA	1,2-DICHLOROETHANE
ACE	ACETONE
BEN	BENZENE
CLF	CHLOROFORM
CLE	CHLOROETHANE
DCM	DICHLOROMETHANE
PCE	TETRACHLOROETHENE
TOL	TOLUENE
TCE	TRICHLOROETHENE
1,1,2-TCA	1,1,2-TRICHLOROETHANE
1,1-DCA	1,1-DICHLOROETHANE
VOCs	VOLATILE ORGANIC COMPOUNDS
ND(1)/ND(1)	ANALYTICAL RESULT/DUPLICATE
1.7/[ND(50)]	RESULTS OF ORIGINAL ANALYSIS AND REANALYSIS IN [ ]
ND	NOT DETECTED
ND(1)	NOT DETECTED AT QUANTITATION LIMIT STATED IN PARENTHESES
J	ANALYTE DETECTED ASSOCIATED VALUE IS AN ESTIMATED QUANTITY.
UJ	NOT DETECTED. DETECTION LIMIT IS ESTIMATED.

NOTE: ALL ANALYTICAL RESULTS REPORTED IN MICROGRAMS/LITER (μg/L)

figure 5.13
VOC DISTRIBUTION-UNIT B
JUNE 1994
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 10, 96-REV.0-(C)(P103)

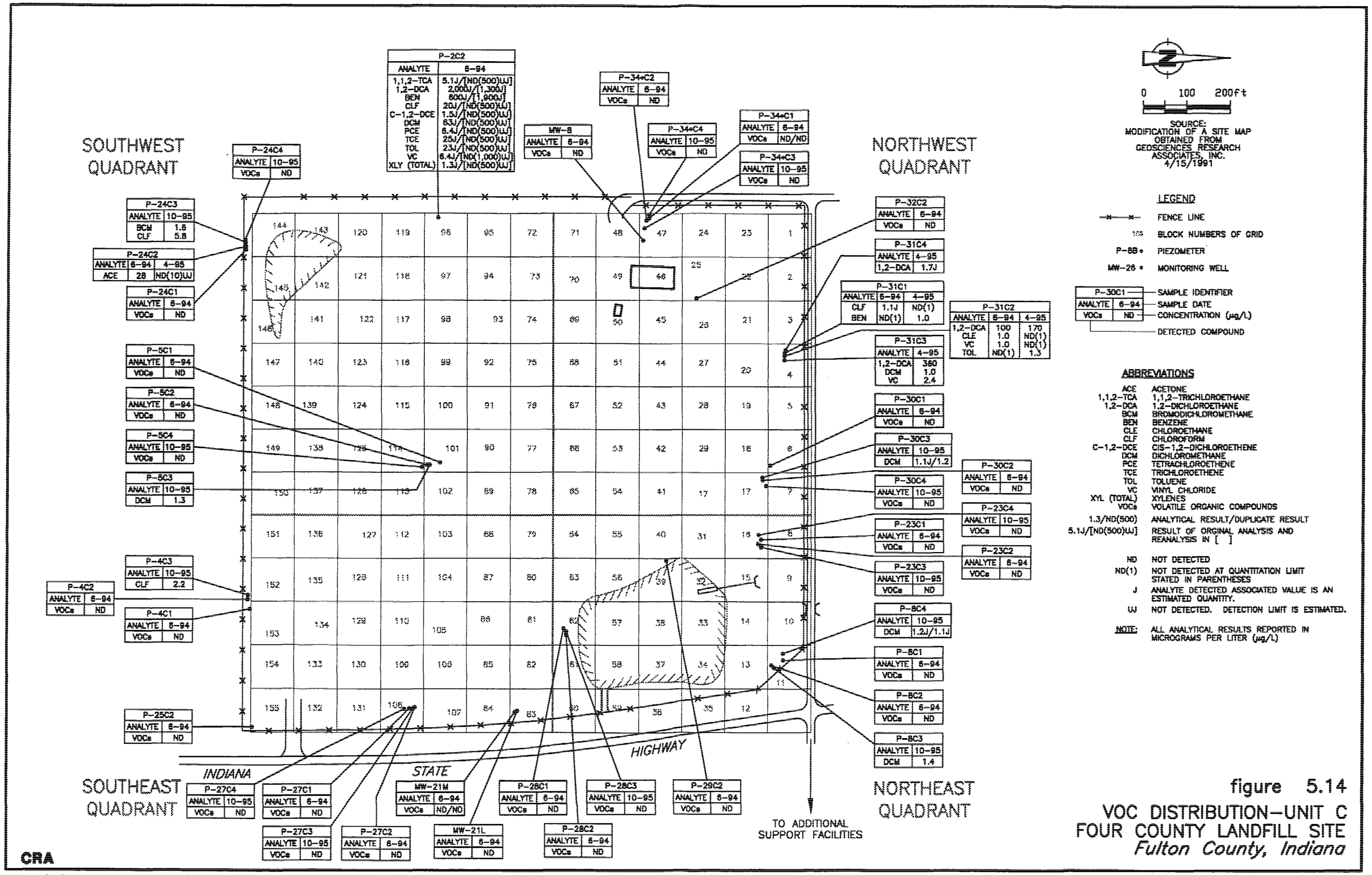
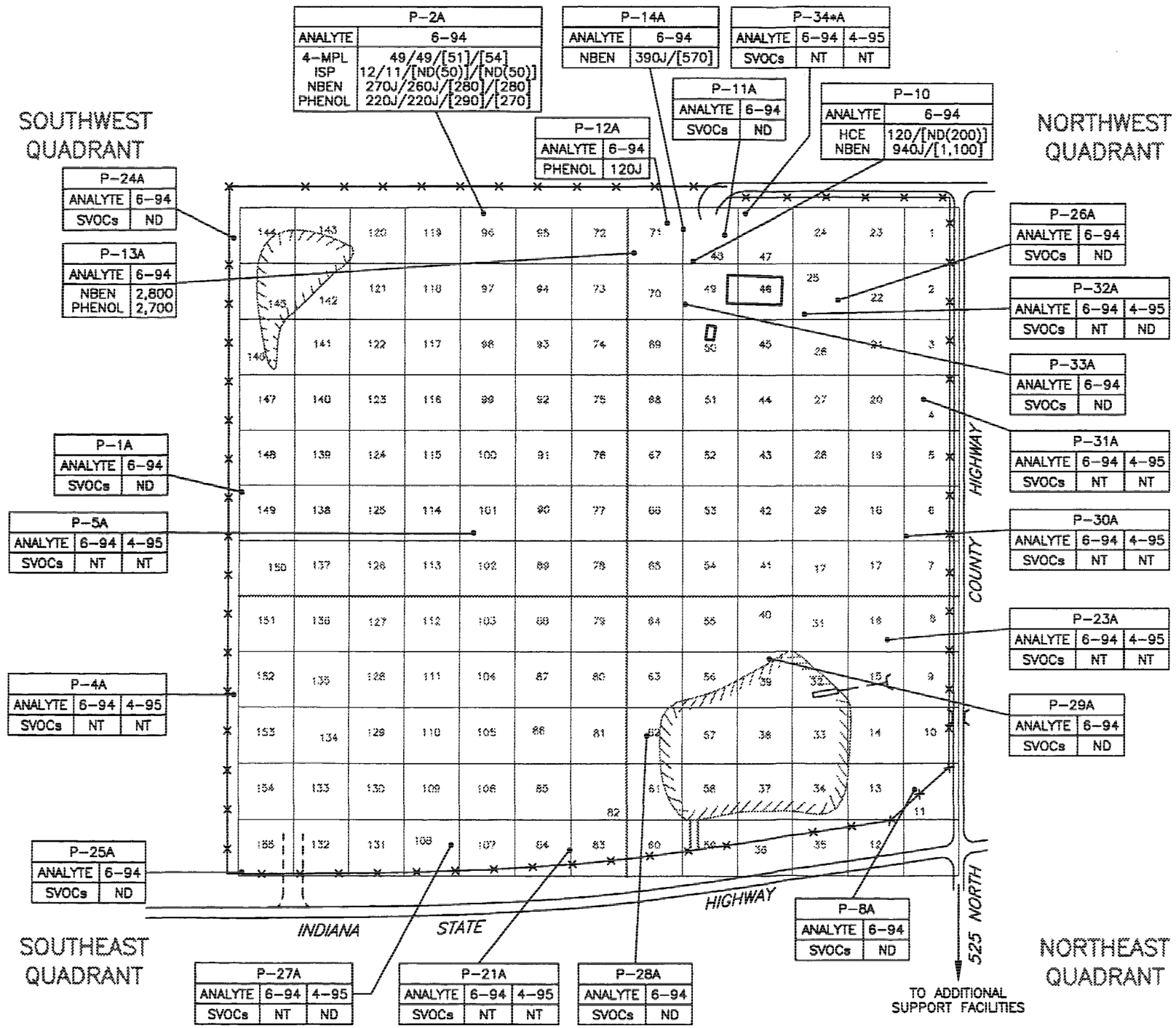


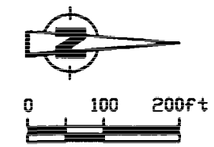
figure 5.14

VOC DISTRIBUTION–UNIT C
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)–JAN. 11, 96–REV.0–(C)(P104)





SOURCE: MODIFICATION OF A SITE MAP (4/15/91) OBTAINED FROM GEOSCIENCES RESEARCH ASSOCIATES, INC.

LEGEND

- FENCE LINE
- 155 BLOCK NUMBERS OF GRID
- P-32A — SAMPLE IDENTIFIER
- 6-94 — SAMPLE DATE
- 4-95 — SAMPLE DATE
- SVOCs NT ND — CONCENTRATION (µg/L)
- SVOCs — DETECTED COMPOUND

ABBREVIATIONS

4-MPL	4-METHYLPHENOL
ISP	ISOPHORONE
NBEN	NITROBENZENE
HCE	HEXACHLOROETHANE
PHENOL	PHENOL
SVOCs	SEMIVOLATILE ORGANIC COMPOUNDS
12/11	ANALYZED SAMPLE/DUPLICATE
120/[ND(200)]	RESULT OF ORIGINAL ANALYSIS AND REANALYSIS IN [ ]
ND	NOT DETECTED
ND( )	NOT DETECTED AT QUANTITATION LIMIT STATED IN PARENTHESES
NT	NOT TESTED (INSUFFICIENT WATER VOLUME TO PERMIT SAMPLE COLLECTION)
J	ANALYTE DETECTED. ASSOCIATED VALUE IS AN ESTIMATED QUANTITY.

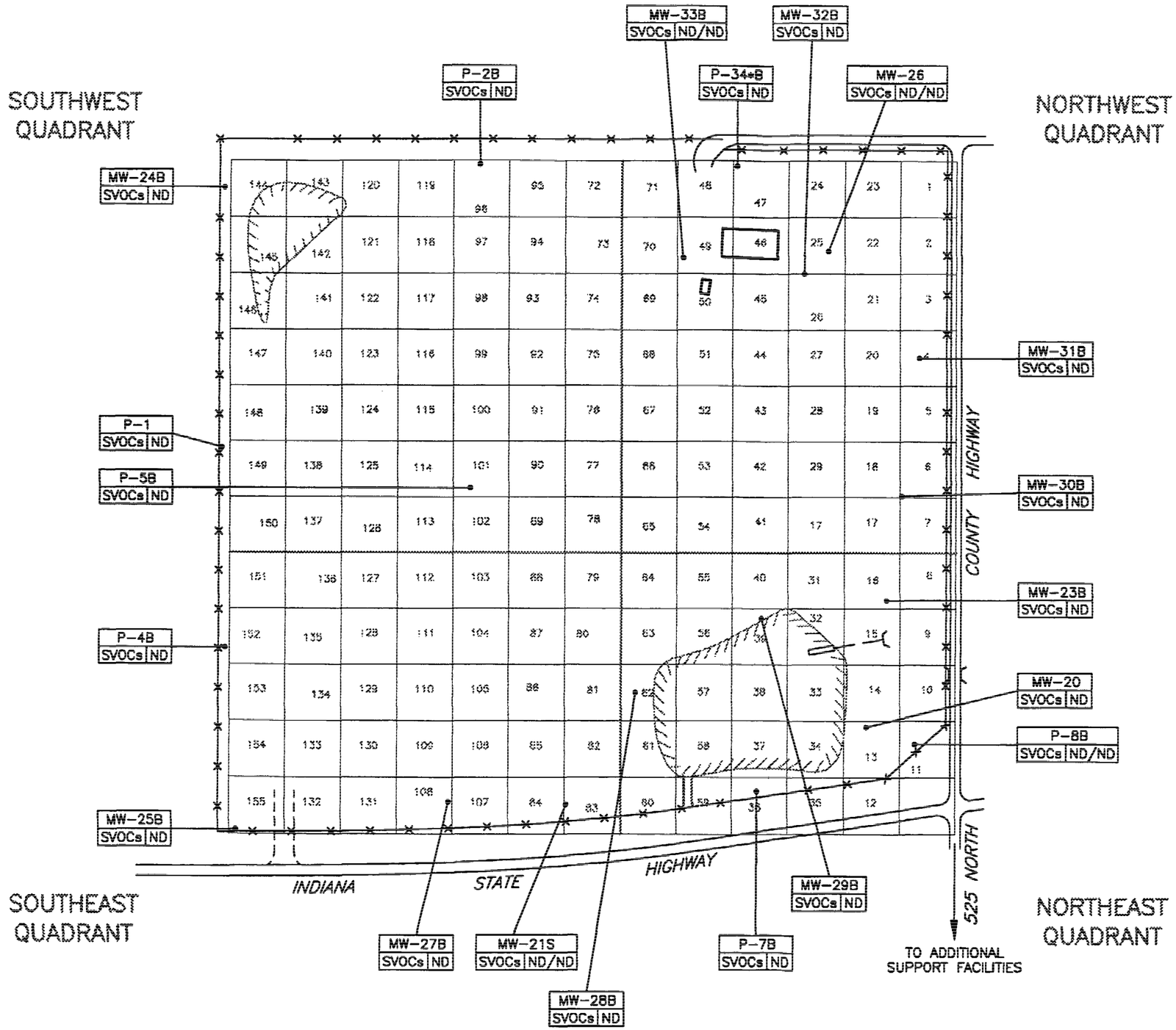
NOTE: ALL ANALYTICAL RESULTS REPORTED IN MICROGRAMS/LITER (µg/L)

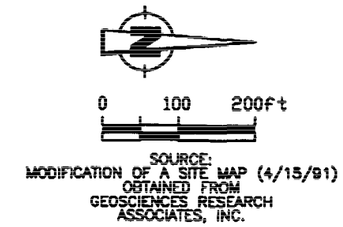
figure 5.15

SVOC DISTRIBUTION–UNIT A
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)–JAN. 16, 96–REV.0–(C)(P114)





LEGEND

—×—×—	FENCE LINE
155	BLOCK NUMBERS OF GRID
P-8B •	PIEZOMETER
MW-26 •	MONITORING WELL
ND	NOT DETECTED
ND/ND	NOT DETECTED IN SAMPLE AND DUPLICATE SAMPLE
SVOCs	SEMIVOLATILE ORGANIC COMPOUNDS

NOTE: ALL ANALYTICAL RESULTS REPORTED IN MICROGRAMS/LITER (μg/L)

figure 5.16
SVOC DISTRIBUTION–UNIT B
JUNE 1994
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)–JAN. 11, 96–REV.0–(C)(P105)

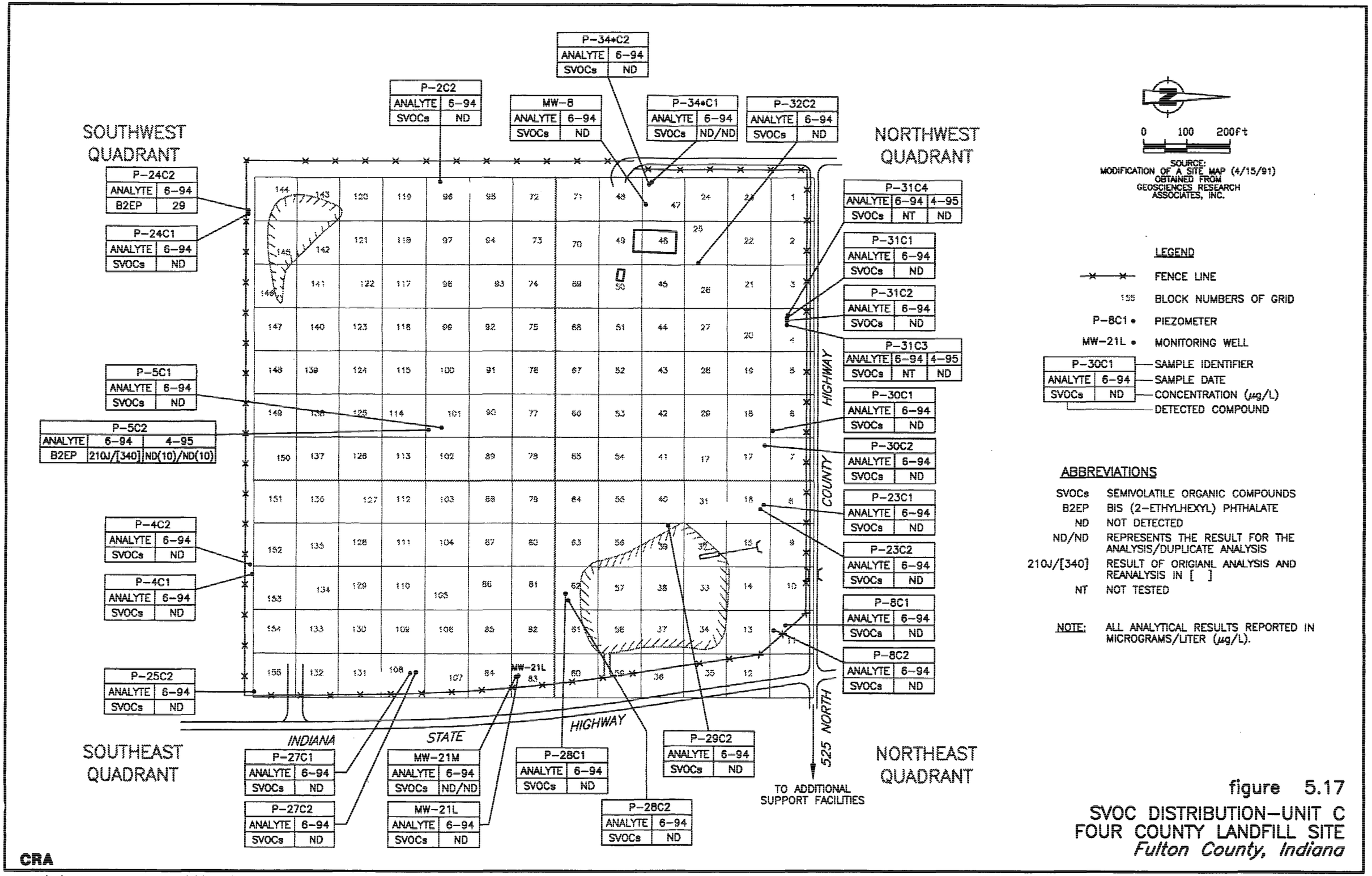
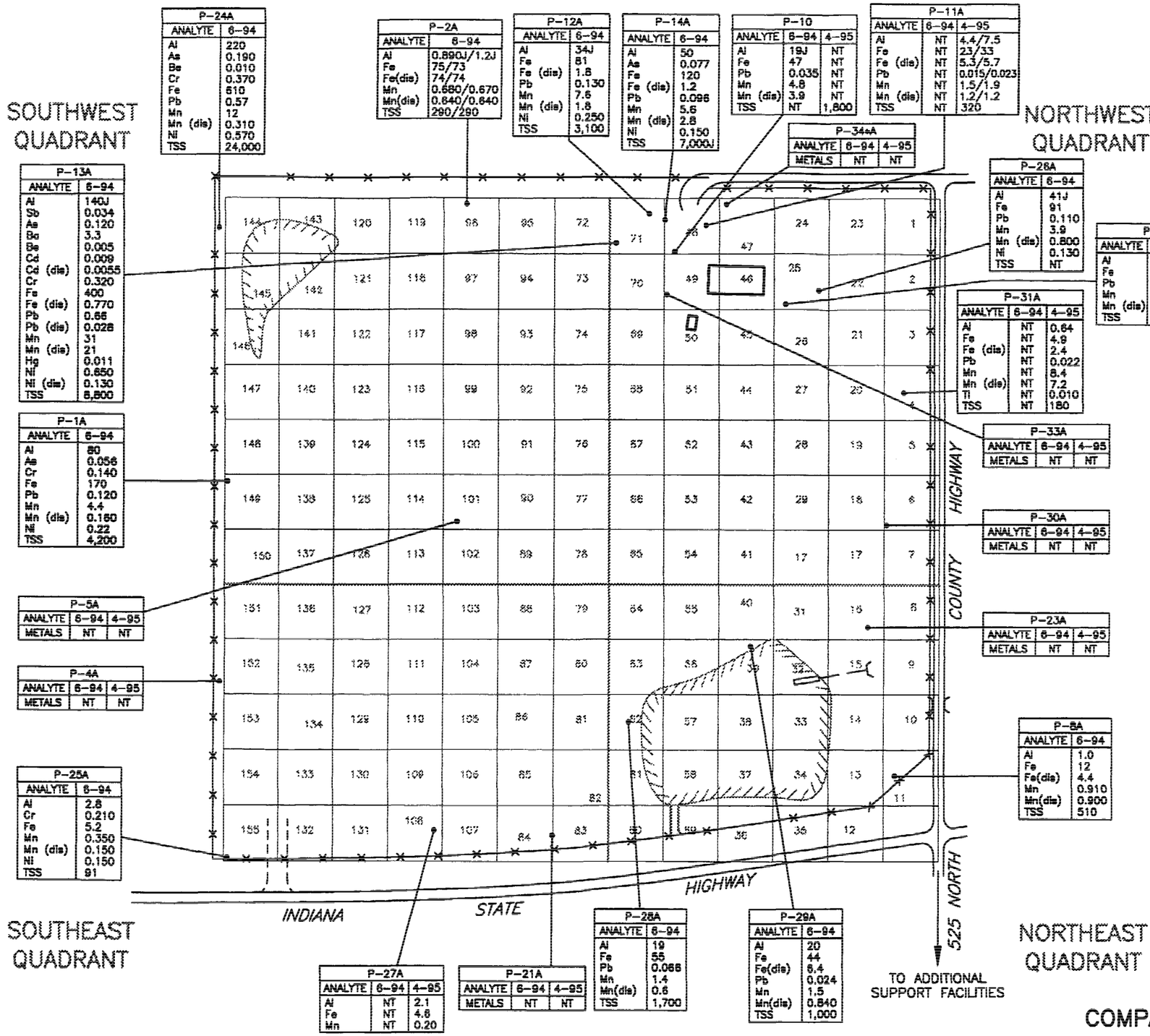


figure 5.17
SVOC DISTRIBUTION–UNIT C
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

5369(13)–JAN. 11, 96–REV.0–(C)(P106)



P-24A	
ANALYTE	6-94
Al	220
As	0.190
Be	0.010
Cr	0.370
Fe	610
Pb	0.57
Mn	12
Mn (dis)	0.310
Ni	0.570
TSS	24,000

P-2A	
ANALYTE	6-94
Al	0.890J/1.2J
Fe	75/73
Fe(dis)	74/74
Mn	0.680/0.670
Mn(dis)	0.640/0.640
TSS	290/290

P-12A	
ANALYTE	6-94
Al	34J
Fe	81
Fe (dis)	1.8
Pb	0.130
Mn	7.6
Mn (dis)	1.8
Ni	0.250
TSS	3,100

P-14A	
ANALYTE	6-94
Al	50
As	0.077
Fe	120
Fe (dis)	1.2
Pb	0.096
Mn	5.6
Mn (dis)	2.8
Ni	0.150
TSS	7,000J

P-10		
ANALYTE	6-94	4-95
Al	19J	NT
Fe	47	NT
Pb	0.035	NT
Mn	4.8	NT
Mn (dis)	3.9	NT
TSS	NT	1,800

P-11A		
ANALYTE	6-94	4-95
Al	NT	4.4/7.5
Fe	NT	23/33
Fe (dis)	NT	5.3/5.7
Pb	NT	0.015/0.023
Mn	NT	1.5/1.9
Mn (dis)	NT	1.2/1.2
TSS	NT	320

P-34aA		
ANALYTE	6-94	4-95
METALS	NT	NT

P-13A	
ANALYTE	6-94
Al	140J
Sb	0.034
As	0.120
Ba	3.3
Be	0.005
Cd	0.009
Cd (dis)	0.0055
Cr	0.320
Fe	400
Fe (dis)	0.770
Pb	0.66
Pb (dis)	0.028
Mn	31
Mn (dis)	21
Hg	0.011
Ni	0.650
Ni (dis)	0.130
TSS	8,800

P-1A	
ANALYTE	6-94
Al	80
As	0.056
Cr	0.140
Fe	170
Pb	0.120
Mn	4.4
Mn (dis)	0.160
Ni	0.22
TSS	4,200

P-5A		
ANALYTE	6-94	4-95
METALS	NT	NT

P-4A		
ANALYTE	6-94	4-95
METALS	NT	NT

P-25A	
ANALYTE	6-94
Al	2.8
Cr	0.210
Fe	5.2
Mn	0.350
Mn (dis)	0.150
Ni	0.150
TSS	91

P-26A	
ANALYTE	6-94
Al	41J
Fe	91
Pb	0.110
Mn	3.9
Mn (dis)	0.800
Ni	0.130
TSS	NT

P-32A		
ANALYTE	6-94	4-95
Al	NT	14
Fe	NT	35
Pb	NT	0.064
Mn	NT	2
Mn (dis)	NT	1.2
TSS	NT	1,800

P-31A		
ANALYTE	6-94	4-95
Al	NT	0.64
Fe	NT	4.9
Fe (dis)	NT	2.4
Pb	NT	0.022
Mn	NT	8.4
Mn (dis)	NT	7.2
Tl	NT	0.010
TSS	NT	180

P-33A		
ANALYTE	6-94	4-95
METALS	NT	NT

P-30A		
ANALYTE	6-94	4-95
METALS	NT	NT

P-23A		
ANALYTE	6-94	4-95
METALS	NT	NT

P-8A	
ANALYTE	6-94
Al	1.0
Fe	12
Fe(dis)	4.4
Mn	0.910
Mn(dis)	0.900
TSS	510

P-27A		
ANALYTE	6-94	4-95
Al	NT	2.1
Fe	NT	4.6
Mn	NT	0.20

P-21A		
ANALYTE	6-94	4-95
METALS	NT	NT

P-28A	
ANALYTE	6-94
Al	19
Fe	55
Pb	0.066
Mn	1.4
Mn(dis)	0.6
TSS	1,700

P-29A	
ANALYTE	6-94
Al	20
Fe	44
Fe(dis)	6.4
Pb	0.024
Mn	1.5
Mn(dis)	0.840
TSS	1,000

0 100 200ft

SOURCE:
MODIFICATION OF A SITE MAP (4/15/91) OBTAINED FROM GEOSCIENCES RESEARCH ASSOCIATES, INC.

LEGEND

FENCE LINE

155 BLOCK NUMBERS OF GRID

P-26A ● PIEZOMETER

P-33A		
ANALYTE	6-94	4-95
METALS	NT	NT

— SAMPLE IDENTIFIER
— SAMPLE DATE
— CONCENTRATION
— DETECTED PARAMETER

ABBREVIATIONS

Al	ALUMINUM
Sb	ANTIMONY
As	ARSENIC
Ba	BARIUM
Be	BERYLLIUM
Cd	CADMIUM
Cr	CHROMIUM
Fe	IRON
Hg	MERCURY
Pb	LEAD
Mn	MANGANESE
Ni	NICKEL
Tl	THALLIUM
TSS	TOTAL SUSPENDED SOLIDS
Fe(dis)	REPRESENTS A METALLIC SPECIES IN DISSOLVED PHASE (FILTERED SAMPLE)
2.5/2.5	REPRESENTS THE RESULT FOR THE ANALYSIS/DUPLICATE ANALYSIS
NT	NOT TESTED DUE TO INSUFFICIENT WATER VOLUME TO PERMIT SAMPLE COLLECTION
J	ANALYTE DETECTED ASSOCIATED VALUE IS AN ESTIMATED QUANTITY.

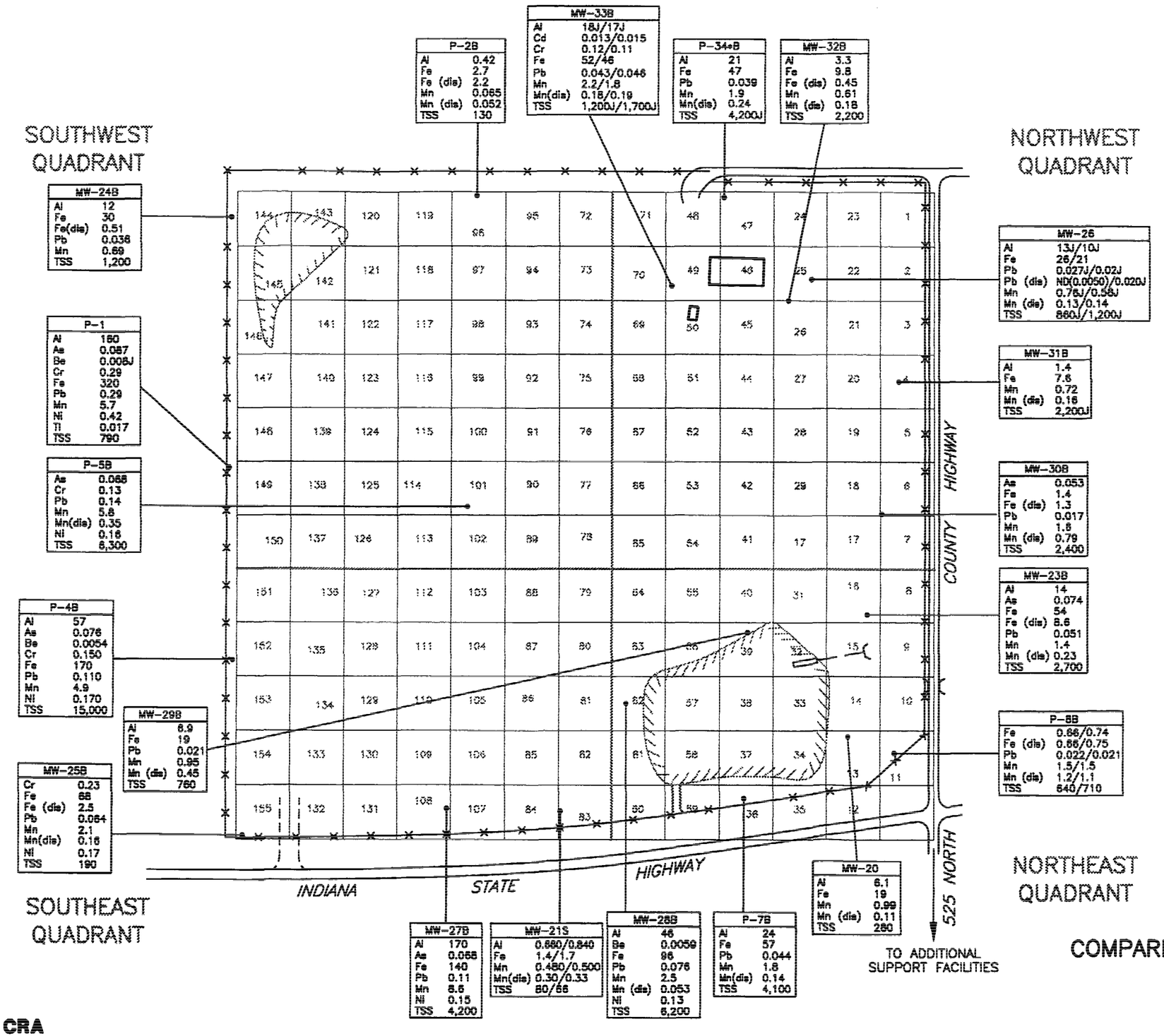
NOTES:
1. ALL CONCENTRATIONS REPORTED IN MILLIGRAMS PER LITER (mg/L).
2. ALL VALUES REPRESENT CONCENTRATIONS FOR UNFILTERED SAMPLES UNLESS INDICATED BY (dis).

figure 5.18

COMPARISON OF METALS DATA WITH MCLs–UNIT A
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)–JAN. 11, 95–REV.0–(C)(P107)



0 100 200ft

SOURCE:
MODIFICATION OF A SITE MAP (4/15/91) OBTAINED FROM GEOSCIENCES RESEARCH ASSOCIATES, INC.

LEGEND

MW-31B •	MONITORING WELL
P-7B •	PIEZOMETER
—×—×—	FENCE LINE
155	BLOCK NUMBERS OF GRID

ABBREVIATIONS

Al	ALUMINUM
As	ARSENIC
Be	BERYLLIUM
Cr	CHROMIUM
Fe	IRON
Pb	LEAD
Mn	MANGANESE
Ni	NICKEL
Tl	THALLIUM
TSS	TOTAL SUSPENDED SOLIDS
Fe(dis)	REPRESENTS A METALLIC SPECIES IN DISSOLVED PHASE (FILTERED SAMPLE)
2.5/2.5	REPRESENTS THE RESULT FOR THE ANALYSIS/DUPLICATE ANALYSIS
J	ANALYTE DETECTED ASSOCIATED VALUE IS AN ESTIMATED QUANTITY.
R	UNABLE TO CONFIRM PRESENCE/ABSENCE OF THIS ANALYTE.

NOTES:
1. ALL CONCENTRATIONS REPORTED IN MILLIGRAMS PER LITER (mg/L).
2. ALL VALUES REPRESENT CONCENTRATIONS FOR UNFILTERED SAMPLES UNLESS INDICATED BY (dis).

figure 5.19

COMPARISON OF METALS DATA WITH MCLs–UNIT B
JUNE 1994
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)–JAN. 11, 96–REV.0–(C)(P108)

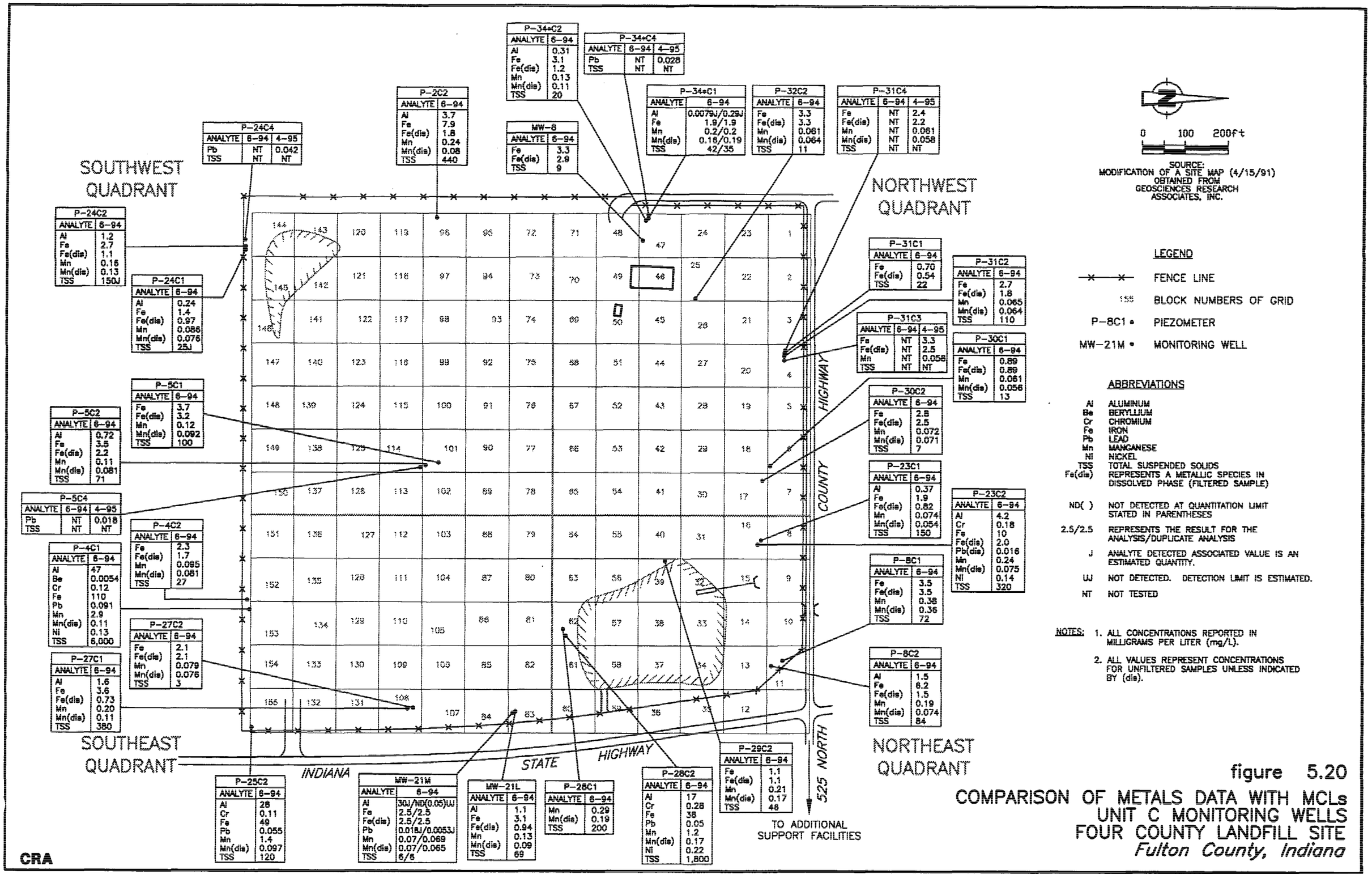
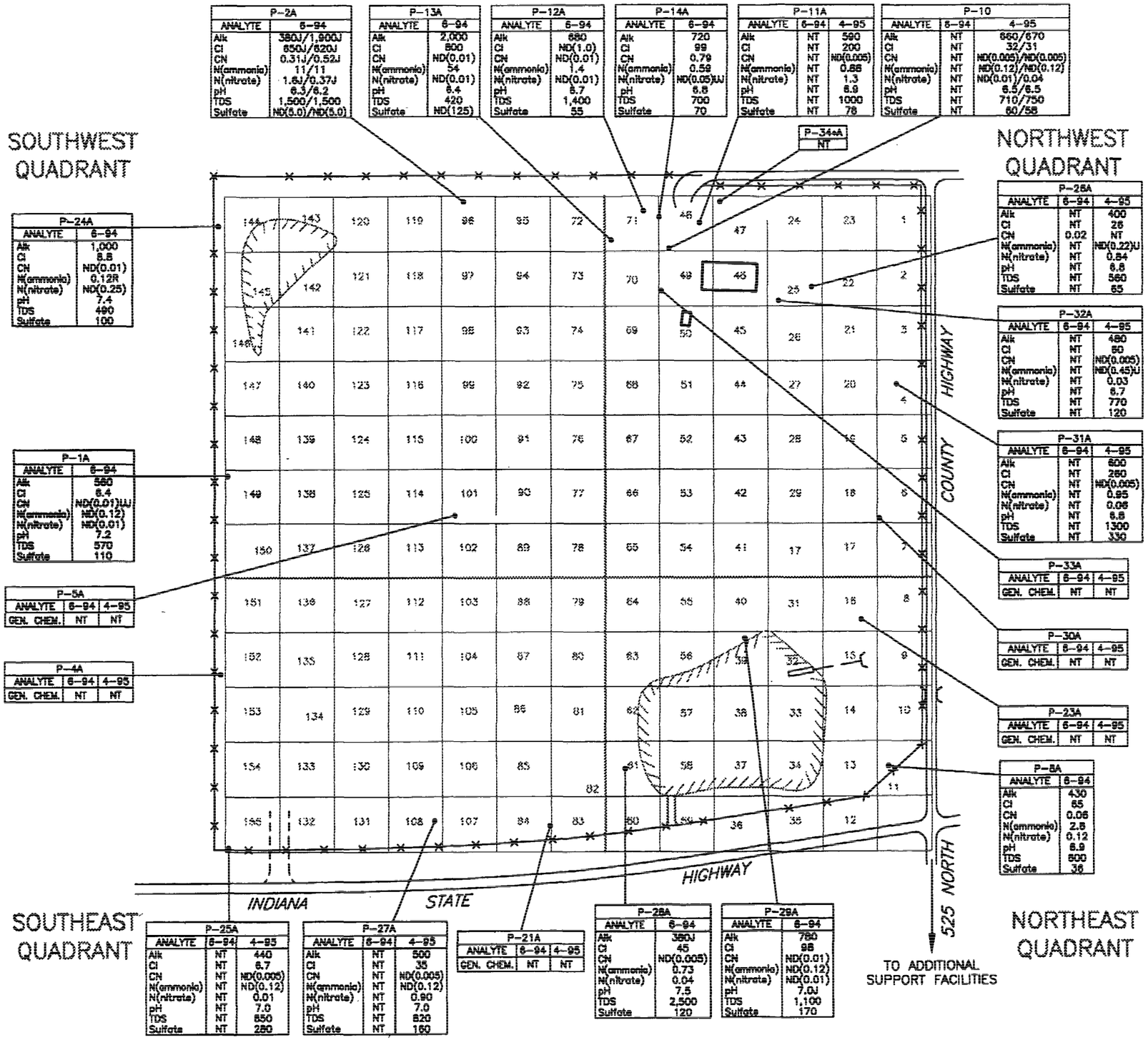


figure 5.20

COMPARISON OF METALS DATA WITH MCLs
UNIT C MONITORING WELLS
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 11, 96-REV.0-(C)(P109)



P-2A	
ANALYTE	6-94
Alk	380J/1,900J
Cl	650J/620J
CN	0.31J/0.52J
N(ammonia)	11/11
N(nitrate)	1.6J/0.37J
pH	6.3/6.2
TDS	1,500/1,500
Sulfate	ND(5.0)/ND(5.0)

P-13A	
ANALYTE	6-94
Alk	2,000
Cl	800
CN	ND(0.01)
N(ammonia)	54
N(nitrate)	ND(0.01)
pH	6.4
TDS	420
Sulfate	ND(125)

P-12A	
ANALYTE	6-94
Alk	680
Cl	ND(1.0)
CN	ND(0.01)
N(ammonia)	1.4
N(nitrate)	ND(0.01)
pH	6.7
TDS	1,400
Sulfate	55

P-14A	
ANALYTE	6-94
Alk	720
Cl	99
CN	0.79
N(ammonia)	0.59
N(nitrate)	ND(0.05)UJ
pH	6.8
TDS	700
Sulfate	70

P-11A		
ANALYTE	6-94	4-95
Alk	NT	590
Cl	NT	200
CN	NT	ND(0.005)
N(ammonia)	NT	0.88
N(nitrate)	NT	1.3
pH	NT	6.9
TDS	NT	1000
Sulfate	NT	78

P-10		
ANALYTE	6-94	4-95
Alk	NT	660/670
Cl	NT	32/31
CN	NT	ND(0.005)/ND(0.005)
N(ammonia)	NT	ND(0.12)/ND(0.12)
N(nitrate)	NT	ND(0.01)/0.04
pH	NT	6.5/6.5
TDS	NT	710/750
Sulfate	NT	60/58

P-34A
NT

P-24A	
ANALYTE	6-94
Alk	1,000
Cl	8.8
CN	ND(0.01)
N(ammonia)	0.12R
N(nitrate)	ND(0.25)
pH	7.4
TDS	490
Sulfate	100

P-1A	
ANALYTE	6-94
Alk	560
Cl	6.4
CN	ND(0.01)UJ
N(ammonia)	ND(0.12)
N(nitrate)	ND(0.01)
pH	7.2
TDS	570
Sulfate	110

P-5A		
ANALYTE	6-94	4-95
GEN. CHEM.	NT	NT

P-4A		
ANALYTE	6-94	4-95
GEN. CHEM.	NT	NT

P-26A		
ANALYTE	6-94	4-95
Alk	NT	400
Cl	NT	26
CN	0.02	NT
N(ammonia)	NT	ND(0.22)U
N(nitrate)	NT	0.84
pH	NT	6.8
TDS	NT	560
Sulfate	NT	65

P-32A		
ANALYTE	6-94	4-95
Alk	NT	480
Cl	NT	50
CN	NT	ND(0.005)
N(ammonia)	NT	ND(0.45)U
N(nitrate)	NT	0.03
pH	NT	6.7
TDS	NT	770
Sulfate	NT	120

P-31A		
ANALYTE	6-94	4-95
Alk	NT	600
Cl	NT	260
CN	NT	ND(0.005)
N(ammonia)	NT	0.95
N(nitrate)	NT	0.06
pH	NT	6.6
TDS	NT	1300
Sulfate	NT	330

P-33A		
ANALYTE	6-94	4-95
GEN. CHEM.	NT	NT

P-30A		
ANALYTE	6-94	4-95
GEN. CHEM.	NT	NT

P-23A		
ANALYTE	6-94	4-95
GEN. CHEM.	NT	NT

P-8A	
ANALYTE	6-94
Alk	430
Cl	65
CN	0.06
N(ammonia)	2.6
N(nitrate)	0.12
pH	6.9
TDS	500
Sulfate	36

P-25A		
ANALYTE	6-94	4-95
Alk	NT	440
Cl	NT	6.7
CN	NT	ND(0.005)
N(ammonia)	NT	ND(0.12)
N(nitrate)	NT	0.01
pH	NT	7.0
TDS	NT	650
Sulfate	NT	280

P-27A		
ANALYTE	6-94	4-95
Alk	NT	500
Cl	NT	35
CN	NT	ND(0.005)
N(ammonia)	NT	ND(0.12)
N(nitrate)	NT	0.90
pH	NT	7.0
TDS	NT	820
Sulfate	NT	150

P-21A		
ANALYTE	6-94	4-95
GEN. CHEM.	NT	NT

P-28A	
ANALYTE	6-94
Alk	350J
Cl	45
CN	ND(0.005)
N(ammonia)	0.73
N(nitrate)	0.04
pH	7.5
TDS	2,500
Sulfate	120

P-29A	
ANALYTE	6-94
Alk	780
Cl	98
CN	ND(0.01)
N(ammonia)	ND(0.12)
N(nitrate)	ND(0.01)
pH	7.0J
TDS	1,100
Sulfate	170

0 100 200ft

SOURCE:
MODIFICATION OF A SITE MAP (4/15/91) OBTAINED FROM GEOSCIENCES RESEARCH ASSOCIATES, INC.

LEGEND

- FENCE LINE
- 155 BLOCK NUMBERS OF GRID
- P-26A • PIEZOMETER
- P-21A — SAMPLE IDENTIFIER
- ANALYTE 6-94 — SAMPLE DATE
- GEN. CHEM. NT — CONCENTRATION
- DETECTED PARAMETERS

ABBREVIATIONS

GEN. CHEM.	GENERAL CHEMISTRY PARAMETERS
Alk	ALKALINITY
Cl	CHLORIDE
CN	CYANIDE (TOTAL)
N	NITROGEN
TDS	TOTAL DISSOLVED SOLIDS
TSS	TOTAL SUSPENDED SOLIDS
NT	NOT TESTED (INSUFFICIENT WATER VOLUME TO PERMIT SAMPLE COLLECTION)
U	ANALYTE WAS NOT DETECTED ABOVE THE QUANTITATION LIMIT STATED IN PARENTHESES
0.31/0.52	SAMPLE/DUPLICATE SAMPLE
J	ANALYTE DETECTED. ASSOCIATED VALUE IS AN ESTIMATED QUANTITY.
UJ	NOT DETECTED. DETECTION LIMIT IS ESTIMATED.
R	UNABLE TO CONFIRM PRESENCE/ABSENCE OF THIS ANALYTE.

NOTES:
1. SITE GRID = 100 FEET
2. ALL RESULTS REPORTED IN mg/L EXCEPT pH WHICH IS REPORTED IN STANDARD UNITS.

figure 5.21

GENERAL CHEMISTRY DATA
UNIT A
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 11, 96-REV.0-(C)(P110)

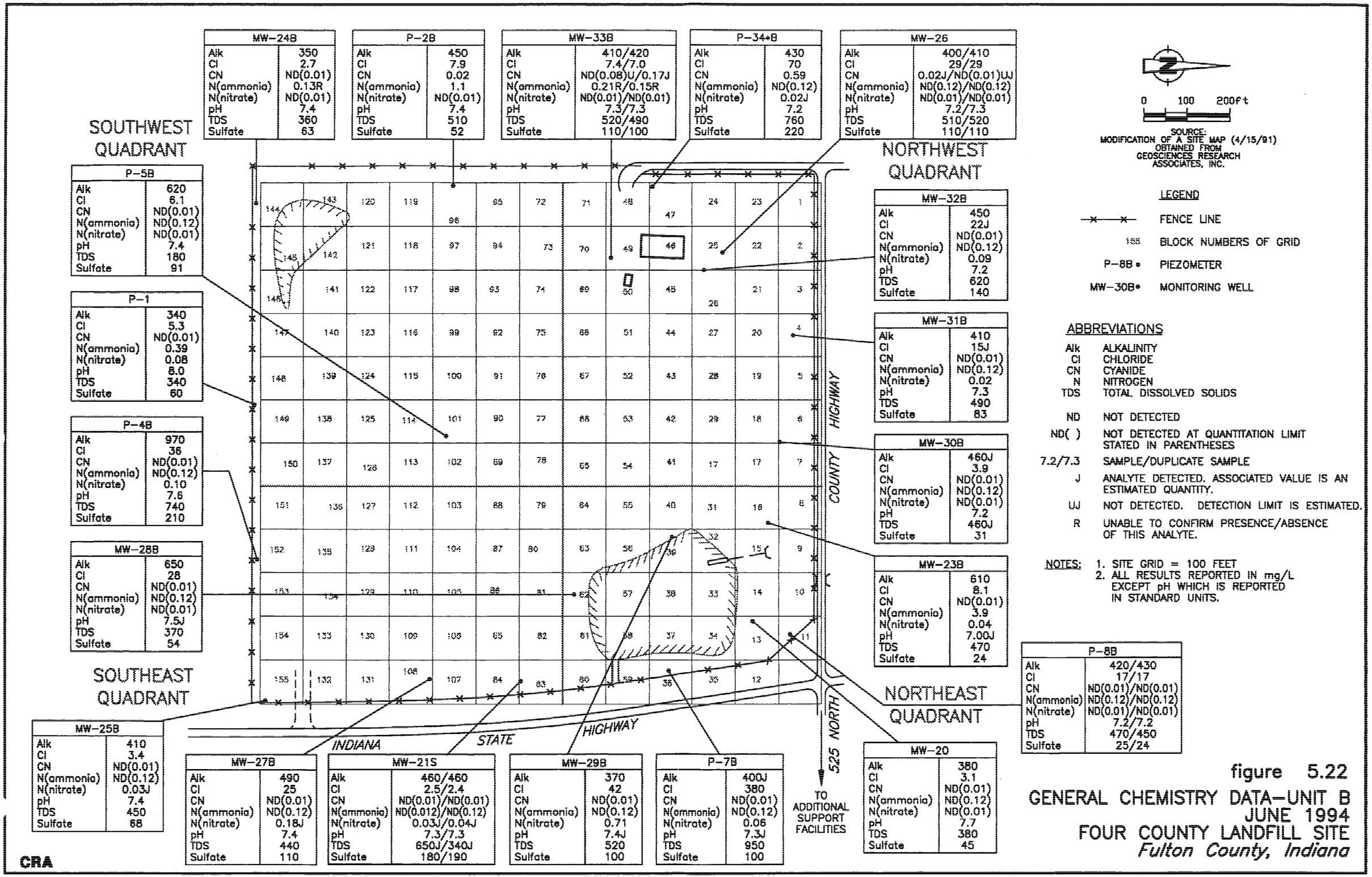


figure 5.22

GENERAL CHEMISTRY DATA—UNIT B
JUNE 1994
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

5369(13)—JAN. 11, 96—REV.0—(C)(P111)

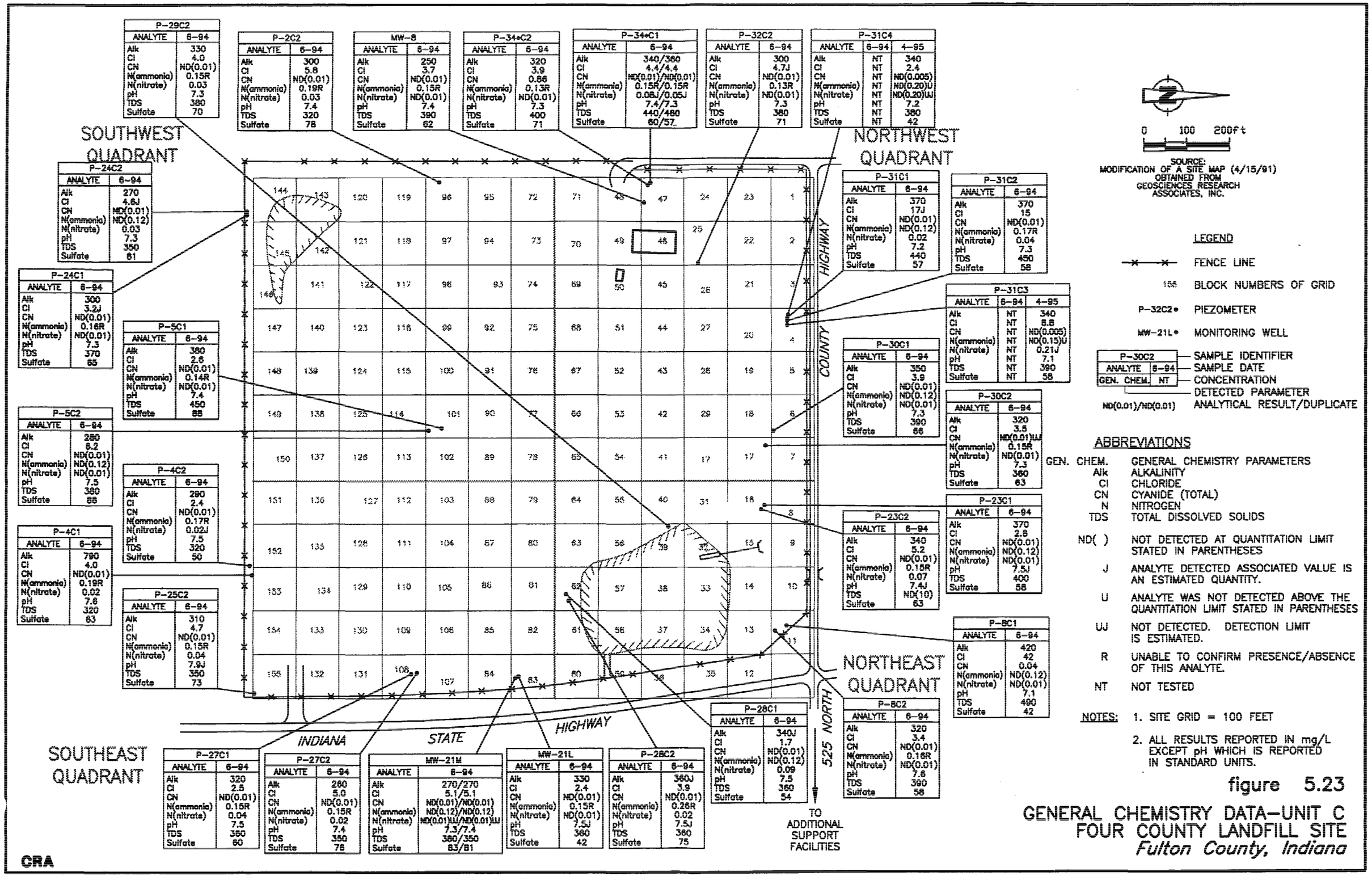
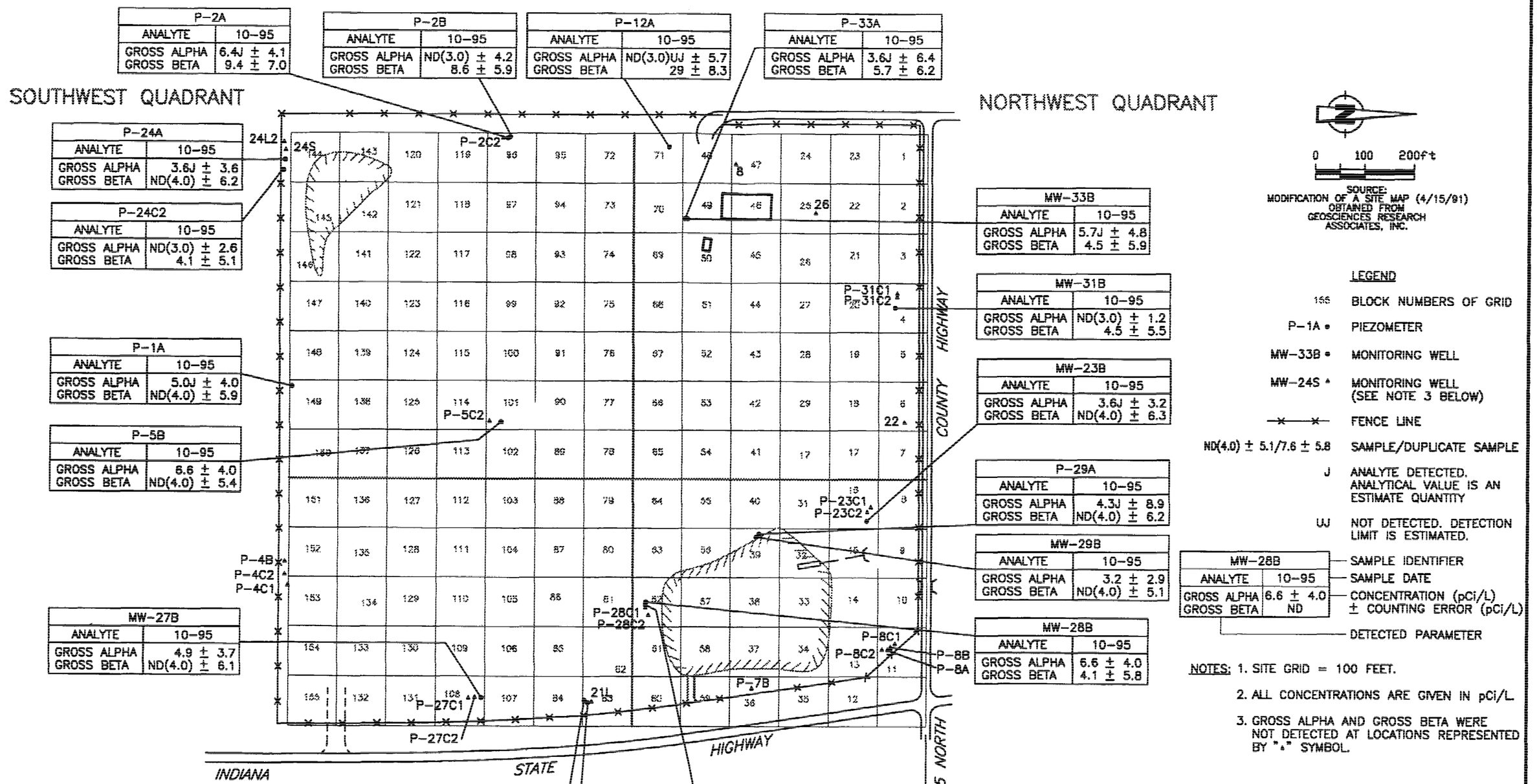


figure 5.23

GENERAL CHEMISTRY DATA—UNIT C
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)—JAN.11, 96—REV.0—(C)(P112)



P-2A	
ANALYTE	10-95
GROSS ALPHA	6.4J ± 4.1
GROSS BETA	9.4 ± 7.0

P-2B	
ANALYTE	10-95
GROSS ALPHA	ND(3.0) ± 4.2
GROSS BETA	8.6 ± 5.9

P-12A	
ANALYTE	10-95
GROSS ALPHA	ND(3.0)UJ ± 5.7
GROSS BETA	29 ± 8.3

P-33A	
ANALYTE	10-95
GROSS ALPHA	3.6J ± 6.4
GROSS BETA	5.7 ± 6.2

P-24A	
ANALYTE	10-95
GROSS ALPHA	3.6J ± 3.6
GROSS BETA	ND(4.0) ± 6.2

P-24C2	
ANALYTE	10-95
GROSS ALPHA	ND(3.0) ± 2.6
GROSS BETA	4.1 ± 5.1

P-1A	
ANALYTE	10-95
GROSS ALPHA	5.0J ± 4.0
GROSS BETA	ND(4.0) ± 5.9

P-5B	
ANALYTE	10-95
GROSS ALPHA	6.6 ± 4.0
GROSS BETA	ND(4.0) ± 5.4

MW-27B	
ANALYTE	10-95
GROSS ALPHA	4.9 ± 3.7
GROSS BETA	ND(4.0) ± 6.1

MW-33B	
ANALYTE	10-95
GROSS ALPHA	5.7J ± 4.8
GROSS BETA	4.5 ± 5.9

MW-31B	
ANALYTE	10-95
GROSS ALPHA	ND(3.0) ± 1.2
GROSS BETA	4.5 ± 5.5

MW-23B	
ANALYTE	10-95
GROSS ALPHA	3.6J ± 3.2
GROSS BETA	ND(4.0) ± 6.3

P-29A	
ANALYTE	10-95
GROSS ALPHA	4.3J ± 8.9
GROSS BETA	ND(4.0) ± 6.2

MW-29B	
ANALYTE	10-95
GROSS ALPHA	3.2 ± 2.9
GROSS BETA	ND(4.0) ± 5.1

MW-28B	
ANALYTE	10-95
GROSS ALPHA	6.6 ± 4.0
GROSS BETA	4.1 ± 5.8

MW-21S	
ANALYTE	10-95
GROSS ALPHA	ND(3.0) ± 2.6/ND(3.0) ± 3.7
GROSS BETA	ND(4.0) ± 5.1/7.6 ± 5.8

MW-21M	
ANALYTE	10-95
GROSS ALPHA	ND(3.0) ± 2.6
GROSS BETA	6.4 ± 5.3

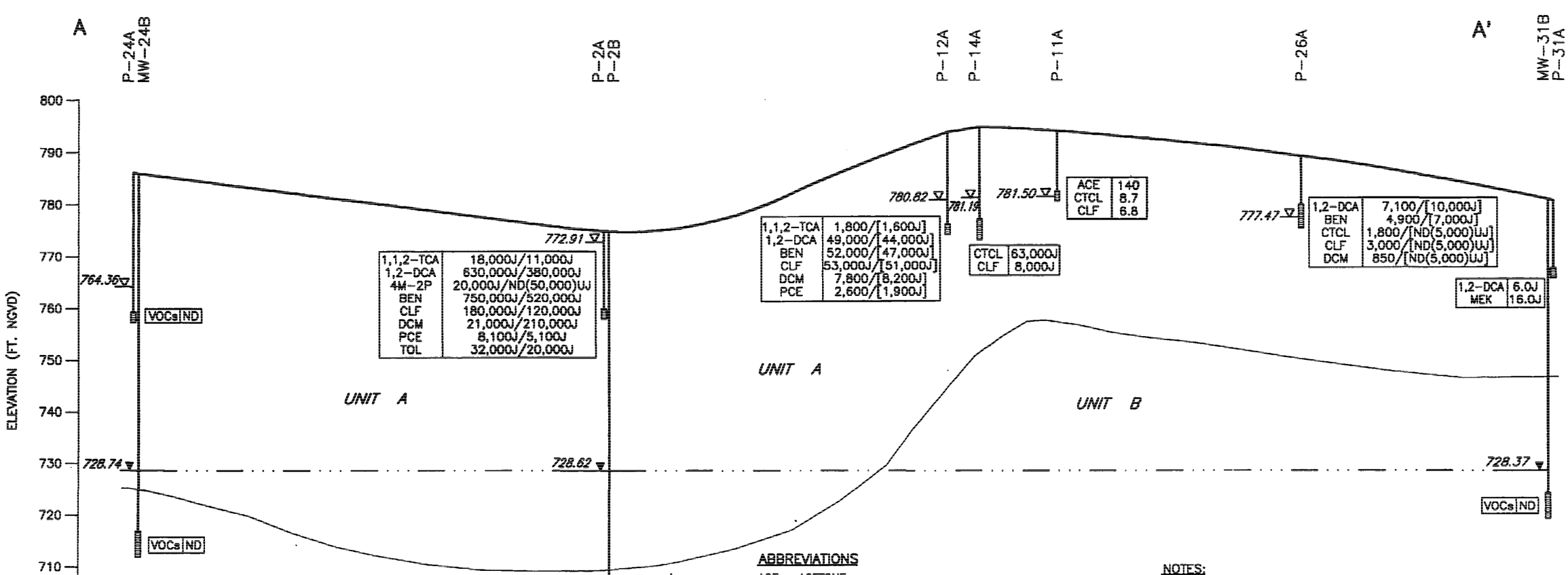
MW-28A	
ANALYTE	10-95
GROSS ALPHA	5.5 ± 4.1
GROSS BETA	4.3 ± 6.2

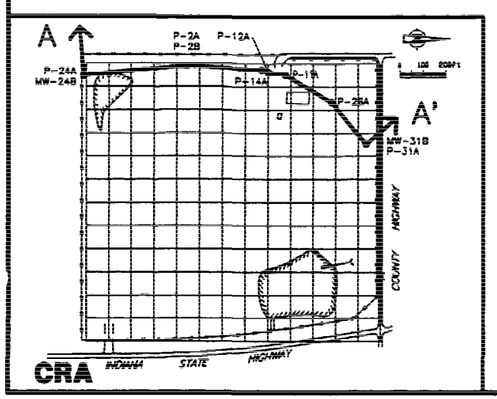
figure 5.24

DETECTED GROSS ALPHA AND GROSS BETA DISTRIBUTION
OCTOBER 1995
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 11, 96-REV.0-(C)(P-113)





SCALE: HORIZ. 1"=100'
VERT. 1"=20'

ABBREVIATIONS

ACE	ACETONE
BEN	BENZENE
CLF	CHLOROFORM
CTCL	CARBON TETRACHLORIDE
1,2-DCA	1,2-DICHLOROETHANE
DCM	DICHLOROMETHANE
MEK	METHYL ETHYL KETONE
PCE	TETRACHLOROETHENE
TCE	TRICHLOROETHENE
TOL	TOLUENE
4M-2P	4-METHYL-2-PENTANONE
1,1,2-TCA	1,1,2-TRICHLOROETHANE
VOCs	VOLATILE ORGANIC COMPOUNDS
ND(500)/1,800	ANALYTICAL RESULT/DUPLICATE
10,000/[7,000]	RESULTS OF ORIGINAL ANALYSIS AND REANALYSIS IN [ ]
ND	NOT DETECTED
ND(1)	NOT DETECTED AT QUANTITATION LIMIT STATED IN PARENTHESES
NT	NOT TESTED (INSUFFICIENT WATER VOLUME TO PERMIT SAMPLE COLLECTION)
J	ANALYTE DETECTED ASSOCIATED VALUE IS AN ESTIMATED QUANTITY.
UJ	NOT DETECTED. DETECTION LIMIT IS ESTIMATED
NOTE:	ALL ANALYTICAL RESULTS REPORTED IN MICROGRAMS/LITER (µg/L)

NOTES:

UNIT A GLACIAL TILL, PREDOMINATELY LOAM AND SILT. SUBUNITS ARE BASED ON VARIATIONS IN TEXTURE, PEBBLE COMPOSITION AND OCCURENCE OF THIN OXIDIZED ZONES AND INTERTILL CLASTIC UNITS.

UNIT B WELL STRATIFIED SEQUENCE OF FINE TO MEDIUM GRAINED SAND AND SILT, COMMONLY CAPPED BY A THIN PEBBLY SAND AND PEBBLY LOAM WHICH IS STRONGLY OXIDIZED IN THE UPPER PART.

772.91▽ PERCHED GROUNDWATER ELEVATION IN JULY 1994.

728.62▼ GROUNDWATER ELEVATION IN JULY 1994.

figure 5.25

GEOLOGICAL CROSS SECTION A-A'
WITH RI ANALYTICAL DATA
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

5369(11) JAN. 11, 96 REV.0 (C)(X-10)

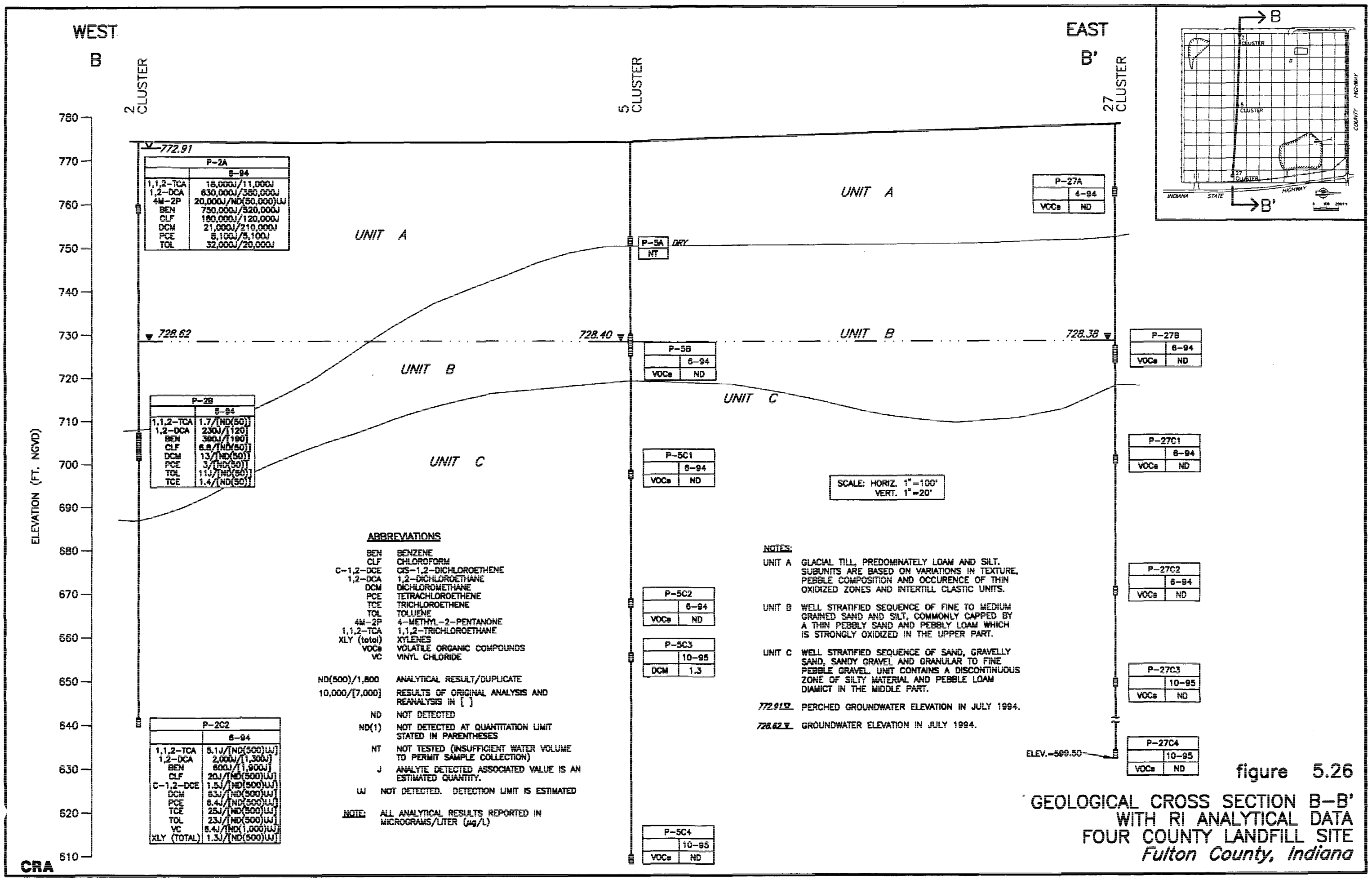


figure 5.26

GEOLOGICAL CROSS SECTION B–B'
WITH RI ANALYTICAL DATA
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

5369(11) JAN. 11, 96 REV.0 (C)(X-09)

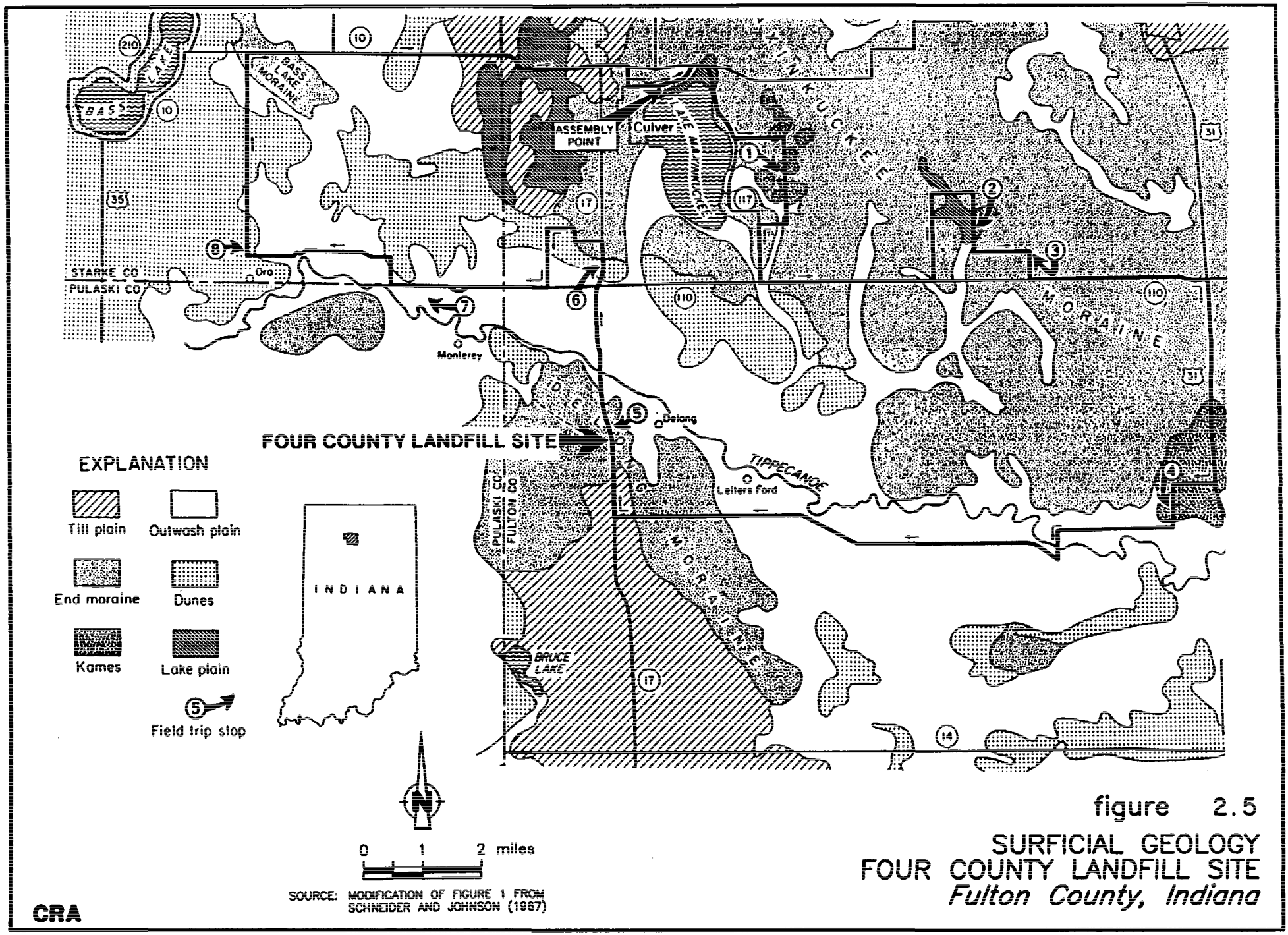
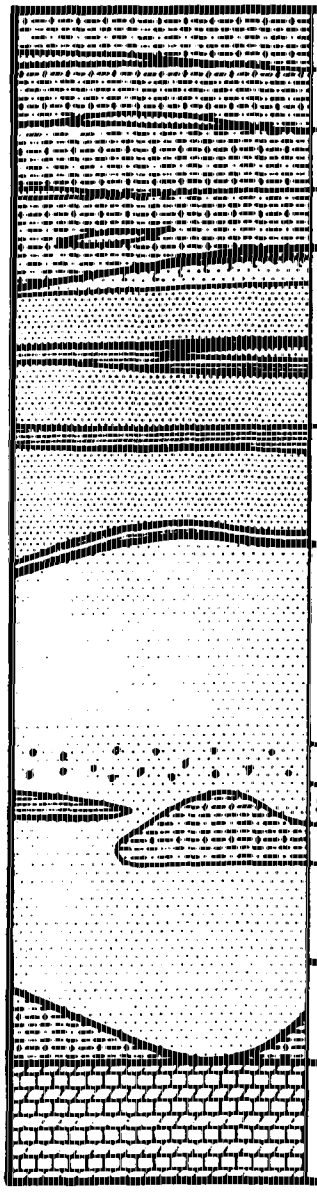


figure 2.5

SURFICIAL GEOLOGY
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 11, 96-REV.0 (C)



STRATIGRAPHIC UNIT/MARKER HORIZON		DESCRIPTION
A1	UNIT A	**TILL SEQUENCE** Glacial till of dominant loam and silt loam texture. Subunits are based on variations in texture and pebble composition, occurrence of thin oxidized zones, intertill clastic units and variation in standard penetration resistance.
A2		
A22		
A3		
SILT MARKER	UNIT B	**GLACIO-LACUSTRINE SEQUENCE** Well stratified sequence of fine to medium grained sand and silt commonly capped by a thin pebbly sand and pebbly loam which is strongly oxidized in the upper part. Base of unit is mapped at the base of the lowest silt bed in the sequence.
C2	UNIT C	**GLACIO-FLUVIAL SEQUENCE** Well stratified sequence of sand, gravelly sand, sandy gravel and granular to fine pebble gravel. Unit contains a discontinuous zone of silty material and pebbly loam dianict in the middle part. Upper part of the sequence coarsens downward to a zone of coarse sand, sandy gravel and gravel, designated as Subunit C2. Below this zone are finer grained materials.
SILTY MUD ZONE		
DIAMICT ZONE		
UNIT D		**BASAL TILL** Loam or finer glacial till. Becomes more clayey and has reddish hue in basal part.
BEDROCK		**BEDROCK** Limestone and Dolostone of Devonian age.

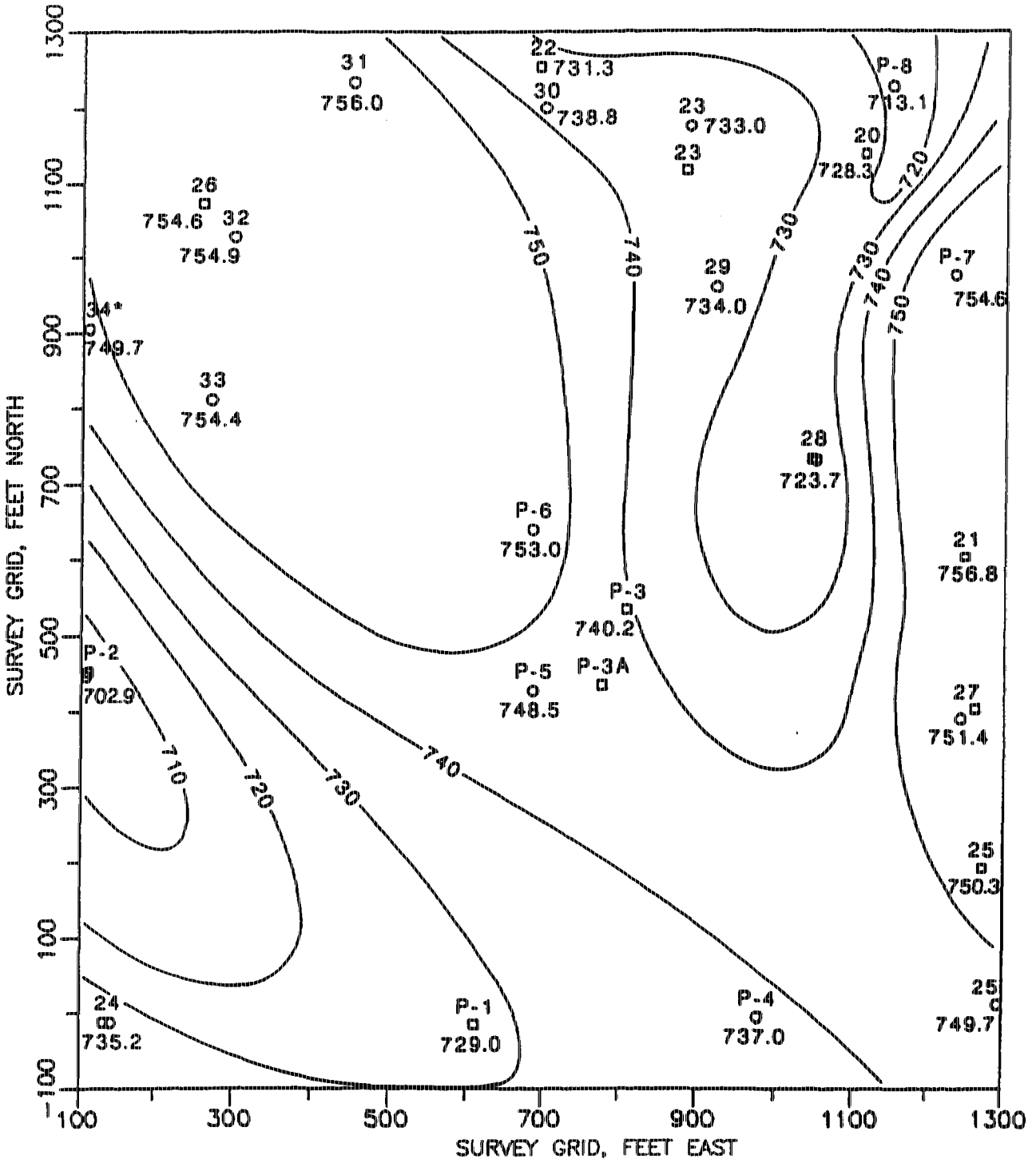
SOURCE: GEOSCIENCES RESEARCH ASSOCIATES, INC.
MEMORANDUM REPORT (4/28/89), PLATE 1.

figure 2.6

GENERALIZED SITE STRATIGRAPHY
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(II)-JAN. 11, 96-REV.0 (C)



CONTOUR INTERVAL = 10 FEET

NOTE: DATA SHOWN IN FEET AMSL.

SYMBOL LEGEND:	
○	1988/1989 BORING LOCATION
□	PRE-1988/1989 BORING LOCATION

N

0 100 200ft

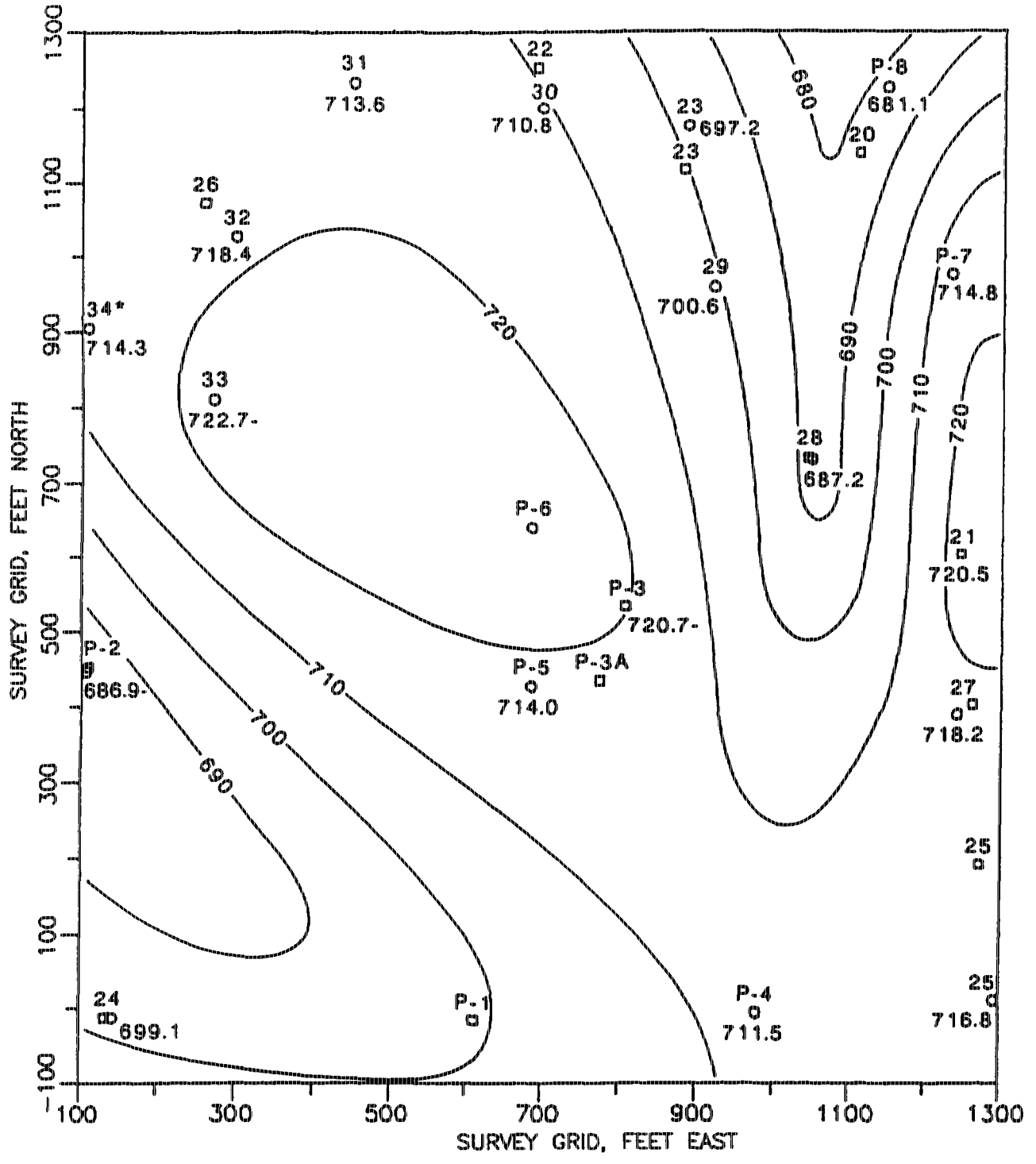
SOURCE: MODIFICATION OF THE GEOSCIENCES RESEARCH ASSOCIATES, INC. MEMORANDUM REPORT (4/28/89), FIGURE 4.

figure 2.7

STRUCTURE CONTOUR MAP
TOP OF STRATIGRAPHIC UNIT B
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 11, 96-REV.0 (C)



CONTOUR INTERVAL = 10 FEET

NOTE: DATA SHOWN IN FEET AMSL

SYMBOL LEGEND:	
○	1988/1989 BORING LOCATION
□	PRE-1988/1989 BORING LOCATION

0 100 200ft

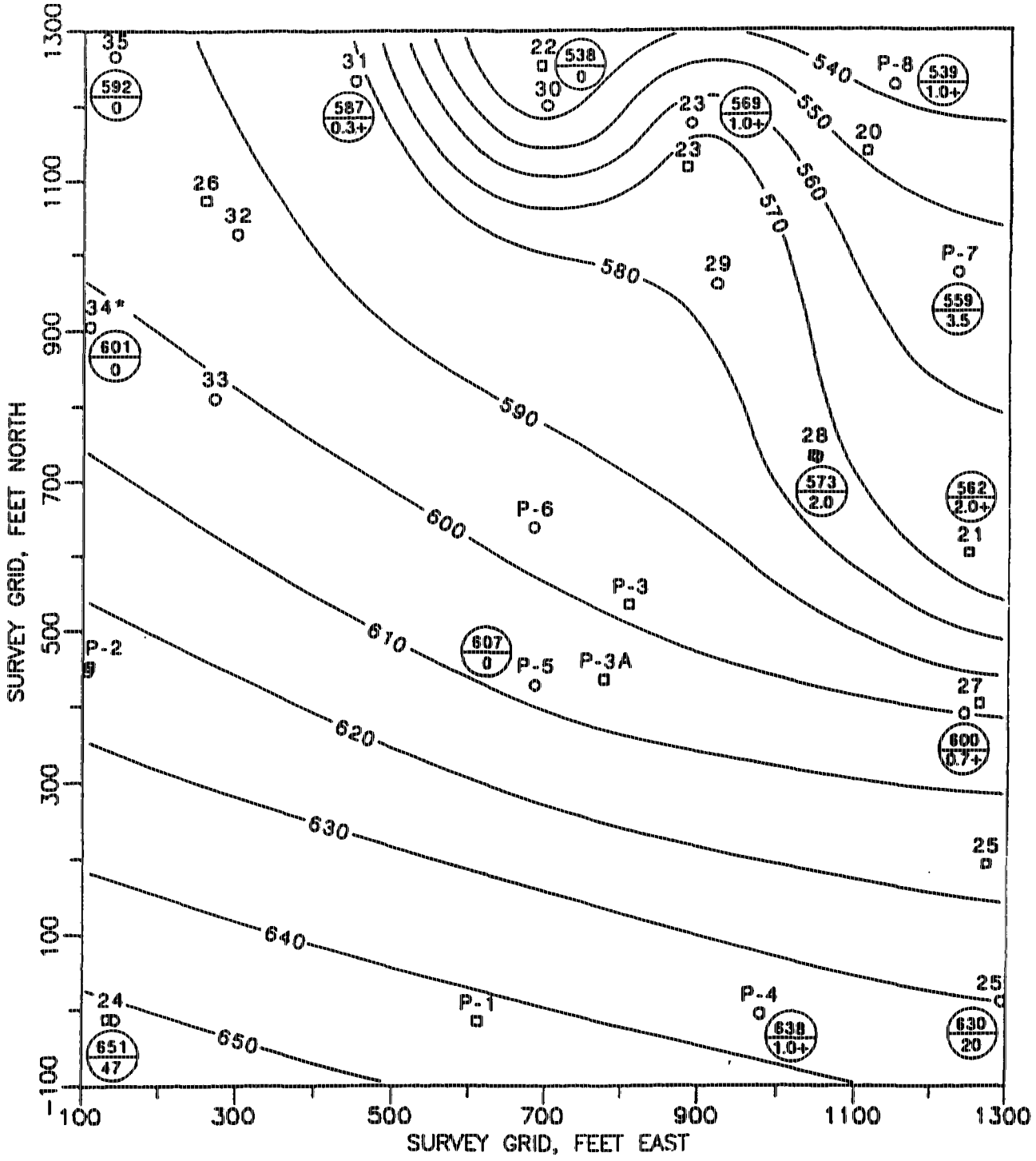
SOURCE: MODIFICATION OF THE GEOSCIENCES RESEARCH ASSOCIATES, INC. MEMORANDUM REPORT (4/28/89), FIGURE 5.

figure 2.8

STRUCTURE CONTOUR MAP
TOP OF STRATIGRAPHIC UNIT C
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

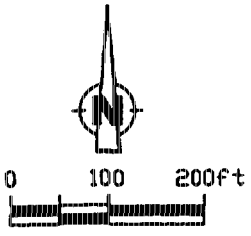
CRA

5369(11)- JAN. 11, 96-REV.0 (C)



CONTOUR INTERVAL = 10 FEET

SYMBOL LEGEND:	
○	1988/1989 BORING LOCATION
□	PRE-1988/1989 BORING LOCATION
607 / 0	BASE UNIT C ELEVATION / UNIT D THICKNESS



SOURCE: MODIFICATION OF THE GEOSCIENCES RESEARCH ASSOCIATES, INC. MEMORANDUM REPORT (4/28/89), FIGURE 6.

NOTE: DATA SHOWN IN FEET AMSL.

figure 2.9

STRUCTURE CONTOUR MAP
BASE OF STRATIGRAPHIC UNIT C
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

CRA

5369(11)-JAN. 11, 96-REV.0-(0)

TABLE 2.1

1994 & 1995 LEACHATE SHIPMENT SUMMARY
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Months/Year	*Volume Shipped (Gallons)*	*Annual Totals*
1994		
January	44,000	
February	41,500	
March	61,550	
April	54,700	
May	60,100	
June	39,800	
July	45,800	
August	40,300	
September	40,000	
October	29,500	
November	39,600	
December	41,800	538,650
1995		
January	29,600	
February	35,000	
March	39,900	
April	44,800	
May	45,400	
June	56,200	
July	64,800	
August	45,300	
September	39,600	
October	44,800	
November	38,700	
December	19,300	503,400

TABLE 2.2

SUMMARY OF HYDRAULIC CONDUCTIVITY DATA[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Identification	*Well Screen Interval (feet bgs)*	*Slug Test Analytical Method*		*Laboratory Analysis* [2] *(cm/sec)*
		Hvorslev (cm/sec)	*Papadopulos (cm/sec)*	
MW-21S	45 - 60	1.42 x 10-5	1.20 x 10-4	3.5 x 10-5
MW-21M	85 - 95	1.00 x 10-4	2.40 x 10-4	4.3 x 10-3
MW-21L	202 - 212	6.00 x 10-6	1.54 x 10-5	2.6 x 10-5
MW-25	64 - 74	1.37 x 10-4	3	--
MW-26	67 - 77	1.06 x 10-5	4.20 x 10-5	--

1 Modified from Table 7 of Dames & Moore's "Hydrogeologic Assessment Report" dated January 12, 1988.
2 Falling head permeability tests were performed on reconstituted or remolded samples.
3 No type curve match was possible.

Key:

bgs = Below ground surface
-- = No data reported

TABLE 2.3

SOIL CHARACTERISTICS OF THE UNIT A TILL SEQUENCE [1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Boring Identification	*Sample Depth (feet bgs)*	*Dry Density (pcf)*	*Natural Water Content (percent)*	*Permeability (cm/sec)*	*USDA Classification*	*Unified Soil Classification* [3]
P-1	8 - 10	124.2	15.8	9.6×10^{-8}	Loam [4]	CL/ML [4]
P-1	24 - 26	136.7	10.6	9.6×10^{-8}	Silty clay [4]	CL [4]
P-2	26 - 28	127.1	15.1	2.4×10^{-8}	Silty clay [4]	CL [4]
MW-25	8 - 10	122.5	18.7	1.3×10^{-7}	Loam [4]	CL [4]
MW-25	32 - 34	132.1	17	6.2×10^{-8}	Silty clay [4]	CL [4]
MW-26	8 - 10	132.3	14.7	1.2×10^{-6}	Clay loam [4]	ML [4]
MW-26	28 - 30	128.5	16.3	1.3×10^{-7}	Clay loam [4]	CL/ML [4]
MW-24S	6 - 8	138.3	12.8	7.0×10^{-7}	Sandy loam	SM
MW-28S	24 - 26	127.0	14.6	2.3×10^{-7}	Silty clay loam	ML
MW-28S	30 - 32	127.7	12.8	7.3×10^{-6}	Silt loam	CL/ML
MW-28S	43 - 45	131.4	11.1	1.3×10^{-5}	Silt loam	CL/ML

1 Modified from Table 3 of the January 12, 1988 "Hydrogeologic Assessment Report" by Dames & Moore. Raw data collected between 1986 and 1987.
2 Falling head permeability tests performed on Shelby tube soil samples.
3 Unified Soil Classification designations are as follows:
CL = Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays;
ML = Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity; and
SM = Silty sands, sand-silt mixtures.
4 Based on visual inspection.

Key:

bgs = Below ground surface
pcf = Pounds per cubic foot
USDA = U. S. Department of Agriculture

TABLE 2.4

SOIL CHARACTERIZATION DATA FROM 1988 AND 1989 INVESTIGATIONS[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

			Texture (Percent Finer)								Atterberg Limits			Soil Classification	
			Sieve					Hydrometer							
Stratigraphic Unit Sampled[2]	*Boring Identification*	*Sample Depth (feet bgs)*	*#4, 4.75 (mm)*	*#10, 2.00 (mm)*	*#35, 0.50 (mm)*	*#120, 0.125 (mm)*	*#200, 0.074 (mm)*	*0.050 (mm)*	*0.005 (mm)*	*0.002 (mm)*	*LL (percent)*	*PL (percent)*	*PI*	*USDA*	*Unified*[3]
Subunit A1	24 B	10.0 - 12.0	97.7	92.0	86.6	71.8	66.7	62.0	27.0	19.5	24.5	14.2	10.3	Loam	CL
	28 B	22.0 - 25.5	95.5	89.7	80.2	65.0	60.4	54.5	22.0	14.9	25.5	15.4	10.1	Loam	CL
	32 B	12.0 - 14.0	96.3	92.0	85.2	66.2	60.3	54.0	22.0	14.5	21.8	13.9	7.9	Loam	CL
Subunit A2	24 B	17.2 - 20.0	100.0	96.5	93.6	88.8	85.8	81.5	37.0	24.0	26.7	16.6	10.1	Silt loam	CL
	25 A	10.0 - 12.0	97.4	94.7	90.9	83.8	79.5	75.5	30.5	19.9	26.0	16.4	9.6	Silt loam	CL
	28 B	28.0 - 30.0	99.2	96.7	93.3	87.8	84.1	78.0	32.5	22.0	24.2	15.4	8.8	Silt loam	CL
	32 B	20.0 - 22.0	98.7	97.0	93.6	86.9	83.3	78.0	34.5	22.5	26.8	15.7	11.1	Silt loam	CL
Subunit A22	24 B	22.0 - 24.0	97.3	91.8	84.4	62.8	57.3	52.5	25.0	15.5	23.9	14.3	9.6	Loam	CL
	25 A	22.0 - 24.0	94.6	89.6	81.2	58.9	52.8	49.5	19.5	14.0	17.6	13.0	4.7	Loam	CL-ML
	28 B	36.0 - 38.0	92.8	88.4	81.4	61.6	55.3	50.5	19.5	13.0	20.2	12.9	7.3	Loam	CL
	32 B	30.0 - 32.0	90.8	86.0	78.6	56.3	50.1	45.0	18.5	12.0	17.5	11.9	5.6	Loam	CL-ML
Subunit A3	24 B	46.0 - 48.0	97.6	94.2	91.5	85.5	83.1	79.0	28.5	18.0	24.9	16.0	9.0	Silt loam	CL
	25 A	34.0 - 36.0	98.8	95.6	91.4	72.5	65.4	61.0	21.0	13.0	18.7	12.7	6.0	Silt loam	CL-ML
	28 B	46.0 - 48.0	97.4	93.6	89.5	72.0	65.3	59.0	20.0	12.0	19.3	12.8	6.5	Silt loam	CL-ML
	32 B	40.0 - 41.5	98.2	95.7	91.9	75.7	68.6	63.0	21.0	13.0	19.4	13.5	5.8	Silt loam	CL-ML
Unit B	5 B	48.0 - 50.0	100.0	100.0	100.0	25.9	11.4	6.0	1.0	1.0		Nonplastic		Sand	SP-SM
	8 C3	71.0 - 73.0	100.0	100.0	99.4	98.2	96.3	90.0	6.5	2.5		Nonplastic		Silt	ML
	23 B	26.0 - 28.0	85.6	78.7	67.2	42.4	37.3	32.0	9.9	6.5		Nonplastic		Gv sandy loam	SM
	23 C3	48.0 - 50.0	99.9	99.9	99.9	97.2	80.2	68.5	11.0	4.0		Nonplastic		Silt loam	ML
	28 B	52.0 - 54.0	85.9	91.6	71.1	22.1	18.3	13.9	5.8	3.5		Nonplastic		Loamy sand	SM
Upper Unit C	5 C1	75.0 - 77.0	100.0	99.9	90.9	12.4	10.0	8.4	3.3	1.9		Nonplastic		Sand	SP-SM
	5 C1	65.0 - 67.0	100.0	99.9	99.9	20.7	11.5	7.5	2.5	1.8		Nonplastic		Sand	SW-SM
	28 C3	95.0 - 97.0	99.8	98.7	96.7	21.6	16.6	11.5	4.0	3.0		Nonplastic		Sand	SM
	28 C3	110.0 - 112.0	98.0	95.3	89.6	31.5	18.1	12.5	2.5	1.5		Nonplastic		Loamy sand	SM
Subunit C2	4 C3	115.0 - 117.0	63.0	47.1	24.9	14.0	12.0	10.0	3.5	2.5		Nonplastic		V gv loamy sand	SW-SM
	5 C3	83.0 - 85.0	94.2	79.0	40.8	13.0	10.0	8.0	2.4	1.6		Nonplastic		Gv sand	SW-SM
	23 C3	115.0 - 117.0	99.1	97.8	42.2	11.4	9.8	8.0	2.9	2.0		Nonplastic		Sand	SW-SM
	25 C2	115.0 - 117.0	80.3	57.0	22.8	8.0	6.0	4.5	3.0	1.9		Nonplastic		Gv sand	SW-SM
	28 C3	120.0 - 122.0	78.9	60.8	28.9	14.5	12.1	10.0	2.9	2.0		Nonplastic		Gv loamy sand	SM
	31 C2	115.0 - 116.5	70.8	48.4	29.1	19.2	17.8	12.0	2.5	2.0		Nonplastic		V gv loamy sand	SM

TABLE 2.4

SOIL CHARACTERIZATION DATA FROM 1988 AND 1989 INVESTIGATIONS[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

			Texture (Percent Finer)								Atterberg Limits			Soil Classification	
			Sieve					Hydrometer							
Stratigraphic Unit Sampled[2]	*Boring Identification*	*Sample Depth (feet bgs)*	*#4, 4.75 (mm)*	*#10, 2.00 (mm)*	*#35, 0.50 (mm)*	*#120, 0.125 (mm)*	*#200, 0.074 (mm)*	*0.050 (mm)*	*0.005 (mm)*	*0.002 (mm)*	*LL (percent)*	*PL (percent)*	*PI*	*USDA*	*Unified*[3]
Unit C Muddy Zone	5 C3	113.0 - 115.0	100.0	100.0	99.7	98.0	87.5	74.0	17.3	10.9	25.3	15.0	10.3	Silt loam	CL
Unit C Diamict Zone	30 C3	110.0 - 111.5	100.0	99.8	98.9	93.1	89.3	84.5	43.0	26.5	31.2	15.8	15.4	Silt loam	CL
Lower Unit C	8 C3	131.0 - 133.0	82.2	67.6	42.4	13.4	10.5	8.9	2.8	1.9		Nonplastic		Gv sand	SW-SM
	23 C3	135.0 - 137.0	96.7	85.2	69.7	11.3	8.9	7.5	2.0	2.0		Nonplastic		Sand	SP-SM
	28 C3	130.0 - 132.0	100.0	99.6	86.1	15.1	11.5	9.0	2.5	1.8		Nonplastic		Sand	SP-SM

1 Modified from Table 1 of the April 28, 1989 Memorandum Report by Geosciences Research Associates, Inc. regarding the 1988 and 1989 investigations.

2 Stratigraphic units are defined as follows:
- A = Glacial till sequence, silty clay loam with silt and sand seams;
- B = Glacio-lacustrine sequence, silt and fine- to medium-grained sand;
- C = Glacio-fluvial sequence, poorly sorted silt, sand, and gravel; and
- D = Basal till, silty clay with reddish hue at base.

3 Unified Soil Classification designations are as follows:
- CL = Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays;
- ML = Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity;
- SM = Silty sands, sand-silt mixtures;
- SP = Poorly graded sands, gravelly sands with little or no fines; and
- SW = Well graded, gravelly sands with little or no fines.

Key:

bgs	=	Below ground surface
Gv	=	Gravelly
LL	=	Liquid limit
PI	=	Plasticity index
PL	=	Plastic limit
USDA	=	U.S. Department of Agriculture
V	=	Very

TABLE 2.5

CATION EXCHANGE CAPACITY AND CALCIUM CARBONATE EQUIVALENCY DATA[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Stratigraphic Unit Sampled [2]	*Boring Identification*	*Sample Depth (feet bgs)*	*CEC (meq/100 g)*	*CCE (percent CaC0 equivalents)* [3]
Subunit A1	24B	10.0-12.0	4.6	26.8
	28B	22.0-25.5	3.6	24.3
	32B	12.0-14.0	5.2	27.2
Subunit A2	24B	17.2-20.0	2.3	24.6
	25A	10.0-12.0	5.7	24.3
	28B	28.0-30.0	5.3	24.5
	32B	20.0-22.0	3.8	23.8
Subunit A22	24B	22.0-24.0	2.3	18.8
	25A	22.0-24.0	2.7	20.6
	28B	36.0-38.0	2.6	21.8
	32B	30.0-32.0	3.9	21.9
Subunit A3	24B	46.8-48.0	4.3	28.8
	25A	34.0-36.0	5.9	23.9
	28B	46.0-48.0	3.2	24.4
	29B	36.0-37.2	--	28.8
	29B	37.2-38.2	--	24.8
	32B	40.0-41.5	3.0	24.1

[1] Modified from Table 2 of the April 28, 1989 Memorandum Report by Geosciences Research Associates, Inc. regarding 1988 and 1989 investigations.

[2] A detailed description of the Unit A glacial till (including subunits) is provided in the April 28, 1989 Memorandum Report prepared by John Bassett of Geosciences Research Associates, Inc.

Key:

bgs = Below ground surface
$CaCo_3$ = Calcium carbonate
CCE = Calcium carbonate equivalency
CEC = Cation exchange capacity
meq = Milliequivalents
-- = No data reported
g = grams

TABLE 3.1

SUMMARY OF HISTORICAL RADIONUCLIDE DETECTIONS[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well ID	*Date*	*Gross Alpha*	*Gross Beta*
MW-2	12/29/82	0	0
	02/18/83	3.1	<4
	06/22/83	2.5	<10
MW-4	12/29/82	0	0
	02/18/83	8.1	11
	06/22/83	<3	<10
	10/11/83	<3	<10
MW-6	12/29/82	0	0
	06/22/83	3.5	6.7
	10/11/83	<3	<10
	12/29/83	<3	<4
	09/06/84	<5	4.6
	12/12/84	<5	5.7
	02/06/85	<5	5.7
	09/26/86	<2	8
	06/04/87	<2	<3
	09/24/87	IS	IS [2]
	12/09/87	<2	15
MW-7	12/29/82	2	0
	02/18/83	2.8	<4
	06/22/83	5.8	<10
	10/11/83	<10	<3
MW-8	02/18/83	2.9	6.7
	06/22/83	6.8	<10
	10/11/83	<3	<10
MW-20	09/15/83	17.3	57
	10/11/83	<3	18.7
	12/29/83	<3	72

TABLE 3.1

SUMMARY OF HISTORICAL RADIONUCLIDE DETECTIONS[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well ID	*Date*	*Gross Alpha*	*Gross Beta*
MW-20	03/29/84	<3	200
	05/04/84	3	28
	09/06/84	<3	83
	12/12/84	6.4	81
	02/06/85	26	150
	09/26/86	10	11
	06/04/87	<2	7
	09/24/87	IS	IS
	12/11/87	0.3	1.3
MW-21L	03/26/87	<2	4
	06/03/87	<2	<3
	09/24/87	IS	IS
	12/08/87	<2	13
MW-21M	03/26/87	<2	<3
	06/03/87	<2	<3
	09/23/87	<2	<3
	12/08/87	<2	7
MW-21S	09/15/83	4.8	9.6
	10/11/83	3.5	<10
	12/29/83	5	13.3
	09/06/84	<3	5.9
	12/12/84	<5	7.9
	02/06/85	<3	6.9
	06/04/87	20	71
	09/24/87	IS	IS
	12/08/87	<2	19
MW-22	08/09/83	2.8	6.9
	10/11/83	3.4	<10
	12/29/83	7	10.6

TABLE 3.1

SUMMARY OF HISTORICAL RADIONUCLIDE DETECTIONS[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well ID	*Date*	*Gross Alpha*	*Gross Beta*
MW-22	03/29/84	<3	<10
	05/04/84	<3	<10
	09/06/84	<2	3.1
	12/12/84	<=5	4.2
	02/06/85	<5	3.8
	09/16/86	6	<3
	06/04/87	<2	10
	09/24/87	IS	IS
	12/11/87	0.3	0
MW-23L	09/26/86	<2	<3
	06/04/87	<2	<3
	09/24/87	IS	IS
	12/10/87	0.2	0
MW-23M	09/26/86	<2	<3
	06/04/87	<2	<3
	09/24/87	IS	IS
MW-23S	09/26/86	15	20
	06/04/87	46	84
	09/23/87	<2	12
	12/10/87	1.3	0.8
MW-24B	09/28/89	9.1	17.4
MW-24L2	06/04/87	23	71
	09/24/87	IS	IS
	12/09/87	<2	17
	04/26/88	5.1	9.7
	04/26/88	4.9	9.5
MW-24M	04/26/88	4.9	9.5

TABLE 3.1

SUMMARY OF HISTORICAL RADIONUCLIDE DETECTIONS[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well ID	*Date*	*Gross Alpha*	*Gross Beta*
MW-24M	03/26/87	<2	6
	06/03/87	6	7
	09/23/87	<2	<3
MW-24S	12/09/87	<2	13
	03/26/87	<2	37
	06/03/87	<2	30
	09/23/87	<2	23
MW-25	12/10/87	8	16
	06/03/87	1.5	6.3
	09/23/87	<2	<3
MW-26	12/10/87	1.6	3.1
	03/26/87	<2	4
	06/04/87	<2	16
	09/24/87	IS	IS
	12/10/87	2.3	2.6
	09/27/89	13.1	12.8
MW-27M	09/27/89	8.8	8.5
	06/04/87	<2	<3
	09/24/87	IS	IS
	12/10/87	1.7	0
MW-27S	04/27/88	12	4.7
	06/03/87	<2	88
	09/24/87	IS	IS
	12/10/87	1.7	3.8
MW-28M	04/27/88	0	74.6
	06/03/87	8	10
	09/24/87	IS	IS

TABLE 3.1

SUMMARY OF HISTORICAL RADIONUCLIDE DETECTIONS[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well ID	*Date*	*Gross Alpha*	*Gross Beta*
MW-28M	12/10/87	1.1	5.1
MW-28S	04/26/88	5.2	1
	06/03/87	11	88
	09/24/87	IS	IS
	12/10/87	2.6	3.2
	04/26/88	3	6.8

1 From a database compiled by ERM. Detection results given in picoCuries/Liter (p C/L)

2 Insufficient sample volume for analysis

TABLE 3.2

SUMMARY OF GRA HEADSPACE SCREENING DATA [1]
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA

Sample Location	*Sample Date*	*Monitored Depth Interval (ft bgs)* [2]	*PID Monitoring Results (ppm)* [3]
P-12A	11/11/89	2.5	0.2
		5.0	25.0
		6.0 - 8.0	250.0
		8.0 - 10.0	350.0
		12.0 - 14.0	350.0
		14.0 - 16.0	20.0
		16.0 - 17.2	35.0
		17.2 - 18.0	60.0
		18.0 - 19.2	150.0
		19.2 - 20.0	180.0
P-13A	11/22/89	2.5	0.2
		5.0	4.0
		6.0 - 8.0	9.0
		8.0 - 10.0	12.0
		10.0 - 12.0	60.0
		12.0 - 14.0	25.0
		14.0 - 16.0	130.0
		16.0 - 18.0	240.0
		18.0 - 20.0	200.0
		20.0 - 21.6	220.0
		21.6 - 22.0	180.0
P-14A	11/27/89	2.5	15.0
		5.0	34.0
		5.5 - 7.5	82.0
		8.0 - 10.0	96.0
		10.0 - 12.0	118.0
		12.0 - 14.0	80.0
		14.0 - 16.0	64.0
		16.0 - 18.0	16.0
		18.0 - 18.5	44.0
		18.5 - 20.0	106.0
		20.0 - 20.7	62.0
		20.7 - 22.0	128.0

TABLE 3.2

SUMMARY OF GRA HEADSPACE SCREENING DATA [1]
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA

Sample Location	*Sample Date*	*Monitored Depth Interval (ft bgs)* [2]	*PID Monitoring Results (ppm)* [3]
P-26A	11/21/89	0.0 - 5.0	0.2
		5.0 - 7.0	0.2
		7.0 - 9.0	0.2
		9.0 - 10.4	0.4
		10.4 - 11.0	6.0
		11.0 - 13.0	70.0
		13.0 - 14.0	80.0
P-32A	11/22/89	1.0 - 3.0	0.4
		3.0 - 5.0	0.4
		5.0 - 7.0	0.8
		7.0 - 9.0	1.4
		9.0 - 11.0	2.0
		11.0 - 13.0	0.8
		13.0 - 15.0	9.0
		15.0 - 15.5	2.0
		15.5 - 17.0	5.0
		17.0 - 19.0	25.0
		19.0 - 21.0	2.0
B-36	11/21/89	2.5	2.0
		5.0	30.0
		5.5 - 7.5	10.0
		8.0 - 10.0	10.0
		10.0 - 12.0	9.0
		12.0 - 14.0	17.0
		14.0 - 16.0	150.0
		16.0 - 18.0	150.0
		18.0 - 20.0	170.0
		20.0 - 22.0	200.0
		22.0 - 24.0	150.0

TABLE 3.2

SUMMARY OF GRA HEADSPACE SCREENING DATA [1]
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA

Sample Location	*Sample Date*	*Monitored Depth Interval (ft bgs)* [2]	*PID Monitoring Results (ppm)* [3]
B-37 [4]	11/20/89	2.5	12.0
		5.0	50.0
		5.5 - 7.5	150.0
		8.0 - 8.6	120.0
		8.6 - 10.0	160.0
		10.0 - 12.0	160.0
		12.0 - 14.0	190.0
		14.0 - 16.0	180.0
		16.0 - 18.0	120.0
		18.0 - 18.3	150.0
		18.3 - 20.0	130.0
B-37	11/27/89	2.5	15.0
		5.0	78.0
		5.5 - 7.5	96.0
		8.0 - 8.6	118.0
		8.6 - 10.0	122.0
		10.0 - 12.0	98.0
		12.0 - 14.0	74.0
		14.0 - 16.0	142.0
		16.0 - 18.0	84.0
		18.0 - 18.3	74.0
		18.3 - 20.0	78.0
B-38	11/21/89	2.5	7.0
		5.0	12.0
		6.0 - 8.0	40.0
		8.0 - 8.5	280.0
		8.5 - 10.0	240.0
		10.0 - 12.0	170.0
		14.0 - 14.8	120.0
		15.0 - 16.0	70.0
		16.0 - 18.0	90.0

TABLE 3.2

SUMMARY OF GRA HEADSPACE SCREENING DATA [1]
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA

Sample Location	*Sample Date*	*Monitored Depth Interval (ft bgs)* [2]	*PID Monitoring Results (ppm)* [3]
B-39	11/22/89	2.5	2.0
		5.0	3.0
		5.0 - 7.0	18.0
		7.0 - 9.0	100.0
		9.0 - 10.1	100.0
		10.1 - 11.0	110.0
		13.0 - 15.0	130.0
B-39	11/27/89	2.5	0.6
		5.0	3.4
		5.0 - 7.0	3.8
		7.0 - 9.0	42.0
		9.0 - 10.1	58.0
		10.1 - 11.0	46.0
		13.0 - 15.0	98.0
B-40	11/27/89	2.5	22.0
		5.0	20.0
		5.0 - 7.0	28.0
		7.0 - 9.0	22.0
		9.0 - 11.0	20.0
		11.0 - 13.0	8.2
		13.0 - 15.0	8.0

1 Referenced from Appendix J of the Groundwater Assessment Plan prepared by Regional Services Corporation, April, 1990.

2 ft bgs = feet below ground surface

3 PPM = parts per million as reported by GRA. The result represents the highest reading recorded for each interval during screening.

4 Two sets of PID monitoring results are provided on different dates for boring locations B-37 and B-39. Available documentation does not clairfy if these results were generated from separate boring locations or boreholes advanced in close proximity to the initial soil boring.

TABLE 3.3

SUMMARY OF DETECTED SURFACE WATER DATA
U.S. EPA HAZARDOUS WASTE GROUNDWATER TASK FORCE EVALUATION [1]
FOUR COUNTY LANDFILL

Type	Analyte	Southwest Retention Pond (µg/L)	Northeast Drainage Control Basin (µg/L)	SW Off Property (µg/L)	Run-On To Property (µg/L)
VOCs	Toluene	430	ND [2]	ND	ND
	Acetone	84	ND	ND	ND
	Chloroform	37	ND	ND	ND
	Methylene Chloride	33	ND	ND	ND
	Benzene	160	ND	ND	ND
	1,1,1-Trichloroethane	18	ND	ND	ND
	Trichloroethene	25	ND	ND	ND
	1,1-Dichloroethane	15	ND	ND	ND
SVOCs	Nitrobenzene	42	ND	ND	ND
	Bis(2-Ethylhexyl)Phthalate	ND	ND	ND	3 J
Total Metals	Aluminum	47500	547	10300	290
	Arsenic	7.9	ND	ND	ND
	Barium	213	62	74	34
	Cadmium	0.7	ND	ND	ND
	Calcium	112000	57100	51800	29000
	Chromium	65			
	Copper	18	106	ND	ND
	Iron	36400	4240	12600	1870
	Lead	54.5	ND	8.9	ND
	Magnesium	38700	15100	17700	10100
	Manganese	1080	1380	2650	1180
	Mercury	0.3	ND	0.2	ND
	Nickel	20	ND	ND	ND
	Potassium	154000	ND	5490	ND
	Sodium	14000	49500	2280	1760
	Vanadium	56	ND	ND	ND
	Zinc	314	28	57	ND
Dissolved Metals	Arsenic	ND	ND	6.1	ND
	Barium	144	65	104	33
	Calcium	94600	66400	54300	33800
	Iron	ND	3130	286	553
	Magnesium	243300	17500	16100	12200
	Manganese	633	1580	2790	1140
	Mercury	ND	ND	0.4	ND
	Potassium	2730	ND	ND	2490
	Sodium	16400	60300	3140	1720
	Zinc	52	47	132	44
Indicator Analytes	POX	104	ND	ND	ND
	TOC	15000	46000	16000	21000
	TOX	258	18	ND	15
	Total Phenol	22	26	ND	24
	Ammonia Nitrogen	1100	230	ND	ND
	Nitrate Nitrogen	140	ND	ND	ND
	Sulfate	26500	9100	3300	2500
	Chloride	22000	28000	2600	2200
	Bromide	540	ND	ND	ND

1 Reference: "Hazardous Waste Groundwater Task Force Evaluation of the Four County Landfill, Fulton County, Indiana." EPA-700 8-87-013, May 1987.

2 ND - Not detected. Detection limits not specified in U.S. EPA Report.

TABLE 4.1

SUMMARY OF WASTE RECEIPT RECORDS
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA [1]

Waste Stream Components - Lined Landfill Cells [2]	*Waste Volume (pounds)*
1) D008-Soil Dredgings 2) D007/D008-Waste Paint Filters 3) F018, F005, D007	485,889
1) F006-WWT Sludge Residue 2) D002/D007/D008	531,014
1) K061-Furnace Dust 2) D008-Spent Coke and Charcoal	5,392,650
1) U151-Mercury Compound 2) D008-Ammunition Ash 3) D006-Incinerator Ash 4) Hydroxide Sludge	1,303,000
D002/K052-Tank Bottoms	79,380
D002-Waste Paint Coating Filters	203,060
D005-Spent Catalyst	121,290
D005-Waste Paint	35,912
D006 - Not Specified	52,480
D006/D007/D008-Copper Sulfate	825,520
D006/D008-Aluminum Baghouse Refractory Waste	70,801
D006/D008-Baghouse Dust	4,731,177
D006/D008-Baghouse Refractory Dust	265,050
D006/D008-Cupola Dust	436,460
D006/D008-Drum Blast Sludge	39,960
D006/D008-Treatment Sludge	9,854,250
D006/F006/D008 & Filter Sludge	22,718
D006-Activated WWT Sludge	172,280
D006-Baghouse Dust	62,922
D006-Contaminated Soil	442,500
D007- Contaminated Debris	7,404
D007/D005-Contaminated Debris	49,740
D007/D008-Drum Cleaning Sludge	138,891
D007/D008-Oil Sludge/Sweepings	2,178
D007/D008-Paint Sludge	184,423
D007/D008-Spent Charcoal	30,800
D007/D008-Treatment Sludge	43,077
D007/D010-Treatment Sludge	51,074

TABLE 4.1

SUMMARY OF WASTE RECEIPT RECORDS
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA [1]

Waste Stream Components - Lined Landfill Cells [2]	*Waste Volume (pounds)*
D007-Contaminated Soil	2,135,280
D007-Contaminated Soil/Sand	2,529
D007-Floor Sweepings	560
D007-Kolene Residue	88,440
D007-Shot Blast Dust	23,525
D007-Waste Paint	13,860
D008- Rubber Grindings	26,750
D008- Treatment Residue	38,041,707
D008-Baghouse Dust	29,559,283
D008-Baghouse Dust	43,752
D008-Contaminated Coal	7,007,861
D008-Contaminated Foundry Sand	15,320
D008-Contaminated Soil	10,035,857
D008-Foundry Sand	11,941,514
D008-Furnace Slag Debris	79,583,625
D008-Paint Contaminated Asphalt & Gravel	1,500
D008-Powdered Lead	337,693
D008-Refractory Waste	445,700
D008-Sand Blast Debris	9,972,204
D008-Spent Charcoal	30,144
D008-Waste Paint Filters	6,350
D008-WWT Filter Cake	470,720
F001- Contaminated Soil	781,300
F002-Cleaning Sludge	159,540
F002-Contaminated Soil	611,280
F003/D008-Contaminated Soil	7,920,005
F003-Contaminated Soil	174,500
F003-Contaminated Soil	1,145,780

TABLE 4.1

SUMMARY OF WASTE RECEIPT RECORDS
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA [1]

Waste Stream Components - Lined Landfill Cells [2]	*Waste Volume (pounds)*
F003-Waste Paint	998
F006, D007-Unspecified	3,746,701
F006/D008-Treatment Sludge	85,672
F006-Contaminated Cement Blocks	11,500
F006-Contaminated Soil	599,050
F006-Electroplating Sludge	264,135
F006-Filter Cake	520,629
F006-Filter Press sludge	648,384
F006-Hydroxide Sludge	3,154,034
F006-Metal Hydroxide Sludge	1,147,250
F006-Nickel Sludge	8,050
F006-Painting Sludge	166,951
F006-Plating Sludge	1,095,599
F006-Plating Waste Debris	24,768
F006-Treament Sludge	286,888,364
F006-WWT Filter Cake	8,791,596
F006-WWT Filter Cake/Treatment Sludge	116,663
F006-WWT Sludge	184,570
F008-Contaminated Concrete	123,040
F008-Sodium Carbon Waste	4,794,601
F010-Heat Treat Debris	50,580
F019-Filter Cake Sludge	116,100
K052-Tank Bottoms	32,200
K052 - Not Specified	1,071,800
K061, D008, D006 - Unspecified	33,489,996
K061/D006/D008-Baghouse Dust	10,829,672
K061-Baghouse Dust	104,810
K061-Contaminated Soil	595,532

TABLE 4.1

SUMMARY OF WASTE RECEIPT RECORDS
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA [1]

Waste Stream Components - Lined Landfill Cells [2]	*Waste Volume (pounds)*
K061-Furnace Dust	1,611,988
K062-Contaminated Debris	97,715
Unspecified Wastes	2,932,571

Waste Stream Components - Unlined Areas [3]	*Waste Volume (pounds)*
#2 B Oily Sludge	6,872
1) D007-Waste Paint Residue 2) Hazardous Waste Solid N.O.S.	417,994
1) D008-Hydroxide Sludge 2) Diatomaceous Earth-Filter Sludge	2,019,715
1) D008-Soil Dredgings 2) D007/D008-Waste Paint Filters 3) F018, F005, D007	1,059,894
1) U151-Mercury Compound 2) D008-Ammunition Ash 3) D006-Incinerator Ash 4) Hydroxide Sludge	125,630
Aluminum Hydroxide Sludge	1,304,170
Chromic Sludge/Chrome Reduction Sludge	1,495,188
Chromium waste (Sludge)	38,372
Contaminated Earth	3,665
Conveyor Sludge	450,993
D001-Paint Sludge	84,300
D002-Caustic Salts	6,876
D002-Caustic Solids	30,238
D005-Waste Paint	458
D006/D008-Aluminum Baghouse Refractory Waste	40,387
D006/D008-Contaminated Soil	2,878,433
D006/D008-Waste Paint Dust	48,571
D006/F006/D008 & Filter Sludge	3,054,185
D007-Paint Waste Sludge	1,677,435
D007-Waste Paint	41,650

TABLE 4.1

SUMMARY OF WASTE RECEIPT RECORDS
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA [1]

Waste Stream Components - Unlined Areas [3]	*Waste Volume (pounds)*
D008 - Unspecified	29,194
D008/D006-Baghouse dust	5,759,627
D008/U013-Asbestos Grindings	132,895
D008-Baghouse Dust	60,692,880
D008-Foundry Sand	10,813,858
D008-Furnace Slag debris	4,553,220
D008-Lead Slag	240,640
D008-Refractory Waste	1,846,912
D008-Spent Charcoal	161,551
D008-Waste Paint	129,641
D008-Waste Paint Filters	286,760
F001/F003/F004/F005-Still Bottom Sludge	6,571,213
F002/F003-Still Bottom Sludge	227,400
F002-Methylene Chloride Sludge	28,863
F005-Still Bottom Sludge	71,930
F006- Hydroxide Sludge	448,621
F006 - Unspecified	476,235
F006, F018 - Unspecified	3,487,066
F006-Contaminated Soil	374,800
F006-Filter Cake	1,947,466
F006-Hydroxide Sludge	7,708,068
F006-Metal Hydroxide Sludge	3,670,090
F006-Nickel Hydroxide Sludge	167,225
F006-Painting Sludge	4,786,716
F006-Plating Sludge	1,130,000
F006-WWT Sludge	172,970
F006-Zinc Plating Sludge	261,568

TABLE 4.1

SUMMARY OF WASTE RECEIPT RECORDS
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA [1]

Waste Stream Components - Unlined Areas [3]	*Waste Volume (pounds)*
F008-Hydroxide Sludge	29,282
F017-Paint Sludge	29,322
F017-Paint Waste Liquid	1,042,458
F017-Waste Paint Filters	193,796
Filter Sludge Cake	147,294
Hardened Resin Waste	31,612
Hydroxide Liquid	18,743
Hydroxide Sludge	8,973,845
K052-Centrifuge Sludge	1,145,986
K061, D008, D006 - Unspecified	154,838
K061-Contaminated Soil	1,308,062
K061-Furnace Dust	42,239,037
K062-Pickle Liquor Corrosive Solid	35,940
Lagoon Sludge	11,864,616
Lead Compound & Oily Rags	61,390
Lead Hydroxide Sludge	188,474
Paint Filters	282,411
Paint Sludge	52,229
Paint Waste Sludge	325,078
Paint Waste Sludge	641,330
Paper Waste Sludge	572,160
Set-up Kolene Salts	117,479
Sewage Treatment Sludge	56,732,680
Sodium Chlorite	1,374
Stabilized Oily Sludge, F011, F017	359,785
Swine Feed	71,519
Tank Wash Sludge	124,950

TABLE 4.1

SUMMARY OF WASTE RECEIPT RECORDS
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA [1]

Waste Stream Components - Unlined Areas [3]	*Waste Volume (pounds)*
Rail Spill Debris	24,176,839
Unspecified Wastes	7,847,150
Unspecified Contaminated Soil	524,833
Various Chemicals	2,501
Waste Oil & Sludge	2,499
White Sludge and Grease Sample	9,621

1 Waste disposal information summarized from a database compiled by the Four County Landfill Group.
2 Wastes delivered to the Site after August 19, 1986 consistent with the ruling handed down by the U. S. District Court, Northern Indiana (Cause No. S87-55).
3 Wastes delivered to the Site prior to August 20, 1986 consistent with the ruling handed down by the U. S. District Court, Northern Indiana (Cause No. S87-55)

TABLE 4.2

SUMMARY OF HAZARDOUS WASTE CODES AND WASTE DESCRIPTIONS FOUR COUNTY LANDFILL FULTON COUNTY, INDIANA [1]

Waste Code [2]	*Waste Description*
D001	Paint Sludge
D002	Caustic Salts Caustic Solids Tank Bottoms Waste Paint Coating Filters
D005	Contaminated Debris Spent Catalyst Waste Paint
D006	Activated WWT Sludge Aluminum Baghouse Refractory Waste Baghouse Dust Baghouse Refractory Dust Contaminated Soil Copper Sulfate Cupola Dust Incinerator Ash Drum Blast Sludge Treatment Sludge Waste Paint Dust
D007	Contaminated Debris Contaminated Soil Contaminated Soil/Sand Copper Sulfate Drum Cleaning Sludge Floor Sweepings Kolene Residue Oil Sludge/Sweepings Paint Sludge Paint Waste Sludge Shot Blast Dust

TABLE 4.2

SUMMARY OF HAZARDOUS WASTE CODES AND WASTE DESCRIPTIONS FOUR COUNTY LANDFILL FULTON COUNTY, INDIANA [1]

Waste Code [2]	*Waste Description*
D007	Spent Charcoal
	Treatment Sludge
	Waste Paint
	Waste Paint Filters
	Waste Paint Residue
D008	Aluminum Baghouse Refractory Waste
	Ammunition Ash
	Asbestos Grindings
	Baghouse Dust
	Baghouse Refractory Dust
	Contaminated Coal
	Contaminated Foundry Sand
	Contaminated Soil
	Copper Sulfate
	Cupola Dust
	Drum Blast Sludge
	Drum Cleaning Sludge
	Foundry Sand
	Furnace Slag Debris
	Hydroxide Sludge
	Lead Slag
	Oil Sludge/Sweepings
	Paint Contaminated Asphalt & Gravel
	Paint Sludge
	Powdered Lead
	Refractory Waste
	Rubber Grindings
	Sand Blast Debris
	Soil Dredgings
	Spent Charcoal
	Spent Coke and Charcoal
	Treatment Residue
	Treatment Sludge

TABLE 4.2

SUMMARY OF HAZARDOUS WASTE CODES AND WASTE DESCRIPTIONS FOUR COUNTY LANDFILL FULTON COUNTY, INDIANA [1]

Waste Code [2]	*Waste Description*
D008	Waste Paint Waste Paint Dust Waste Paint Filters WWT Filter Cake
D010	Treatment Sludge
F001	Contaminated Soil Still Bottom Sludge
F002	Cleaning Sludge Contaminated Soil Methylene Chloride Sludge Still Bottom Sludge
F003	Contaminated Soil Still Bottom Sludge Waste Paint
F004	Still Bottom Sludge
F005	Still Bottom Sludge
F006	Contaminated Cement Blocks Contaminated Soil Electroplating Sludge Filter Cake Filter Press sludge Hydroxide Sludge Hydroxide Sludge Metal Hydroxide Sludge Nickel Hydroxide Sludge Nickel Sludge Painting Sludge

TABLE 4.2

SUMMARY OF HAZARDOUS WASTE CODES AND WASTE DESCRIPTIONS FOUR COUNTY LANDFILL FULTON COUNTY, INDIANA [1]

Waste Code [2]	*Waste Description*
F006	Plating Sludge Plating Waste Debris Treatment Sludge Treatment Sludge WWT Filter Cake WWT Filter Cake/Treatment Sludge WWT Sludge WWT Sludge Residue Zinc Plating Sludge
F008	Contaminated Concrete Hydroxide Sludge Sodium Carbon Waste
F010	Heat Treat Debris
F011	Stabilized Oily Sludge
F017	Paint Sludge Paint Waste Liquid Stabilized Oily Sludge Waste Paint Filters
F019	Filter Cake Sludge
K052	Centrifuge Sludge Tank Bottoms
K061	Baghouse Dust Contaminated Soil Furnace Dust
K062	Contaminated Debris Pickle Liquor Corrosive Solid

TABLE 4.2

SUMMARY OF HAZARDOUS WASTE CODES AND WASTE DESCRIPTIONS FOUR COUNTY LANDFILL FULTON COUNTY, INDIANA [1]

Waste Code [2]	*Waste Description*
U013	Asbestos Grindings
U151	Mercury Compound

[1] Summarized from database compiled by the Four County Landfill Group.

[2] Hazardous wastes disposed of in lined landfill cells (Cells A, B and C after August 19, 1986 consistent with the ruling handed down by the U.S. District Court, Northern Indiana (Cause No. S87-55).

TABLE 4.3

SUMMARY OF MONITORING WELL AND PIEZOMETER CONSTRUCTION DATA[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Piezometer/ Well ID	*Stratigraphic Unit(s) Screened*	*Former/ Other ID* [2]	*Casing Elevation (feet amsl)*	*Site Quadrant* [3]	*Date of Installation*	*Well Depth (feet bgs)/ Bottom Elevation (feet amsl)*	*Screen Length (feet)*	*Sand Pack Length (feet)*	*Well Construction Details* [4]	*Comments*
P-1	B	MW-1B	783.14	SW	12/08/86	65.0/718.1	10.0	13.0	hand slotted PVC, 1" dia., 3.75" dia. borehole,	
P-1A	A	--	787.68	SW	12/05/88	37.1/749.2	2.0	2.7	4.25" dia. borehole, 2' bentonite seal, [5]	
P-2	B	--	777.55	SW	12/15/86	80.0/697.9	5.0	12.0	hand slotted PVC, 1" dia., 7.25" dia. borehole, 8' bentonite seal	Abandonment
P-2A	A	--	777.04	SW	12/05/88	17.0/758.0	2.1	2.6	4.25" dia. borehole, 3' bentonite seal, [5]	
P-2B	B	MW-2B	777.00	SW	12/05/88	72.2/702.7	4.3	6.4	4.25" dia. borehole, 7.8' bentonite seal, [5]	
P-2C2	C	--	776.82	SW	12/09/89	134.9/639.8	2.0	5.5	4.9" dia. borehole, no bentonite seal, [5]	
P-3	B?	--	772.71	SW	12/10/86	50.9/715.4	10.0	18.9	hand slotted PVC, 1" dia., 3.75" dia. borehole, 2' bentonite seal	Assume casing removed 12/19/86.
P-3A	A?	--	766.22	SE	unknown	unknown	unknown	unknown	unknown	Assume casing removed during Cell B construction.
P-4A	A	--	792.47	SE	11/07/88	19.0/769.1	2.0	2.8	4.25" dia. borehole, 2' bentonite seal, [5]	
P-4B	B	--	792.24	SE	11/04/88	69.6/718.6	4.4	6.4	4.25" dia. borehole, 2.7' bentonite seal, [5]	
P-4C1	C	--	791.80	SE	01/04/89	85.6/703.9	1.8	4.0	4.9" dia. borehole, no bentonite seal, [5]	
P-4C2	C	--	791.79	SE	01/03/89	132.9/656.7	1.9	4.0	4.9" dia. borehole, no bentonite seal, [5]	
P-4C3	C	--	791.71	SE	02/02/89	155.6/633.9	1.9	4.5	4.9" dia. borehole, no bentonite seal, [5]	
P-4C4	C	--	791.02	SE	01/27/89	152.5/637.0	2.0	4.0	Schedule 80 PVC, 4.9"dia. borehole, no bentonite seal, [5]	
P-5A	A/B?	--	776.95	SW	11/08/88	28.1/746.3	2.0	4?	4.25" dia. borehole, 2' bentonite seal, [5]	
P-5B	B	MW-5B	776.85	SW	11/03/88	49.1/725.0	5.0	6.1	4.25" dia. borehole, 2' bentonite seal, [5]	
P-5C1	C	--	796.65	SW	01/12/89	77.1/696.6	1.9	3.0	4.5" dia. borehole, no bentonite seal, [5]	
P-5C2	C	--	777.18	SW	01/18/89	107.4/666.9	1.9	4.0	4.9" dia. borehole, no bentonite seal, [5]	
P-5C3	C	--	777.07	SW	01/18/89	119.8/654.5	1.9	2.8	4.25" dia. borehole, no bentonite seal, [5]	
P-5C4	C	--	777.52	SW	01/29/89	166.2/608.3	1.9	5.0	Schedule 80 PVC, 4.9"dia. borehole, no bentonite seal, [5]	
P-6A	A		776.57	SW	11/01/88	21.0/752.9	1.6	3.0	4.25" dia. borehole, 2.1' bentonite seal, [6]	
P-7A	B	--	771.24	NE	11/18/88	21.4/748.0	2.0	2.7	4.25" dia. borehole, 2' bentonite seal, [5]	
P-7B	B	MW-7B	770.92	NE	11/17/88	50.9/718.4	5.0	6.0	4.25" dia. borehole, 2' bentonite seal, [5]	
P8A	A	--	757.72	NE	11/23/88	19.9/735.4	2.0	3.9	4.25" dia. borehole, 2' bentonite seal, [5]	
P-8B	B	MW-8B	756.92	NE	11/02/88	47.9/707.2	4.4	5.5	4.25" dia. borehole, 6' bentonite seal, [5]	
P-8C1	C	--	757.70	NE	01/25/89	79.8/675.3	1.9	3.8	5.25" dia. borehole, no bentonite seal, [5]	
P-8C2	C	--	757.70	NE	01/27/89	113.0/642.8	1.9	4.0	4" dia. borehole, no bentonite seal, [5]	
P-8C3	C	--	757.65	NE	01/26/89	133.5/622.1	1.9	4.5	4.75" dia. borehole, no bentonite seal, [5]	
P-8C4	C	MW-8C4	757.79	NE	01/03/89	180.5/575.3	1.8	5.4	Schedule 80 PVC, 5.75" dia. borehole, no bentonite seal, [5]	
P-10	A	P-10A	797.12	NW	11/18/88	14.5/779.4	2.0	2.8	4.25" dia. borehole, 2' bentonite seal, [5]	Drilled through refuse
P-11A	A	--	796.22	NW	11/21/88	13.5/780.6	2.1	3.2	4.25" dia. borehole, 2' bentonite seal, [5]	

TABLE 4.3

SUMMARY OF MONITORING WELL AND PIEZOMETER CONSTRUCTION DATA[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Piezometer/ Well ID	*Stratigraphic Unit(s) Screened*	*Former/ Other ID*	*Casing Elevation (feet amsl)*	*Site Quadrant*	*Date of Installation*	*Well Depth (feet bgs)/ Bottom Elevation (feet amsl)*	*Screen Length (feet)*	*Sand Pack Length (feet)*	*Well Construction Details* [4]	*Comments*
P-12A	A	–	796.91	NW	11/16/89	19.6/774.2	2.0	3.0	3.25" dia. borehole, 0.5' bentonite seal, [5]	Drilled through refuse
P-13A	A	–	799.93	NW	11/17/89	21.6/775.2	4.5	6.0	3.25" dia. borehole, 1' bentonite seal, [5] screened in refuse,[5]	Drilled through refuse
P-14A	A	–	797.73	NW	11/20/89	21.5/773.2	4.0	5.5	3.25" dia. borehole, 1' bentonite seal, [5]	Drilled through refuse
P-21A	A	MW-21A	776.47	SE	11/09/88	22.3/752.2	2.0	2.8	4.25" dia. borehole, 2' bentonite seal, [5]	
P-23A	A	MW-23A	760.13	NE	11/23/88	19.3/738.5	2.0	3.3	4.25" dia. borehole, 2' bentonite seal, [5]	
P-23C1	C	–	761.05	NE	01/13/89	77.7/680.4	1.9	5.9	4.75" dia. borehole, no bentonite seal, [5]	
P-23C2	C	–	761.14	NE	01/12/89	116.1/642.0	1.9	3.7	4.75" dia. borehole, no bentonite seal, [5]	
P-23C3	C	–	760.83	NE	01/12/89	136.5/621.1	1.9	3.9	4.75" dia. borehole, no bentonite seal, [5]	
P-23C4	C	–	760.02	NE	01/18/89	177.7/580.5	1.9	4.5	Schedule 80 PVC, 5.75" dia. borehole, no bentonite seal, [5]	Two points identified on 4/15/91 site map
P-24A	A	MW-24A	788.27	SW	12/04/88	28.8/757.5	1.8	2.7	4.25" dia. borehole, 2' bentonite seal, [5]	
P-24C1	C	–	788.34	SW	01/19/89	89.9/696.2	2.0	4.4	4.75" dia. borehole, no bentonite seal, [5]	
P-24C2	C	–	787.93	SW	01/18/89	104.9/681.2	2.0	3.2	4.75" dia. borehole, no bentonite seal, [5]	
P-24C3	C	–	788.51	SW	01/17/89	119.1/666.9	1.9	4.5	4.75" dia. borehole, no bentonite seal, [5]	
P-24C4	C	–	788.78	SW	01/16/89	131.2/654.9	1.9	4.4	Schedule 80 PVC, 4.75" dia. borehole, no bentonite seal, [5]	
P-25A	A	MW-25A	793.86	SE	12/06/88	32.2/759.9	2.0	3.0	4.25" dia. borehole, 2.3' bentonite seal, [5]	
P-25C2	C	–	794.86	SE	01/20/89	122.0/670.4	1.9	4.0	4.75" dia. borehole, no bentonite seal, [5]	
P-26A	A	–	792.32	NW	11/21/89	13.9/775.3	4.6	3.7	3.25" dia. borehole, 0.5' bentonite seal, [5]	
P-27A	A	MW-27A	780.32	SE	12/01/88	17.0/761.6	1.7	3.5	4.25" dia. borehole, 2' bentonite seal, [5]	
P-27C1	C	–	780.42	SE	01/13/89	79.3/699.8	1.9	4.0	4.75" dia. borehole, no bentonite seal, [5]	
P-27C2	C	–	780.11	SE	01/10/89	109.3/669.4	1.9	5.0	4" dia. borehole, no bentonite seal, [5]	
P-27C3	C	–	780.10	SE	01/12/89	130.3/648.4	1.9	6.0	4.25" dia. borehole, no bentonite seal, [5]	
P-27C4	C	–	781.96	SE	01/17/89	18.7/599.5	1.9	4.5	Schedule 80 PVC, 4.75" dia. borehole, no bentonite seal, [5]	
P-28A	A	MW-28A	775.37	NE	11/28/88	26.1/748.2	2.0	3.0	4.25" dia. borehole, 2' bentonite seal, [5]	
P-28C1	BC	–	777.02	NE	01/16/89	85.0/689.4	1.9	3.2	4.25" dia. borehole, no bentonite seal, [5]	
P-28C2	C	–	776.34	NE	01/26/89	121.9/652.2	1.9	4.5	Schedule 80 PVC, 4.75" dia. borehole, no bentonite seal, [5]	
P-28C3	C	–	776.77	NE	01/26/89	135.1/639.1	1.9	6.0	4.75" dia. borehole, no bentonite seal, [5]	
P-28C4	C	–	776.50	NE	01/25/89	201.8/572.3	2.0	7.0	Schedule 80 PVC, 4.75" dia. borehole, no bentonite seal, [5]	
P-29A	A	MW-29A	773.79	NE	11/30/88	13.5/758.1	2.0	2.4	4.25" dia. borehole, 4' bentonite seal, [5]	
P-29C2	C	–	772.94	NE	01/18/89	116.2/655.4	1.9	4.9	4" dia. borehole, no bentonite seal, [5]	
P-30A	A	MW-30A	761.97	NW	11/22/88	20.4/739.6	2.0	2.9	4.25" dia. borehole, 2.5' bentonite seal, [5]	
P-30C1	C	–	762.58	NW	01/23/89	59.8/700.0	1.9	4.3	4" dia. borehole, no bentonite seal, [5]	
P-30C2	C	–	764.05	NW	01/31/89	102.4/659.2	1.9	4.5	4.75" dia. borehole, no bentonite seal, [5]	

TABLE 4.3

SUMMARY OF MONITORING WELL AND PIEZOMETER CONSTRUCTION DATA[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Piezometer/ Well ID	*Stratigraphic Unit(s) Screened*	*Former/ Other ID* [2]	*Casing Elevation (feet amsl)*	*Site Quadrant* [3]	*Date of Installation*	*Well Depth (feet bgs)/ Bottom Elevation (feet amsl)*	*Screen Length (feet)*	*Sand Pack Length (feet)*	*Well Construction Details* [4]	*Comments*
P-30C3	C	--	764.38	NW	01/30/89	122.4/639.1	1.9	4.2	4.75" dia. borehole, no bentonite seal, [5]	
P-30C4	C	--	762.88	NW	01/19/89	219.8/541.0	1.9	10.3	Schedule 80 PVC, 4.75" dia. borehole, no bentonite seal, (5)	
P-31A	A	MW-31A	783.02	NW	11/29/88	14.9/765.7	2.0	2.9	4.25" dia. borehole, 2' bentonite seal,	
P-31C1	C	--	782.79	NW	01/10/89	86.7/694.0	1.9	2.6	4.75" dia. borehole, no bentonite seal, [5]	
P-31C2	C	--	782.61	NW	01/09/89	111.6/669.1	1.9	2.5	4.75" dia. borehole, no bentonite seal, [5]	
P-31C3	C	--	782.73	NW	01/06/89	134.2/646.5	2.0	3.5	4" dia. borehole, no bentonite seal, [5]	
P-31C4	C	--	782.74	NW	01/17/89	194.1/586.5	1.9	3.4	Schedule 80 PVC, 4.75" dia. borehole, no bentonite seal, [5]	
P-32A	A	--	798.54	NW	11/22/89	18.1/777.7	4.5	5.0	3.25" dia. borehole, 0.3' bentonite seal, [5]	
P-32C2	C	--	797.57	NW	01/13/89	130.8/665.0	1.9	2.8	4.75" dia. borehole, no bentonite seal, [5]	
P-33A	A	MW-33A	798.08	NW	11/11/88	20.0/775.2	2.0	3.1	4.25" dia. borehole, 2' bentonite seal, [5]	
P-34A	A	MW-34A	794.73	NW	10/11/88	18.8/772.8	1.9	2.7	4.25" dia. borehole, 2' bentonite seal, [5]	Drilled through refuse. Removed 11/07/89. Now a sump.
P-34*A	A	MW-34*A	796.01	NW	12/07/88	26.0/767.9	1.3	3.0	4.25" dia. borehole,2' bentonite seal, [5]	
P-34*C1	C	--	796.17	NW	01/10/89	97.7/696.4	1.9	2.7	4.25" dia. borehole, no bentonite seal, [5]	
P-34*C2	C	--	795.90	NW	01/12/89	126.6/667.3	1.9	4.0	4.75" dia. borehole, no bentonite seal, [5]	
P-34*C3	C	--	796.30	NW	01/11/89	149.8/644.1	1.9	3.8	4.75" dia. borehole, no bentonite seal, [5]	
P-34*C4	C	--	796.31	NW	01/11/89	193.7/600.3	1.8	3.7	Schedule 80 PVC, 4.75" dia. borehole, no bentonite seal, [5]	
MW-1	A/B?	W-1	790.61	NW	12/26/78	42/749	2.0	unknown	4" dia. casing, glued joints, 25-slot screen, no bentonite seal or grout	Buried?
MW-2	A	W-2	769.88	NE	12/26/78	20/750	2.0	unknown	4" dia. casing, glued joints, 25-slot screen, no bentonite seal or grout	Not accessible ? Abandoned
MW-3	A?	W-3	771.57	NE	12/27/78	38/732	2.0	unknown	4" dia. casing, glued joints, 25-slot screen, no bentonite seal or grout	Abandoned
MW-4	A	W-4	786.24	SE	02/20/79	19/?	7?	unknown	4" dia. casing, glued joints, 25-slot screen, no bentonite seal or grout	Disturbed, casing broken. Abandoned
MW-5	B	W-5	789.23	SE	02/20/79	35/740	2.0	unknown	4" dia. casing, glued joints, 25-slot screen, no bentonite seal or grout	Abandoned
MW-6	A/B?	W-6	780.63	SW	01/03/79	51/724	2.0	unknown	4" dia. casing, glued joints, 25-slot screen, no bentonite seal or grout	Formerly buried. Abandoned Casing raised ~3.5

TABLE 4.3

SUMMARY OF MONITORING WELL AND PIEZOMETER CONSTRUCTION DATA[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Piezometer/ Well ID	*Stratigraphic Unit(s) Screened*	*Former/ Other ID* [2]	*Casing Elevation (feet amsl)*	*Site Quadrant* [3]	*Date of Installation*	*Well Depth (feet bgs)/ Bottom Elevation (feet amsl)*	*Screen Length (feet)*	*Sand Pack Length (feet)*	*Well Construction Details* [4]	*Comments*
MW-7	B?	W-7	776.87	SW	12/29/78	36/737	2.0	unknown	4" dia. casing, glued joints, 25-slot screen, no bentonite seal or grout	Not accessible. Buried?
MW-8	B/C?	W-8	unknown	NW	unknown	unknown	unknown	unknown	unknown	Former residential well. Buried?
MW-20	A/B?	W-20	767.21	NE	05/19/83	45.5/721.7	15.0	17.5	4" dia. PVC, 10.5" dia. borehole, 2' bentonite seal	Possible grout. Abandoned contamination.
MW-21S	B	W-21, MW021	778.01	SE	05/27/83	60.0/718.0	15.0	20.0	4" dia. PVC, 10.5" dia. borehole, 2' bentonite seal	
MW-21M	C	--	777.37	SE	01/27/87	94.8/682.5	10.0	18.3	4.25" dia. borehole, 11.5' bentonite seal	
MW-21L	C	--	777.01	SE	01/20/87	212.0/565.0	10.0	14.0	4.25" dia. borehole, 5' bentonite seal	
MW-22	B	--	757.17	NW	06/01/83	38.5/718.7	15.0	14.5	4" dia. PVC, 10.5" dia. borehole, 2' bentonite seal	
MW-23B	B	MW-23BW	759.78	NE	11/22/88	39.4/718.2	5.1	7.0	4.5" dia. borehole, 2' bentonite seal	
MW-23S	A/B	--	765.41	NE	04/08/85	48.0/717.4	20.0	24.0	6.5" dia. borehole	Abandoned
MW-23M	A/B/C	--	765.46	NE	04/08/85	85.5/680.0	20.0	69.5	6.5" dia. borehole, 1' bentonite seal	Abandoned
MW-23L	B/C	MW-23D	765.50	NE	04/08/85	122.0/643.5	20.0	92.0	6.5" dia. borehole, 1' bentonite seal	Abandoned
MW-24B	B	P-24B	787.72	SW	12/04/88	74.2/711.9	5.0	7.0	4.5" dia. borehole, 2' bentonite seal [5]	
MW-24S	C	P-24S	789.66	SW	12/05/86	75.0/714.7	10.0	19.0	7.25" dia. borehole, 5' bentonite seal	
MW-24M	B/C	P-24M	788.96	SW	01/26/87	108.5/680.5	10.0	28.5	4.5" dia. borehole, 5' bentonite seal	
MW-24L	C/D	MW-24L1, P-24L	788.86	SW	01/22/87	142.8/646.0	10.0	22.8	4.5" dia. borehole, 5' bentonite seal	Abandoned, not plugged. High pH-grout? Replaced.
MW-24L2	C	MW-24L1, P-24L2	788.65	SW	4/87, 5/87	136.0/652.6	10.0	36.0	Schedule 80 PVC, 4.5" dia. borehole, 56' bentonite seal	
MW-25	A/B	OW-25	789.96	SE	12/17/86	74.0/716.0	10.0	38.0	7.25" dia. borehole, 5' bentonite seal	Possible grout contamination.
MW-25B	B/C?	MW-25BW,	793.81	SE	12/07/88	78.5/713.7	5.0	6.5	4.5" dia. borehole, 2' bentonite seal,	
MW-26	B	OW-26	791.40	NW	01/06/87	77.2/14.2	10.0	16.7	4.5" dia. borehole, 5.5' bentonite seal	
MW-27B	B	MW-27BW	779.74	SE	12/01/88	55.0/723.2	4.2	7.0	4.25" dia. borehole, 2.5' bentonite seal,	
MW-27S	B/C	--	778.95	SE	04/29/87	72.0/707.0	10.0	34.0	4.5" dia. borehole, 9.3' bentonite seal,	Abandoned
MW-27M	B/C	--	779.44	SE	04/29/87	101.4/678.0	10.0	48.4	4.5" dia. borehole, 10' bentonite seal,	Abandoned
MW-28B	B	MW-28BW	775.59	NE	11/28/88	60.0/713.7	5.0	6.8	4.25" dia. borehole, 2' bentonite seal,	
MW-28S	A/B	--	775.71	NE	05/04/87	60.5/715.2	10.0	17.5	4.5" dia. borehole, 10' bentonite seal,	Abandoned
MW-28M	B/C	--	776.20	NE	05/01/87	101.1/675.2	10.0	28.0	4.5" dia. borehole, 5' bentonite seal,	Abandoned
MW-29B	B	MW-29BW	773.41	NE	11/30/88	51.9/719.3	5.0	7.4	4.25" dia. borehole, 9.8' bentonite seal,	
MW-30B	B	MW-30BW	762.02	NW	11/21/88	42.2/718.8	5.0	8.2	4.25" dia. borehole, 4' bentonite seal,	
MW-31B	B	MW-31BW	782.95	NW	11/29/88	61.9/719.0	5.0	6.9	4.5" dia. borehole, 3' bentonite seal,	
MW-32B	B	P-32B,	798.87	NW	11/14/88	78.0/718.4	5.0	8.0	4.5" dia. borehole, 2' bentonite seal,	

TABLE 4.3

SUMMARY OF MONITORING WELL AND PIEZOMETER CONSTRUCTION DATA[1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Piezometer/ Well ID	*Stratigraphic Unit(s) Screened*	*Former/ Other ID* [2]	*Casing Elevation (feet amsl)*	*Site Quadrant* [3]	*Date of Installation*	*Well Depth (feet bgs)/ Bottom Elevation (feet amsl)*	*Screen Length (feet)*	*Sand Pack Length (feet)*	*Well Construction Details* [4]	*Comments*
MW-33B	B	MW-33BW	796.57	NW	11/10/88	725./722.2	5.0	8.5	4.25" dia. borehole, 12' bentonite seal, [5]	
MW-34*B	B	MW-34B	796.16	NW	12/06/88	74.9/719.2	4.2	6.2	4.25" dia. borehole, 2' bentonite seal, [5]	
6" Diameter Supply Well	B/C?	unknown	796.78	NW	unknown	unknown	unknown	unknown	unknown	
Former Support Facilities (Trailer Well)	unknown	unknown	unknown	SE	unknown	unknown	unknown	unknown	unknown	

[1] This monitoring well and piezometer summary was derived from data tables and well construction logs included in the following sources:

- Site Map (4/15/91) obtained from Geosciences Research Associates, Inc.;
- "CAP Task I - Description of Current Conditions", Geosciences Research Associates, Inc. (12/7/89);
- Memorandum Report, Geosciences Research Associates, Inc. (4/28/89); and
- "Hazardous Waste Groundwater Task Force Evaluation of the Four County Landfill, Fulton County, IN", USEPA, May 1987.

[2] Stratigraphic units are defined as follows:

A = Glacial till sequence, silty clay loam with silt and sand seams;
B = Glacio-lacustrine sequence, silt to fine- to medium-grained sand;
C = Glacio fluvial sequence, poorly sorted silt, sand, and gravel; and
D = Basal till, silty clay with reddish hue at base.

[3] Site quadrants are arbitrarily defined by the 7+00 North and 8+00 East survey grid lines.

[4] Well materials are assumed to be 2-inch diameter, threaded, Schedule 40 PVC with a 10-slot screen, unless otherwise noted.

[5] Well annulus filled with Volclay grout from filter pack or annular seal to surface.

[6] Well annulus filled with pea gravel and bentonite grout from filter pack or annular seal to surface.

Key:

amsl = Above mean sea level
bgs = Below ground surface
dia. = Diameter
unknown = Information incomplete or unavailable
— = Not applicable

- All elevations and depth measurements noted in this table were referenced from the well installation logs.

TABLE 4.4

GROUNDWATER SAMPLING SUMMARY - JUNE 1994
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Location	*Quadrant*	*Parameters* [1]
MW-8 (Supply Well)	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
Unit A Wells		
P-10	NW	VOCs, SVOCs, TAL Inorganics
P-11A	NW	VOCs, SVOCs
P-12A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-13A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-14A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-26A	NW	VOCs, SVOCs, TAL Inorganics, Cyanide
P-33A	NW	VOCs, SVOCs
P-8A	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-28A	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-29A	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-1A	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-2A and Duplicate	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-24A	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-25A	SE	VOCs, SVOCs, TAL Inorganics
Unit B Wells		
P-1	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-26 and Duplicate	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-30B	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-31B	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-32B	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-33B and Duplicate	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-34*B	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-7B	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-8B and Duplicate	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-20	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-23B	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-28B	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-29B	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-2B	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-5B	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-24B	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-4B	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-21S and Duplicate	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-25B	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-27B	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry

TABLE 4.4

GROUNDWATER SAMPLING SUMMARY - JUNE 1994
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Location	*Quadrant*	*Parameters* [1]
Unit C Wells		
P-30C1	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-30C2	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-31C1	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-31C2	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-32C2	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-34*C1 and Duplicate	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-34*C2	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-8C1	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-8C2	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-23C1	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-23C2	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-28C1	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-28C2	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-29C2	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-2C2	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-5C1	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-5C2	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-24C1	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-24C2	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-4C1	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-4C2	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-21L	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
MW-21M and Duplicate	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-25C2	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-27C1	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-27C2	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry

[1] Analytical parameters include TCL VOCs and SVOC, TAL Metals (total and dissolved), TAL total cyanide, and the general chemistry parameters defined in the RI/FS Work Plan.

TABLE 4.5

GROUNDWATER SAMPLING SUMMARY- APRIL 1995
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA

Location	*Quadrant*	*Parameters*
Unit A Wells		
P-10 and Duplicate	NW	General Chemistry
P-11A	NW	TAL Metals, General Chemistry
P-11A Duplicate	NW	TAL Metals
P-26A	NW	General Chemistry (excluding Cyanide)
P-31A	NW	VOCs, SVOCs, TAL Metals, General Chemistry
P-32A	NW	VOCs, SVOCs, TAL Metals, General Chemistry
P-34*A	NW	VOCs
P-25A	SE	VOCs, TAL Metals, General Chemistry
P-25A Duplicate	SE	VOCs
P-27A	SE	VOCs, SVOCs, TAL Metals, General Chemistry
Unit C Wells		
P-31C1	NW	VOCs (MS/MSD)
P-31C2	NW	VOCs
P-31C3	NW	VOCs, SVOCs, TAL Metals, General Chemistry (MS/MSD)
P-31C4	NW	VOCs, SVOCs, TAL Metals (MS/MSD), General Chemistry
P-5C2 and Duplicate	SW	SVOCs
P-24C2	SW	VOCs

Analytical parameters include TCL VOCs and SVOCs, TAL Metals (total and dissolved), and the general chemistry parameters including TAL total cyanide defined in the RI/FS Work Plan.

TABLE 4.6

GROUNDWATER SAMPLING SUMMARY
OCTOBER 1995
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA

Location	*Quadrant*	*Parameters*
Unit A Wells		
P-12A	NW	Gross Alpha & Beta
P-33A	NW	Gross Alpha & Beta
P-8A	NE	Gross Alpha & Beta
P-28A	NE	Gross Alpha & Beta
P-29A	NE	Gross Alpha & Beta
P-1A	SW	Gross Alpha & Beta
P-2A	SW	Gross Alpha & Beta
P-24A	SW	Gross Alpha & Beta
Unit B Wells		
MW-31B	NW	Gross Alpha & Beta
MW-33B	NW	Gross Alpha & Beta
P-7B	NE	Gross Alpha & Beta
P-8B	NE	Gross Alpha & Beta
P-8B (Duplicate)	NE	Gross Alpha & Beta
MW-23B	NE	Gross Alpha & Beta
MW-23B (Duplicate)	NE	Gross Alpha & Beta
MW-28B	NE	Gross Alpha & Beta
MW-29B	NE	Gross Alpha & Beta
P-2B	SW	Gross Alpha & Beta
P-5B	SW	Gross Alpha & Beta
MW-4B	SE	Gross Alpha & Beta
MW-27B	SE	Gross Alpha & Beta
Unit C Wells		
P-30C3	NW	TCL-VOCs, Total & Dissolved Selected Metals
P-30C3 (Duplicate)	NW	TCL-VOCs, Total & Dissolved Selected Metals
P-30C4	NW	TCL-VOCs, Total & Dissolved Selected Metals
P-31C1	NW	Gross Alpha & Beta
P-31C2	NW	Gross Alpha & Beta
P-34*C3	NW	TCL-VOCs, Total & Dissolved Selected Metals
P-34*C4	NW	TCL-VOCs, Total & Dissolved Selected Metals
MW-8	NW	Gross Alpha & Beta
MW-22	NW	Gross Alpha & Beta
MW-26	NW	Gross Alpha & Beta
P-8C1	NE	Gross Alpha & Beta
P-8C2	NE	Gross Alpha & Beta
P-8C3	NE	TCL-VOCs, Total & Dissolved Selected Metals
P-8C4	NE	TCL-VOCs, Total & Dissolved Selected Metals
P-8C4 (Duplicate)	NE	TCL-VOCs, Total & Dissolved Selected Metals
P-23C1	NE	Gross Alpha & Beta

TABLE 4.6

GROUNDWATER SAMPLING SUMMARY
OCTOBER 1995
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA

Location	*Quadrant*	*Parameters*
Unit C Wells		
P-23C2	NE	Gross Alpha & Beta
P-23C3	NE	TCL-VOCs, Total & Dissolved Selected Metals
P-23C4	NE	TCL-VOCs, Total & Dissolved Selected Metals
P-28C1	NE	Gross Alpha & Beta
P-28C2	NE	Gross Alpha & Beta
P-28C3	NE	TCL-VOCs, Total & Dissolved Selected Metals
P-2C2	SW	Gross Alpha & Beta
P-5C2	SW	Gross Alpha & Beta
P-5C3	SW	TCL-VOCs, Total & Dissolved Selected Metals
P-5C4	SW	TCL-VOCs, Total & Dissolved Selected Metals, MS/MSD
P-24C2	SW	Gross Alpha & Beta
P-24C3	SW	TCL-VOCs, Total & Dissolved Selected Metals
P-24C4	SW	TCL-VOCs, Total & Dissolved Selected Metals
MW-24S	SW	Gross Alpha & Beta
MW-24L2	SW	Gross Alpha & Beta
MW-24L2 (Duplicate)	SW	Gross Alpha & Beta
P-4C1	SE	Gross Alpha & Beta
P-4C2	SE	Gross Alpha & Beta
P-4C2 (Duplicate)	SE	Gross Alpha & Beta
P-4C3	SE	TCL-VOCs, Total & Dissolved Selected Metals
P-27C1	SE	Gross Alpha & Beta
P-27C2	SE	Gross Alpha & Beta
P-27C3	SE	TCL-VOCs, Total & Dissolved Selected Metals
P-27C4	SE	TCL-VOCs, Total & Dissolved Selected Metals
MW-21L	SE	Gross Alpha & Beta
MW-21M	SE	Gross Alpha & Beta
MW-21S	SE	Gross Alpha & Beta
MW-21S (Duplicate)	SE	Gross Alpha & Beta

TABLE 4.7

SUMMARY OF GROUNDWATER ELEVATION DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Location	*Reference Elevation (ft NGVD)* [1]	*Total Depth (ft BTOC)* [2]	*Screen Length (ft)* [3]	*Elevation of Screen Bottom (ft NGVD)*	*Depth to Groundwater (feet) 5/24-25/94*	*Groundwater Elevation (ft NGVD) 5/24-25/94*	*Depth to Groundwater (feet) 7/27-28/94*	*Groundwater Elevation (ft NGVD) 7/27-28/94*
NORTHWEST QUADRANT - STRATIGRAPHIC UNIT A								
P-10	797.12	17.70	2.0	779.4	14.70	782.42	15.54	781.58
P-11A	796.22	15.74	2.1	780.5	13.93	782.29	14.72	781.50
P-12A	796.91	22.70	2.0	774.2	15.78	781.13	16.09	780.82
P-13A	799.93	24.42	4.5	775.5	20.50	779.43	22.38	777.55
P-14A	797.73	24.24	4.0	773.5	15.70	782.03	16.54	781.19
P-26A	792.32	17.31	4.6	775.0	14.32	778.00	14.85	777.47
P-31A	783.02	16.47	2.0	766.6	15.95	767.07	Dry	-
P-32A	798.54	21.24	4.5	777.3	19.84	778.70	20.41	778.13
P-33A	798.08	25.17	2.0	772.9	22.92	775.16	24.44	773.64
P-34*A	796.01	28.31	1.3	767.7	24.76	771.25	25.40	770.61
NORTHWEST QUADRANT - STRATIGRAPHIC UNIT B								
MW-26	791.40	79.99	10.0	711.4	61.79	729.61	63.03	728.37
MW-30B	762.02	44.50	5.0	717.5	32.29	729.73	33.53	728.49
MW-31B	782.95	64.00	5.0	719.0	53.31	729.64	54.58	728.37
MW-32B	798.87	79.00	5.0	719.9	69.20	729.67	70.47	728.40
MW-33B	796.57	74.75	5.0	721.8	66.84	729.73	68.11	728.46
MW-34*B	796.16	75.40	4.2	720.8	66.41	729.75	67.72	728.44
NORTHWEST QUADRANT - STRATIGRAPHIC UNIT C								
P-30C1	762.58	62.36	1.9	700.2	33.01	729.57	34.22	728.36
P-30C2	764.05	104.90	1.9	659.2	34.69	729.36	35.70	728.35
P-30C3	764.38	125.80	1.9	638.6	34.98	729.40	NR[4]	-
P-30C4	762.88	219.80	1.9	543.1	34.12	728.76	NR	-
P-31C1	782.79	88.49	1.9	694.3	53.29	729.50	54.46	728.33
P-31C2	782.61	113.20	1.9	669.4	53.10	729.51	54.28	728.33
P-31C3	782.73	136.10	2.0	646.6	53.35	729.38	NR	-
P-31C4	782.74	195.30	1.9	587.4	53.13	729.61	NR	-

TABLE 4.7

SUMMARY OF GROUNDWATER ELEVATION DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Location	*Reference Elevation (ft NGVD)* [1] [2]	*Total Depth (ft BTOC)* [3]	*Screen Length (ft)*	*Elevation of Screen Bottom (ft NGVD)*	*Depth to Groundwater (feet) 4/24-25/95*	*Groundwater Elevation (ft NGVD) 4/24-25/95*	*Depth to Groundwater (feet) 10/16/95*	*Groundwater Elevation (ft NGVD) 10/16/95*
NORTHWEST QUADRANT - STRATIGRAPHIC UNIT A								
P-10	797.12	17.70	2.0	779.4	12.10	785.02	17.11	780.01
P-11A	796.22	15.74	2.1	780.5	10.99	785.23	NR	-
P-12A	796.91	22.70	2.0	774.2	NR	-	17.74	779.17
P-13A	799.93	24.42	4.5	775.5	NR	-	NR	-
P-14A	797.73	24.24	4.0	773.5	NR	-	NR	-
P-26A	792.32	17.31	4.6	775.0	10.66	781.66	15.65	776.67
P-31A	783.02	16.47	2.0	766.6	14.76	768.26	NR	-
P-32A	798.54	21.24	4.5	777.3	17.93	780.61	NR	-
P-33A	798.08	25.17	2.0	772.9	25.04	773.04	23.55	774.53
P-34*A	796.01	28.31	1.3	767.7	23.22	772.79	NR	-
NORTHWEST QUADRANT - STRATIGRAPHIC UNIT B								
MW-26	791.40	79.99	10.0	711.4	62.99	728.41	64.82	726.58
MW-30B	762.02	44.50	5.0	717.5	33.66	728.36	35.34	726.68
MW-31B	782.95	64.00	5.0	719.0	54.60	728.35	56.35	726.60
MW-32B	798.87	79.00	5.0	719.9	70.46	728.41	72.25	726.62
MW-33B	796.57	74.75	5.0	721.8	68.25	728.32	69.94	726.63
MW-34*B	796.16	75.40	4.2	720.8	67.84	728.32	69.52	726.64
NORTHWEST QUADRANT - STRATIGRAPHIC UNIT C								
P-30C1	762.58	62.36	1.9	700.2	34.20	728.38	36.04	726.54
P-30C2	764.05	104.90	1.9	659.2	35.63	728.42	37.53	726.52
P-30C3	764.38	125.80	1.9	638.6	36.05	728.33	37.88	726.50
P-30C4	762.88	219.80	1.9	543.1	35.31	727.57	35.28	727.60
P-31C1	782.79	88.49	1.9	694.3	54.41	728.38	56.24	726.55
P-31C2	782.61	113.20	1.9	669.4	54.34	728.27	56.06	726.55
P-31C3	782.73	136.10	2.0	646.6	54.36	728.37	56.20	726.53
P-31C4	782.74	195.30	1.9	587.4	54.35	728.39	56.19	726.55

TABLE 4.7

SUMMARY OF GROUNDWATER ELEVATION DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Location	*Reference Elevation (ft NGVD)* [1] [2]	*Total Depth (ft BTOC)* [3]	*Screen Length (ft)*	*Elevation of Screen Bottom (ft NGVD)*	*Depth to Groundwater (feet) 5/24-25/94*	*Groundwater Elevation (ft NGVD) 5/24-25/94*	*Depth to Groundwater (feet) 7/27-28/94*	*Groundwater Elevation (ft NGVD) 7/27-28/94*
P-32C2	797.57	132.12	1.9	665.5	68.03	729.54	69.17	728.40
P-34*C1	796.17	99.64	1.9	696.5	66.43	729.74	67.71	728.46
P-34*C2	795.90	128.59	1.9	667.3	66.22	729.68	67.45	728.45
P-34*C3	796.30	151.65	1.9	644.7	66.74	729.56	NR	-
P-34*C4	796.31	192.87	1.8	603.4	66.60	729.71	NR	-
NORTHEAST QUADRANT - STRATIGRAPHIC UNIT A								
P-8A	757.72	22.64	2.0	735.1	6.95	750.77	8.28	749.44
P-29A	773.79	16.05	2.0	757.7	8.39	765.40	9.98	763.81
NORTHEAST QUADRANT - STRATIGRAPHIC UNIT B								
MW-23B	759.78	41.30	5.1	718.5	30.11	729.67	31.34	728.44
MW-28B	775.59	60.84	5.0	714.8	45.71	729.88	47.06	728.53
MW-29B	773.41	54.32	5.0	719.1	43.51	729.90	44.81	728.60
P-7B	770.89	50.68	5.0	720.2	41.39	729.50	42.62	728.27
P-8B	756.92	49.80	4.4	707.1	27.18	729.74	28.39	728.53
NORTHEAST QUADRANT - STRATIGRAPHIC UNIT C								
P-8C1	757.70	81.62	1.9	676.1	28.34	729.36	29.44	728.26
P-8C2	757.65	114.98	1.9	642.7	28.18	729.47	29.40	728.25
P-8C3	757.33	135.43	1.9	621.9	27.99	729.34	NR	-
P-8C4	757.79	175.12	1.8	582.7	20.45	737.34	NR	-
P-23C1	761.05	80.73	1.9	680.3	31.70	729.35	32.73	728.32
P-23C2	761.14	120.98	1.9	640.2	31.81	729.33	32.81	728.33
P-23C3	760.83	140.30	1.9	620.5	31.42	729.41	NR	-
P-23C4	760.02	179.20	1.9	580.8	30.48	729.54	NR	-
P-28C1	777.02	87.06	1.9	690.0	47.52	729.50	48.62	728.40
P-28C2	776.34	124.02	1.9	652.3	46.98	729.36	48.00	728.34
P-28C3	776.77	137.70	1.9	639.1	47.60	729.17	NR	-

TABLE 4.7

SUMMARY OF GROUNDWATER ELEVATION DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Location	*Reference Elevation (ft NGVD)* [1] [2]	*Total Depth (ft BTOC)* [3]	*Screen Length (ft)*	*Elevation of Screen Bottom (ft NGVD)*	*Depth to Groundwater (feet) 4/24-25/95*	*Groundwater Elevation (ft NGVD) 4/24-25/95*	*Depth to Groundwater (feet) 10/16/95*	*Groundwater Elevation (ft NGVD) 10/16/95*
P-32C2	797.57	132.12	1.9	665.5	69.14	728.43	70.96	726.61
P-34*C1	796.17	99.64	1.9	696.5	67.77	728.40	69.49	726.68
P-34*C2	795.90	128.59	1.9	667.3	67.41	728.49	69.28	726.62
P-34*C3	796.30	151.65	1.9	644.7	67.83	728.47	69.66	726.64
P-34*C4	796.31	192.87	1.8	603.4	67.84	728.47	69.64	726.67
NORTHEAST QUADRANT - STRATIGRAPHIC UNIT A								
P-8A	757.72	22.64	2.0	735.1	8.40	749.32	11.56	746.16
P-29A	773.79	16.05	2.0	757.7	6.95	766.84	10.83	762.96
NORTHEAST QUADRANT - STRATIGRAPHIC UNIT B								
MW-23B	759.78	41.30	5.1	718.5	31.46	728.32	33.15	726.63
MW-28B	775.59	60.84	5.0	714.8	47.35	728.24	48.80	726.79
MW-29B	773.41	54.32	5.0	719.1	45.22	728.19	46.57	726.84
P-7B	770.89	50.68	5.0	720.2	42.55	728.34	44.39	726.50
P-8B	756.92	49.80	4.4	707.1	28.71	728.21	30.14	726.78
NORTHEAST QUADRANT - STRATIGRAPHIC UNIT C								
P-8C1	757.70	81.62	1.9	676.1	29.41	728.29	31.28	726.42
P-8C2	757.65	114.98	1.9	642.7	29.34	728.31	31.21	726.44
P-8C3	757.33	135.43	1.9	621.9	29.02	728.31	30.89	726.44
P-8C4	757.79	175.12	1.8	582.7	20.81	736.98	24.71	733.08
P-23C1	761.05	80.73	1.9	680.3	32.70	728.35	34.54	726.51
P-23C2	761.14	120.98	1.9	640.2	32.90	728.24	34.63	726.51
P-23C3	760.83	140.30	1.9	620.5	32.57	728.26	34.23	726.60
P-23C4	760.02	179.20	1.9	580.8	31.65	728.37	33.51	726.51
P-28C1	777.02	87.06	1.9	690.0	48.81	728.21	50.32	726.70
P-28C2	776.34	124.02	1.9	652.3	47.95	728.39	49.79	726.55
P-28C3	776.77	137.70	1.9	639.1	48.49	728.28	50.25	726.52

TABLE 4.7

SUMMARY OF GROUNDWATER ELEVATION DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Location	*Reference Elevation (ft NGVD)* [1] [2]	*Total Depth (ft BTOC)* [3]	*Screen Length (ft)*	*Elevation of Screen Bottom (ft NGVD)*	*Depth to Groundwater (feet) 5/24-25/94*	*Groundwater Elevation (ft NGVD) 5/24-25/94*	*Depth to Groundwater (feet) 7/27-28/94*	*Groundwater Elevation (ft NGVD) 7/27-28/94*
P-28C4	776.50	189.16	2.0	587.3	20.95	755.55	NR	-
P-29C2	772.94	117.20	1.9	655.7	43.44	729.50	44.58	728.36
SOUTHWEST QUADRANT - STRATIGRAPHIC UNIT A								
P-1A	787.68	38.78	2.0	748.9	23.59	764.09	27.05	760.63
P-2A	777.04	19.58	2.1	757.5	3.72	773.32	4.13	772.91
P-24A	788.27	31.09	1.8	757.2	17.42	770.85	23.91	764.36
SOUTHWEST QUADRANT - STRATIGRAPHIC UNIT B								
MW-24B	787.72	72.68	5.0	715.0	57.70	730.02	58.98	728.74
P-1	783.14	66.62	10.0	716.5	53.02	730.12	54.39	728.75
P-2B	777.00	74.98	4.3	702.0	47.06	729.94	48.38	728.62
P-5B	776.85	52.48	5.0	724.4	47.11	729.74	48.45	728.40
SOUTHWEST QUADRANT - STRATIGRAPHIC UNIT C								
P-2C2	776.82	136.50	2.0	640.3	46.98	729.84	48.24	728.58
P-5C1	776.65	79.80	1.9	696.9	46.98	729.67	48.22	728.43
P-5C2	777.18	110.42	1.9	666.8	47.61	729.57	48.81	728.37
P-5C3	777.07	121.84	1.9	655.2	47.41	729.66	NR	-
P-5C4	777.52	166.20	1.9	611.3	NR	-	NR	-
P-24C1	788.34	92.43	2.0	695.9	58.20	730.14	59.41	728.93
P-24C2	787.93	106.96	2.0	681.0	57.71	730.22	58.97	728.96
P-24C3	788.51	120.10	1.9	668.4	58.34	730.17	NR	-
P-24C4	788.78	133.98	1.9	654.8	58.69	730.09	NR	-

TABLE 4.7

SUMMARY OF GROUNDWATER ELEVATION DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Location	*Reference Elevation* [1] *(ft NGVD)* [2]	*Total Depth (ft BTOC)* [3]	*Screen Length (ft)*	*Elevation of Screen Bottom (ft NGVD)*	*Depth to Groundwater (feet) 4/24-25/95*	*Groundwater Elevation (ft NGVD) 4/24-25/95*	*Depth to Groundwater (feet) 10/16/95*	*Groundwater Elevation (ft NGVD) 10/16/95*
P-28C4	776.50	189.16	2.0	587.3	19.81	756.69	22.96	753.54
P-29C2	772.94	117.20	1.9	655.7	44.55	728.39	46.38	726.56
SOUTHWEST QUADRANT - STRATIGRAPHIC UNIT A								
P-1A	787.68	38.78	2.0	748.9	26.23	761.45	31.62	756.06
P-2A	777.04	19.58	2.1	757.5	NR	-	5.88	771.16
P-24A	788.27	31.09	1.8	757.2	12.32	775.95	29.46	758.81
SOUTHWEST QUADRANT - STRATIGRAPHIC UNIT B								
MW-24B	787.72	72.68	5.0	715.0	59.14	728.58	60.83	726.89
P-1	783.14	66.62	10.0	716.5	54.36	728.78	56.22	726.92
P-2B	777.00	74.98	4.3	702.0	47.84	729.16	49.45	727.55
P-5B	776.85	52.48	5.0	724.4	48.52	728.33	50.23	726.62
SOUTHWEST QUADRANT - STRATIGRAPHIC UNIT C								
P-2C2	776.82	136.50	2.0	640.3	47.83	728.99	49.45	727.37
P-5C1	776.65	79.80	1.9	696.9	48.28	728.37	49.99	726.66
P-5C2	777.18	110.42	1.9	666.8	48.74	728.44	50.57	726.61
P-5C3	777.07	121.84	1.9	655.2	48.61	728.46	50.24	726.83
P-5C4	777.52	166.20	1.9	611.3	49.11	728.41	50.57	726.95
P-24C1	788.34	92.43	2.0	695.9	59.37	728.97	61.24	727.10
P-24C2	787.93	106.96	2.0	681.0	58.92	729.01	60.81	727.12
P-24C3	788.51	120.10	1.9	668.4	59.57	728.94	61.41	727.10
P-24C4	788.78	133.98	1.9	654.8	59.83	728.95	61.68	727.10

SUMMARY OF GROUNDWATER ELEVATION DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Location	*Reference Elevation (ft NGVD)* [1] [2]	*Total Depth (ft BTOC)* [3]	*Screen Length (ft)*	*Elevation of Screen Bottom (ft NGVD)*	*Depth to Groundwater (feet) 5/24-25/94*	*Groundwater Elevation (ft NGVD) 5/24-25/94*	*Depth to Groundwater (feet) 7/27-28/94*	*Groundwater Elevation (ft NGVD) 7/27-28/94*
SOUTHEAST QUADRANT - STRATIGRAPHIC UNIT A								
P-25A	793.86	34.01	2.0	759.9	32.62	761.24	33.54	760.32
SOUTHEAST QUADRANT - STRATIGRAPHIC UNIT B								
MW-21S	778.01	59.70	15.0	718.3	48.54	729.47	49.70	728.31
MW-25B	793.81	74.00	5.0	719.8	64.26	729.55	65.46	728.35
MW-27B	779.74	56.26	4.2	723.5	50.17	729.57	51.36	728.38
P-4B	792.24	73.16	4.4	719.1	62.54	729.70	63.72	728.52
SOUTHEAST QUADRANT - STRATIGRAPHIC UNIT C								
MW-21L	777.01	212.00	10.0	565.0	47.51	729.50	49.04	727.97
MW-21M	777.37	97.53	10.0	679.8	48.09	729.59	48.69	728.68
P-4C1	791.80	87.60	1.8	704.2	62.21	729.68	63.29	728.51
P-4C2	791.79	135.01	1.9	656.8	62.24	729.55	63.26	728.53
P-4C3	791.78	157.26	1.9	634.5	56.66	735.12	NR	-
P-25C2	794.86	124.54	1.9	670.3	65.43	729.43	66.45	728.41
P-27C1	780.42	82.22	1.9	698.2	50.83	729.59	52.07	728.35
P-27C2	780.11	110.42	1.9	669.7	50.56	729.55	51.75	728.36
P-27C3	780.10	131.10	1.9	649.0	50.59	729.51	NR	-
P-27C4	781.96	174.10	1.9	607.9	52.26	729.70	NR	-

TABLE 4.7

SUMMARY OF GROUNDWATER ELEVATION DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Location	*Reference Elevation* [1] *(ft NGVD)* [2]	*Total Depth (ft BTOC)* [3]	*Screen Length (ft)*	*Elevation of Screen Bottom (ft NGVD)*	*Depth to Groundwater (feet) 4/24-25/95*	*Groundwater Elevation (ft NGVD) 4/24-25/95*	*Depth to Groundwater (feet) 10/16/95*	*Groundwater Elevation (ft NGVD) 10/16/95*
SOUTHEAST QUADRANT - STRATIGRAPHIC UNIT A								
P-25A	793.86	34.01	2.0	759.9	28.28	765.58	NR	-
SOUTHEAST QUADRANT - STRATIGRAPHIC UNIT B								
MW-21S	778.01	59.70	15.0	718.3	NR	-	51.47	726.54
MW-25B	793.81	74.00	5.0	719.8	65.53	728.28	68.26	725.55
MW-27B	779.74	56.26	4.2	723.5	51.33	728.41	53.19	726.55
P-4B	792.24	73.16	4.4	719.1	63.71	728.53	65.55	726.69
SOUTHEAST QUADRANT - STRATIGRAPHIC UNIT C								
MW-21L	777.01	212.00	10.0	565.0	NR	-	50.51	726.50
MW-21M	777.37	97.53	10.0	679.8	NR	-	50.84	726.53
P-4C1	791.80	87.60	1.8	704.2	63.27	728.53	65.13	726.67
P-4C2	791.79	135.01	1.9	656.8	63.25	728.54	65.10	726.69
P-4C3	791.78	157.26	1.9	634.5	57.89	733.89	59.85	731.93
P-25C2	794.86	124.54	1.9	670.3	66.42	728.44	67.28	727.58
P-27C1	780.42	82.22	1.9	698.2	52.02	728.40	53.87	726.55
P-27C2	780.11	110.42	1.9	669.7	51.71	728.40	53.51	726.60
P-27C3	780.10	131.10	1.9	649.0	51.71	728.39	53.56	726.54
P-27C4	781.96	174.10	1.9	607.9	53.70	728.26	55.06	726.90

1 Elevation of top of casing recorded during monitoring well survey conducted during the RI.

2 Elevation in feet as referenced to National Geodetic Vertical Datum (NGVD).

3 (ft BTOC) - Total depth (below top of casing) recorded during monitoring well inspection activities conducted during the RI.

4 NR -Not Recorded.

TABLE 4.8

SUMMARY OF RESPONSE TEST DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

	Hydraulic Conductivity Results (ft/s) [1]		
Location	*Rising*	*Falling*	*Geometric Mean*
P-4B	4.1×10^{-6}	1.0×10^{-5}	6.4×10^{-6}
MW-24B	8.8×10^{-5}	6.8×10^{-5}	7.7×10^{-5}
MW-29B	1.1×10^{-5}	9.1×10^{-6}	1.0×10^{-5}
MW-31B	1.4×10^{-5}	1.3×10^{-5}	1.3×10^{-5}
P-27C2	5.6×10^{-5}	2.2×10^{-5}	3.6×10^{-5}
P-29C2	2.6×10^{-5}	7.1×10^{-6}	1.4×10^{-5}
P-34*C3	1.9×10^{-4}	1.4×10^{-4}	1.6×10^{-4}
P-24C4	1.6×10^{-5}	1.1×10^{-5}	1.3×10^{-5}

Geometric Mean - Unit B = 1.6×10^{-5} ft/s
Geometric Mean - Unit C = 3.2×10^{-5} ft/s

[1] ft/s - feet per second

TABLE 4.9

SUMMARY OF MONITORING WELL AND PIEZOMETER ABANDONMENT
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Location	*Date Conducted*	*Stick-Up (feet)*	*Depth to Water (feet BTOC)* [1]	*Total Depth (feet BTOC)*	*Well Diameter (inches)*	*Method of Abandonment*
MW-2	09/02/94	3.00	Dry	22.95	4	Overdrilled 6-1/4" HSA to 30 feet and bentonite grouted.
MW-3	09/02/94	1.80	Dry	38.65	4	Bentonite grouted.
MW-4	08/30/94	3.40	19.05	21.15	4	Bentonite grouted.
MW-5	08/30/94	2.10	Dry	36.55	4	Bentonite grouted.
MW-6	09/01/94	1.30	23.11	55.40	4	Bentonite grouted.
MW-20	08/31/94	2.60	39.05	52.00	4	Bentonite grouted.
MW-23S	08/31/94	2.50	37.95	49.67	2	Casing filled with bentonite chips, overdrilled 3-1/2" mud rotary to 26 feet and bentonite grouted.
MW-23M	08/31/94	2.40	38.02	90.45	2	Casing filled with bentonite chips, overdrilled 3-1/2" mud rotary to 10 feet and bentonite grouted.
MW-23L	08/31/94	2.30	38.05	123.30	2	Bentonite grouted.
MW-24M	08/31/94	2.40	60.80	111.90	2	Bentonite grouted.

TABLE 4.9

SUMMARY OF MONITORING WELL AND PIEZOMETER ABANDONMENT
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Well Location	*Date Conducted*	*Stick-Up (feet)*	*Depth to Water (feet BTOC)* [1]	*Total Depth (feet BTOC)*	*Well Diameter (inches)*	*Method of Abandonment*
MW-25	08/30/94	2.50	62.41	76.93	2	Bentonite grouted.
MW-27S	08/30/94	2.10	51.31	70.00	2	Bentonite grouted.
MW-27M	08/30/94	2.50	51.95	96.00	2	Bentonite grouted.
MW-28S	08/31/94	1.20	47.85	61.60	2	Bentonite grouted.
MW-28M	08/31/94	1.80	52.22	101.40	2	Bentonite grouted.
P-2	09/01/94	1.30	NA	83.0	1	Overdrilled 3-1/2" mud rotary to 83 feet and bentonite grouted
P-4C4	08/30/94	NA	59.30	153.90	2	Bentonite grouted.

[1] BTOC - below top of casing

TABLE 5.1

COMPARISON OF ON-SITE SEDIMENT DATA WITH
PUBLISHED BACKGROUND LEVELS
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Element	*Observed Range (ppm)* [1]	*Arithmetic Mean (ppm) of Background*	*Detected Range (ppm)*
Aluminum (percent)	0.7 - >10	5.7	0.41 - 1.3
Arsenic	<0.1 - 73	7.4	2.8 - 6.5
Barium	10 - 1,300	420	20 - 41
Beryllium	<1 - 7	0.85	ND(0.50) - 0.79
Cadmium	0.01 - 7 [2]	--	ND(2.5) - ND(5.0)
Calcium (percent)	0.01 - 28	0.63	2.1 - 5.2
Chromium	1 - 1,000	52	8.8 - 28
Cobalt	<0.3 - 70	9.2	4.3 - 10
Copper	<1 - 700	22	12-27
Iron (percent)	0.01 - >10	2.5	0.87 - 2.3
Lead	<10 - 300	17	10-30
Magnesium (percent)	0.005 - 5	0.46	1.1 - 2.4
Manganese	<2 - 7,000	640	150 - 400
Mercury	0.01 - 3.4	0.12	ND
Nickel	<5 - 700	18	12R - 41
Potassium (percent)	0.005 - 3.7	--	0.094 - 0.37
Selenium	<0.1 - 3.9	0.45	ND
Sodium (percent)	<0.05 - 5	0.78	0.0071 - 0.017
Thallium	---	---	ND
Vanadium	<7 - 300	66	8.9 - 22
Zinc	<5 - 2,900	52	70 - 150

1 Source: Shacklette, H.T. and Boerngen, J.G., "Elemental Concentrations in Soil and Other Surficial Materials of the Conterminous United States" (USGS Professional Paper 1270, 1984) unless otherwise noted.

2 Source: "Reclamation and Redevelopment of Contaminated Land - Volume I, U. S. Case Studies" EPA/600/2-86/066 (August 1986)

ND(0.50) - not detected at the reporting limit noted in parentheses

ND - not detected

TABLE 5.2

SUMMARY OF AMBIENT WATER AND SEDIMENT QUALITY CRITERIA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

	AWQC FOR FRESHWATER PROTECTION				SEDIMENT				
	INDIANA [1]		FEDERAL		NOAA [2]		ONTARIO [3]		BIOCONCENTRATION FACTOR [4]
PARAMETER	ACUTE (mg/L)	CHRONIC (mg/L)	ACUTE (mg/L)	CHRONIC (mg/L)	ER-L (mg/kg)	ER-M (mg/kg)	LEL (mg/kg)	SEL (mg/kg)	(L/kg)
VOCs									
Acetone	--	--	--	--	--	--	--	--	--
Butanone, 2-	--	--	--	--	--	--	--	--	--
Carbon Disulfide	--	--	--	--	--	--	--	--	0
Dichloromethane	--	--	11 [5]	--	--	--	--	--	5
4-Methyl-2-Pentanone	--	--	--	--	--	--	--	--	--
Toluene	--	--	17.5 [5]	--	--	--	--	--	10.7
SVOCs									
Butylbenzyl Phthalate	--	--	0.94 [5]	0.003 [8]	--	--	--	--	--
METALS									
Aluminum	--	--	--	--	--	--	--	--	--
Antimony	--	--	0.088 [5]	0.03 [5]	2	25	--	--	1
Arsenic	0.36*	0.19*	0.36 [5]	0.19 [5]	33	85	6	33	44
Barium	--	--	--	--	--	--	--	--	--
Beryllium	--	--	0.13 [8]	0.0053 [8]	--	--	--	--	19
Cadmium	0.009 [6]	0.002 [6]	0.0039 [5]	0.0011 [5]	5	9	0.6	10	81
Calcium	--	--	--	--	--	--	--	--	--
Chromium	3.064** [6]	0.365** [6]	--	--	80	145	26	110	--
Cobalt	--	--	--	--	--	--	--	--	--
Copper	0.034 [6]	0.021 [6]	0.009 [5]	0.0065 [5]	70	390	16	110	200
Iron	--	--	--	1 [5]	--	--	2%	4%	--
Lead	0.197 [6]	0.008 [6]	0.082 [5]	0.0032 [5]	35	110	31	250	49
Magnesium	--	--	--	--	--	--	--	--	--
Manganese	--	--	0.082 [5]	0.0032 [5]	--	--	460	1100	--
Mercury	0.0024	0.000012	0.0024 [5]	0.000012 [5]	0.15	1.3	0.2	2	5500
Nickel	2.549 [6]	0.283 [6]	1.4 [5]	0.16 [5]	30	50	16	75	47
Potassium	--	--	--	--	--	--	--	--	--
Selenium	0.13	0.035	--	--	--	--	--	--	16
Silver	0.007 [6]	--	0.00092 [5]	--	1	2.2	0.5 [7]	0.5 [7]	3080
Sodium	--	--	--	--	--	--	--	--	--
Thallium	--	--	1.4 [8]	0.04 [8]	--	--	--	--	--
Vanadium	--	--	--	--	--	--	--	--	--
Zinc	0.21 [6]	0.191 [6]	0.12 [8]	0.11 [8]	120	270	120	820	47
Cyanide	--	--	0.022 [5]	0.0052 [5]	--	--	--	--	--

NOTES :

-- = Not Available
ER-L = Effects Range-Low; a concentration at the low end of reported concentrations in which biological effects have been observed.
ER-M = Effects Range-Moderate; a concentration approximately midway in the range of reported concentrations associated with biological effects.
* = Value taken from Arsenic (III).
** = Value taken from Chromium (III).

1 Water Pollution Control Board, Title 327 IAC 2-1-6, Minimum Surface Water Quality Standards, November 9, 1993.
2 The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program, NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, August 1991.
3 MOEE Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario, August 1993.
4 EPA Superfund Public Health Evaluation Manual, U.S. Environmental Protection Agency, Washington D.C., EPA/540/1-86/060, October 1986.
5 IRIS-EPA Integrated Risk Information System Database, July 1994.
6 Inorganic water quality criteria is hardness dependent. Since no hardness analysis was performed, the following equation was used to calculate a hardness value; [Hardness(mg/L) = 2.5(Ca) + 4.1(Mg)]. Hardness mean value was determined for the entire site and used as the guidance value.
7 Additional parameters from Open Water Disposal Guidelines taken from (3).
8 USEPA Quality Criteria for Water, 1986, EPA 440/5-86-001 May 86 51, Federal Register 43665, Update Sept. 1987.

TABLE 5.3

COMPARISON OF OFF-SITE SEDIMENT DATA WITH
PUBLISHED BACKGROUND LEVELS [1]
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Element	*Observed Background Range (ppm)*	*Arithmetic Mean (ppm) of Background*	*Detected Range (ppm)*
Aluminum (percent)	0.7 - >10	5.7	0.1 - 1.5
Arsenic	<0.1 - 73	7.4	0.6 - 7.3
Barium	10 - 1,300	420	16 - 67
Beryllium	<1 - 7	0.85	ND(0.50) [2] - 0.79
Cadmium	0.01 - >7 [3]	--	ND(0.50) - 1.3
Calcium (percent)	0.01 - 28	0.63	0.076 - 3.9
Chromium	1 - 1,000	52	3 - 28
Cobalt	<0.3 - 70	9.2	ND(1.0) - 9.8
Copper	<1 - 700	22	2 - 28
Iron (percent)	0.01 - >10	2.5	1.3 - 24
Lead	<10 - 300	17	6.5 - 36
Magnesium (percent)	0.005 - 5	0.46	0.02 - 1.3
Manganese	<2 - 7,000	640	36 - 1,600
Mercury	0.01 - 3.4	0.12	ND(0.05) - ND(0.12)
Nickel	<5 - 700	18	1.8 - 27
Potassium (percent)	0.005 - 3.7	--	0.014 - 0.29
Selenium	<0.1 - 3.9	0.45	ND(0.5) - 0.74
Sodium (percent)	<0.05 - 5	0.78	0.0024 - 0.025
Thallium	--	--	1.1 - ND(2.0)
Vanadium	<7 - 300	66	1.8 - 26
Zinc	<5 - 2,900	52	19 - 170

1 Source: Shacklette, H.T. and Boerngen, J.G., "Elemental Concentrations in Soil and Other Surficial Materials of the Conterminous United States" (USGS Professional Paper 1270, 1984) unless otherwise noted

2 ND(0.50) - not detected at the reporting limit noted in parentheses

3 Source: "Reclamation and Redevelopment of Contaminated Land - Volume I, U. S. Case Studies" EPA/600/2-86/066 (August 1986).

TABLE 5.4

Date Printed: January 31, 1996

Summary of Detected VOCs in Groundwater
Four County Landfill Site
Fulton County, Indiana

Location:		MW-26	MW-26	MW-29B	MW-33B	MW-33B	P-1	P-2A	P-2A
Sample I.D.:		GW-WP-066	GW-WP-068	GW-WP-023	GW-WP-074	GW-WP-076	GW-WP-088	GW-WP-054	GW-WP-056
Date Sampled:		06/08/94	06/08/94	06/03/94	06/08/94	06/08/94	06/15/94	06/07/94	06/07/94
			Dupl.			Dupl.			Dupl.
Parameters	*Units*								
Volatile Organic Compounds									
1,1,2,2-TETRACHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	ug/L	--	--	--	--	--	--	18000 J	11000 J
1,1-DICHLOROETHANE	ug/L	--	--	6.1	--	--	--	--	--
1,2-DICHLOROETHANE	ug/L	--	--	2.0	3.4 J	6.1 J	--	630000 J	380000 J
2-BUTANONE	ug/L	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	ug/L	--	--	--	--	--	--	20000 J	--
ACETONE	ug/L	--	--	--	210 J	35	33	--	--
BENZENE	ug/L	--	--	--	--	--	--	750000 J	520000 J
BROMODICHLOROMETHANE	ug/L	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	ug/L	--	--	--	--	--	--	--	--
CHLOROETHANE	ug/L	--	--	9.7	--	--	--	--	--
CHLOROFORM	ug/L	--	--	--	1.4 J	--	--	180000 J	120000 J
CIS-1,2-DICHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
DICHLOROMETHANE	ug/L	--	--	--	--	--	--	21000 J	210000 J
TETRACHLOROETHENE	ug/L	2.7 J	3.8 J	--	--	--	--	8100 J	5100 J
TOLUENE	ug/L	--	--	--	--	--	--	32000 J	20000 J
TRICHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
VINYL CHLORIDE	ug/L	--	--	--	--	--	--	--	--
XYLENES (TOTAL)	ug/L	--	--	--	--	--	--	--	--

TABLE 5.4

Date Printed: January 31, 1996

Summary of Detected VOCs in Groundwater
Four County Landfill Site
Fulton County, Indiana

Location:		P-2B	P-2B DIL	P-2C2	P-2C2 DIL	P-4C3	P-5C3	P-8C3	P-8C4
Sample I.D.:		GW-WP-079	GW-WP-079	GW-WP-081	GW-WP-081	GW-SC-49	GW-SC-040	GW-SC-028	GW-SC-30
Date Sampled:		06/08/94	06/08/94	06/08/94	06/08/94	10/19/95	10/18/95	10/17/95	10/19/95
Parameters	*Units*								
Volatile Organic Compounds									
1,1,2,2-TETRACHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	ug/L	1.7	--	5.1 J	--	--	--	--	--
1,1-DICHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	ug/L	230 J	120	2000 J	1300 J	--	--	--	--
2-BUTANONE	ug/L	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	ug/L	--	--	--	--	--	--	--	--
ACETONE	ug/L	--	--	--	--	--	--	--	--
BENZENE	ug/L	390 J	190	600 J	1900 J	--	--	--	--
BROMODICHLOROMETHANE	ug/L	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	ug/L	--	--	--	--	--	--	--	--
CHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
CHLOROFORM	ug/L	6.8	--	20 J	--	2.2	--	--	--
CIS-1,2-DICHLOROETHENE	ug/L	--	--	1.5 J	--	--	--	--	--
DICHLOROMETHANE	ug/L	13	--	63 J	--	--	1.3	1.4	1.2 J
TETRACHLOROETHENE	ug/L	3.0	--	6.4 J	--	--	--	--	--
TOLUENE	ug/L	11 J	--	23 J	--	--	--	--	--
TRICHLOROETHENE	ug/L	1.4	--	25 J	--	--	--	--	--
VINYL CHLORIDE	ug/L	--	--	6.4 J	--	--	--	--	--
XYLENES (TOTAL)	ug/L	--	--	1.3 J	--	--	--	--	--

TABLE 5.4

Summary of Detected VOCs in Groundwater
Four County Landfill Site
Fulton County, Indiana

Location:		P-8C4	P-10	P-11A	P-12A	P-12A DIL	P-13A	P-13A DIL	P-14A
Sample I.D.:		GW-SC-32	GW-WP-084	GW-WP-089	GW-WP-082	GW-WP-082	GW-WP-080	GW-WP-080	GW-WP-064
Date Sampled:		10/19/95	06/08/94	06/09/94	06/08/94	06/08/94	06/08/94	06/08/94	06/07/94
		Dupl.							
Parameters	*Units*								
Volatile Organic Compounds									
1,1,2,2-TETRACHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	ug/L	--	--	--	1800	1600 J	10000	11000 J	--
1,1-DICHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	ug/L	--	54000	--	49000	44000 J	660000 J	630000 J	--
2-BUTANONE	ug/L	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	ug/L	--	--	--	--	--	--	--	--
ACETONE	ug/L	--	--	140	--	--	140000	180000 J	--
BENZENE	ug/L	--	30000	--	52000	47000 J	200000 J	190000 J	--
BROMODICHLOROMETHANE	ug/L	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	ug/L	--	210000	8.7	--	--	59000	60000 J	63000 J
CHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
CHLOROFORM	ug/L	--	41000	6.8	53000 J	51000 J	160000	150000 J	8000 J
CIS-1,2-DICHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
DICHLOROMETHANE	ug/L	1.1 J	7600	--	7800	8200 J	180000	190000 J	--
TETRACHLOROETHENE	ug/L	--	9100	--	2600	1900 J	--	--	--
TOLUENE	ug/L	--	--	--	--	--	--	--	--
TRICHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
VINYL CHLORIDE	ug/L	--	--	--	--	--	--	--	--
XYLENES (TOTAL)	ug/L	--	--	--	--	--	--	--	--

TABLE 5.4

Date Printed: January 31, 1996

Summary of Detected VOCs in Groundwater
Four County Landfill Site
Fulton County, Indiana

Location:		P-24C2	P-24C3	P-25A	P-26A	P-26A DIL	P-28A	P-29A	P-30C3
Sample I.D.:		GW-WP-063	GW-SC-47	GW-WP-009	GW-WP-070	GW-WP-070	GW-WP-114	GW-WP-021	GW-SC-027
Date Sampled:		06/06/94	10/19/95	06/01/94	06/08/94	06/08/94	06/01/91	06/03/94	10/17/95
Parameters	*Units*								
Volatile Organic Compounds									
1,1,2,2-TETRACHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	ug/L	--	--	--	--	--	--	30	--
1,2-DICHLOROETHANE	ug/L	--	--	--	7100	10000 J	--	12	--
2-BUTANONE	ug/L	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	ug/L	--	--	--	--	--	--	--	--
ACETONE	ug/L	28	--	74	--	--	--	--	--
BENZENE	ug/L	--	--	--	4900	7000 J	--	--	--
BROMODICHLOROMETHANE	ug/L	--	1.6	--	--	--	--	--	--
CARBON TETRACHLORIDE	ug/L	--	--	--	1800	--	--	--	--
CHLOROETHANE	ug/L	--	--	--	--	--	--	3.8	--
CHLOROFORM	ug/L	--	5.8	--	3000	--	--	--	--
CIS-1,2-DICHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
DICHLOROMETHANE	ug/L	--	--	--	850	--	1.2	--	1.1 J
TETRACHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
TOLUENE	ug/L	--	--	--	--	--	7.4	--	--
TRICHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
VINYL CHLORIDE	ug/L	--	--	--	--	--	--	--	--
XYLENES (TOTAL)	ug/L	--	--	--	--	--	--	--	--

TABLE 5.4

Summary of Detected VOCs in Groundwater
Four County Landfill Site
Fulton County, Indiana

Location:		P-30C3	P-31A	P-31C1	P-31C1	P-31C2	P-31C2	P-31C3	P-31C4
Sample I.D.:		GW-SC-029	GW-SC-014	GW-WP-067	GW-SC-004	GW-WP-077	GW-SC-022	GW-SC-021	GW-SC-020
Date Sampled:		10/17/95	04/27/95	06/07/94	04/25/95	06/08/94	04/28/95	04/27/95	04/27/95
		Dupl.							
Parameters	*Units*								
Volatile Organic Compounds									
1,1,2,2-TETRACHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	ug/L	--	6.0 J	--	--	--	--	--	--
1,2-DICHLOROETHANE	ug/L	--	--	--	--	100	170	360	1.7 J
2-BUTANONE	ug/L	--	16 J	--	--	--	--	--	--
4-METHYL-2-PENTANONE	ug/L	--	--	--	--	--	--	--	--
ACETONE	ug/L	--	--	--	--	--	--	--	--
BENZENE	ug/L	--	--	--	1.0	--	--	--	--
BROMODICHLOROMETHANE	ug/L	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	ug/L	--	--	--	--	--	--	--	--
CHLOROETHANE	ug/L	--	--	--	--	1.0	--	--	--
CHLOROFORM	ug/L	--	--	1.1 J	--	--	--	--	--
CIS-1,2-DICHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
DICHLOROMETHANE	ug/L	1.2	--	--	--	--	--	1.0	--
TETRACHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
TOLUENE	ug/L	--	--	--	--	--	1.3	--	--
TRICHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
VINYL CHLORIDE	ug/L	--	--	--	--	1.0	--	2.4	--
XYLENES (TOTAL)	ug/L	--	--	--	--	--	--	--	--

TABLE 5.4

Summary of Detected VOCs in Groundwater
Four County Landfill Site
Fulton County, Indiana

Location:		P-32A	P-33A	P-33A DIL	P-34*A	RBLK(MW-28B)	RBLK(MW-31B)	RBLK(MW-33B)	RBLK(P-4C1)
Sample I.D.:		GW-SC-009	GW-WP-078	GW-WP-078	GW-SC-012	GW-WP-018	GW-WP-050	GW-WP-072	GW-WP-002
Date Sampled:		04/26/95	06/08/94	06/08/94	04/26/95	06/02/94	06/06/94	06/08/94	06/01/94
Parameters	*Units*								
Volatile Organic Compounds									
1,1,2,2-TETRACHLOROETHANE	ug/L	9 J	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	ug/L	170 J	10	--	--	--	--	--	--
1,1-DICHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	ug/L	7100 J	420 J	--	--	--	--	--	--
2-BUTANONE	ug/L	--	86	--	--	--	--	--	--
4-METHYL-2-PENTANONE	ug/L	--	--	--	--	--	--	--	--
ACETONE	ug/L	260 J	57000 J	110000 J	290 J	--	--	--	--
BENZENE	ug/L	--	16	--	--	--	--	--	--
BROMODICHLOROMETHANE	ug/L	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	ug/L	5500 J	240 J	--	--	--	--	--	--
CHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
CHLOROFORM	ug/L	2700 J	--	--	--	--	--	--	--
CIS-1,2-DICHLOROETHENE	ug/L	--	1.0	--	--	--	--	--	--
DICHLOROMETHANE	ug/L	170 J	460 J	--	--	1.0	1.2	1.2	1.2
TETRACHLOROETHENE	ug/L	440 J	26	--	--	--	--	--	--
TOLUENE	ug/L	11 J	--	--	--	--	--	--	--
TRICHLOROETHENE	ug/L	9 J	1.2	--	--	--	--	--	--
VINYL CHLORIDE	ug/L	--	1.3	--	--	--	--	--	--
XYLENES (TOTAL)	ug/L	--	--	--	--	--	--	--	--

TABLE 5.4

Date Printed: January 31, 1996

Summary of Detected VOCs in Groundwater
Four County Landfill Site
Fulton County, Indiana

Location:		RBLK(P-24C2)	RBLK(P-27C4)	RBLK(P-29A)	RBLK(P-34*C4)	TBLK	TBLK	TBLK	TBLK
Sample I.D.:		GW-SC-015	W-SC-51	GW-WP-019	W-SC-033	GW-WP-060	GW-WP-083	W-1C-031	W-1C-031
Date Sampled:		04/26/95	10/19/95	06/03/94	10/18/95	06/07/94	04/26/95	10/19/95	10/20/95
Parameters	*Units*								
Volatile Organic Compounds									
1,1,2,2-TETRACHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	ug/L	--	--	--	--	3.3	--	--	--
2-BUTANONE	ug/L	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	ug/L	--	--	--	--	--	--	--	--
ACETONE	ug/L	--	--	--	--	--	--	--	--
BENZENE	ug/L	2.5 J	--	--	--	1.5	--	--	--
BROMODICHLOROMETHANE	ug/L	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	ug/L	--	--	--	1.1	--	--	--	--
CHLOROETHANE	ug/L	--	--	--	--	--	--	--	--
CHLOROFORM	ug/L	--	1.1	--	1.2	--	--	--	--
CIS-1,2-DICHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
DICHLOROMETHANE	ug/L	--	--	1.9	1.0	1.8	1.1	1.0	1.1
TETRACHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
TOLUENE	ug/L	6.3 J	--	--	--	--	--	--	--
TRICHLOROETHENE	ug/L	--	--	--	--	--	--	--	--
VINYL CHLORIDE	ug/L	--	--	--	--	--	--	--	--
XYLENES (TOTAL)	ug/L	--	--	--	--	--	--	--	--

Organic Data Qualifiers

Data Validation Qualifiers

J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

U( ) - The analyte was analyzed for, but was not detected above the reported sample quantitation limit (in parentheses).

R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative idenitification".

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

NS - Not sampled.

Laboratory Qualifiers

J - Indicates that the compound was analyzed for and determined to be present in the sample. The mass spectrum of the compound meets the identification criteria of the method. The concentration listed is an estimated value, which is less than the specified minimum detection limit but is greater than zero.

B - This flag is used when the analyte is found in the blanks as well as the sample. It indicates possible sample contamination and warns the data user to use caution when applying the results of this analyte.

N - Indicates that the compound was analyzed for but not requested as an analyte. Value will not be listed on tabular result sheet.

S - Estimated due to surrogate outliers.

A - This flag indicates that a TIC is a suspected aldol condensation product.

E - Indicates that it exceeds calibration curve range.

D - This flag identifies all compounds identified in an analysis at a secondary dilution factor.

Inorganic and Indicator Parameter Data Qualifiers

Data Validation Qualifiers

U( ) - The analyte was analyzed for but was not detected above the level of the associated value in parentheses. The associated value is the Instrument Detection Limit (IDL) for all analytes except Cyanide (CN) and Mercury (Hg). For CN and Hg, the associated value is the Contract Required Detection Limit (CRDL)

J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample.

R - The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Resampling and reanalyses are necessary to confirm or deny the presence of the analyte.

UJ - A combination of the "U" and the "J" qualifier. The analyte was analyzed for but was not detected above the level of the associated value. The associated value may not accurately or precisely represent the sample detection limit.

NS - Not sampled.

Laboratory Qualifiers

B - The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but was greater than or equal to the Instrument Detection Limit (IDL).

E - The reported value is estimated because of the presence of interference.

M - Duplicate injection precision not met.

N - Spiked sample recovery not within control limits.

S - The reported value was determined by the Method of Standard Additions (MSA).

W - Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while the sample absorbance is less than 50% of spike absorbance.

* - Duplicate analysis not within control limits.

\+ - Correlation coefficient for the MSA is less than 0.995.

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			MW-8	MW-20	MW-21L	MW-21M	MW-21M	MW-21S	MW-21S
Sample I.D.:			GW-WP-087	GW-WP-055	GW-WP-025	GW-WP-003	GW-WP-005	GW-WP-013	GW-WP-015
Date Sampled:			06/08/94	06/06/94	06/03/94	06/01/94	06/01/94	06/02/94	06/02/94
							Dupl.		Dupl.
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	ND(0.050) UJ	6.1	1.1	30 J	ND(0.050) UJ	0.66	0.84
ALUMINUM, DISSOLVED	mg/L	.2	ND(0.050) UJ	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
ANTIMONY	mg/L	.006	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
ARSENIC	mg/L	.05	ND(0.0050)	0.018	0.0062	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
ARSENIC, DISSOLVED	mg/L	--	ND(0.0050)	ND(0.0050)	0.0082	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BARIUM	mg/L	2	0.11	0.11 R	0.16	0.055	0.055	0.036	0.036
BARIUM, DISSOLVED	mg/L	--	0.11	0.048	0.15	0.055	0.055	0.032	0.032
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	83	120	84	81	80	100	100
CALCIUM, DISSOLVED	mg/L	--	84	88	77	81	80	100	98
CHROMIUM	mg/L	.1	ND(0.010)	0.080	0.018	ND(0.010)	ND(0.010)	0.015	0.017
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COPPER	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
IRON	mg/L	.3	3.3	19	3.1	2.5	2.5	1.4	1.7
IRON, DISSOLVED	mg/L	.3	2.9	0.088	0.94	2.5	2.5	0.098 J	0.13 J
LEAD	mg/L	.015	ND(0.0030)	0.012	ND(0.0030)	0.018 J	0.0053 J	ND(0.0030)	0.0052
LEAD, DISSOLVED	mg/L	.015	ND(0.0030)	ND(0.0030)	0.0035	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	28	49	31	28	27	77	77
MAGNESIUM, DISSOLVED	mg/L	--	28	34	28	28	28	77	77
MANGANESE	mg/L	.05	0.044	0.99	0.13	0.070	0.069	0.48	0.50
MANGANESE, DISSOLVED	mg/L	.05	0.044	0.11	0.090	0.070	0.065	0.30	0.33
MERCURY	mg/L	.002	ND(0.00050)	ND(0.00020)	ND(0.00020)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)
MERCURY, DISSOLVED	mg/L	.002	ND(0.00050)	ND(0.00020)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)
NICKEL	mg/L	.1	ND(0.010)	0.069	0.021	ND(0.010)	ND(0.010)	0.024	0.030
NICKEL, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	0.016	0.014
POTASSIUM	mg/L	--	1.1	3.7	1.6	1.1	1.1	2.3	2.3
POTASSIUM, DISSOLVED	mg/L	--	1.0	2.0	1.2	0.98	1.0	2.0	1.8
SELENIUM	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SILVER	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SODIUM	mg/L	--	4.3 J	5.9	5.8	2.9	2.9	8.4	8.2
SODIUM, DISSOLVED	mg/L	--	4.3	5.9	5.6	2.6	2.6	8.4	8.0
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			MW-8	MW-20	MW-21L	MW-21M	MW-21M	MW-21S	MW-21S
Sample I.D.:			GW-WP-087	GW-WP-055	GW-WP-025	GW-WP-003	GW-WP-005	GW-WP-013	GW-WP-015
Date Sampled:			06/08/94	06/06/94	06/03/94	06/01/94	06/01/94	06/02/94	06/02/94
							Dupl.		Dupl.
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
ZINC	mg/L	5	2.5	0.070 R	0.084	0.040 J	0.020 J	0.040 J	0.032 J
ZINC, DISSOLVED	mg/L	5	1.9	ND(0.020)	0.034	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			MW-23B	MW-24B	MW-25B	MW-26	MW-26	MW-27B	MW-28B
Sample I.D.:			GW-WP-026	GW-WP-048	GW-WP-007	GW-WP-066	GW-WP-068	GW-WP-010	GW-WP-020
Date Sampled:			06/03/94	06/06/94	06/01/94	06/08/94	06/08/94	06/01/94	06/02/94
							Dupl.		
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	14	12	ND(0.050)	13 J	10 J	170	46
ALUMINUM, DISSOLVED	mg/L	.2	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
ANTIMONY	mg/L	.006	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.30)	ND(0.30)	ND(0.030)	ND(0.030)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
ARSENIC	mg/L	.05	0.074	0.025	0.029	0.012 J	0.0087 J	0.068	0.032
ARSENIC, DISSOLVED	mg/L	--	0.013	0.0097	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BARIUM	mg/L	2	0.17	0.14 R	0.16	0.12	0.11	0.41	0.19
BARIUM, DISSOLVED	mg/L	--	0.11	0.076	0.041	0.059	0.059	0.048	0.037
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.0059
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.005)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	270	160	370	210	170	2000	380
CALCIUM, DISSOLVED	mg/L	--	120	78	85	120	120	88	86
CHROMIUM	mg/L	.1	0.068	0.078	0.23	0.057 J	0.040 J	0.095	0.10
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	0.022	ND(0.010)	0.032	0.012 J	ND(0.010) UJ	0.066	0.049
COBALT, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COPPER	mg/L	1.3	0.027	0.024	0.050	0.020 J	ND(0.020) UJ	0.15	0.080
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.040)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
IRON	mg/L	.3	54	30	68	26	21	140	96
IRON, DISSOLVED	mg/L	.3	8.6	0.51	2.5	0.30	0.27	ND(0.025)	ND(0.025)
LEAD	mg/L	.015	0.051	0.036	0.064	0.027 J	0.020 J	0.11	0.076
LEAD, DISSOLVED	mg/L	.015	0.014	ND(0.0030)	ND(0.0030)	ND(0.0050)	0.020 J	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	99	73	190	86	69	550	180
MAGNESIUM, DISSOLVED	mg/L	--	23	32	52	44	45	42	35
MANGANESE	mg/L	.05	1.4	0.69	2.1	0.76 J	0.58 J	8.6	2.5
MANGANESE, DISSOLVED	mg/L	.05	0.23	0.038	0.16	0.13	0.14	0.019	0.053
MERCURY	mg/L	.002	ND(0.00020)	ND(0.00020)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00020)
MERCURY, DISSOLVED	mg/L	.002	ND(0.00050)	ND(0.00020)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)
NICKEL	mg/L	.1	0.056	0.059	0.17	0.058	0.049	0.15	0.13
NICKEL, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
POTASSIUM	mg/L	--	7.4	5.4	11	6.1	5.0	14	15
POTASSIUM, DISSOLVED	mg/L	--	2.3	1.1	2.2	1.3	1.3	1.3	1.6
SELENIUM	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	0.0069	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SILVER	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SODIUM	mg/L	--	9.8	5.6	6.5	5.0	4.2	16	12
SODIUM, DISSOLVED	mg/L	--	9.2	5.1	6.2	5.0	4.2	13	12
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			MW-23B	MW-24B	MW-25B	MW-26	MW-26	MW-27B	MW-28B
Sample I.D.:			GW-WP-026	GW-WP-048	GW-WP-007	GW-WP-066	GW-WP-068	GW-WP-010	GW-WP-020
Date Sampled:			06/03/94	06/06/94	06/01/94	06/08/94	06/08/94	06/01/94	06/02/94
							Dupl.		
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	0.032	0.023	0.055	0.023	0.019	0.11	0.078
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
ZINC	mg/L	5	0.20 R	0.20	0.29 J	0.18	0.15	0.57 J	0.42
ZINC, DISSOLVED	mg/L	5	ND(0.020)	ND(0.020)	0.020	0.021	0.021	ND(0.020)	ND(0.020)

Table 5.5
Comparison of TAL Metals Detections in Groundwater
With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			MW-29B	MW-30B	MW-31B	MW-32B	MW-33B	MW-33B	P-1
Sample I.D.:			GW-WP-023	GW-WP-032	GW-WP-052	GW-WP-058	GW-WP-074	GW-WP-076	GW-WP-088
Date Sampled:			06/03/94	06/05/94	06/06/94	06/07/94	06/08/94	06/08/94	06/15/94
								Dupl.	
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	6.9	ND(0.050)	1.4	3.3	18 J	17 J	160
ALUMINUM, DISSOLVED	mg/L	.2	0.12	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050) UJ	ND(0.050) UJ	ND(0.050)
ANTIMONY	mg/L	.006	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(3.0)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
ARSENIC	mg/L	.05	0.0084	0.053	ND(0.0050)	ND(0.0050)	0.020	0.017	0.087
ARSENIC, DISSOLVED	mg/L	--	ND(0.0050)	0.011	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BARIUM	mg/L	2	0.10	0.075	0.050	0.068	0.17	0.16	0.72
BARIUM, DISSOLVED	mg/L	--	0.062	0.053 R	0.032	0.055	0.052	0.053	0.062
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.0080 J
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.013	0.015	ND(0.050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	160	240	210	200	350	300	1100
CALCIUM, DISSOLVED	mg/L	--	120	120	100	120	100	100	63
CHROMIUM	mg/L	.1	0.048	0.040	ND(0.010)	0.021	0.12	0.11	0.29
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	0.015	ND(0.010)	ND(0.010)	ND(0.010)	0.025	0.020	0.15
COBALT, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COPPER	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	0.073	0.067	0.52
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
IRON	mg/L	.3	19	1.4	7.6	9.8	52	46	320
IRON, DISSOLVED	mg/L	.3	0.25 R	1.3	ND(0.12) U	0.45	0.047 J	0.025 J	ND(0.025)
LEAD	mg/L	.015	0.021	0.017	0.012	0.012	0.043	0.046	0.29
LEAD, DISSOLVED	mg/L	.015	0.0043	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	71	89	100	96	160	140	380
MAGNESIUM, DISSOLVED	mg/L	--	46	33	50	61	49	49	33
MANGANESE	mg/L	.05	0.93	1.6	0.72	0.61	2.2	1.8	5.7
MANGANESE, DISSOLVED	mg/L	.05	0.45	0.79	0.16	0.18	0.18	0.19	0.028
MERCURY	mg/L	.002	ND(0.00020)	ND(0.00020)	ND(0.00020)	ND(0.00020)	ND(0.00050)	ND(0.00050)	0.00023
MERCURY, DISSOLVED	mg/L	.002	ND(0.00050)	ND(0.00050)	ND(0.0002)	ND(0.00020)	ND(0.00050)	ND(0.00050)	ND(0.00020)
NICKEL	mg/L	.1	0.048	0.043 R	0.012	0.028	0.10	0.10	0.42
NICKEL, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	0.015
POTASSIUM	mg/L	--	6.1	4.5	2.4	2.5	6.8	7.1	46
POTASSIUM, DISSOLVED	mg/L	--	2.1	2.6	2.1	1.4	1.6	1.6	3.4
SELENIUM	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	ND(0.0060)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SILVER	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.10)
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SODIUM	mg/L	--	14	12	4.9	5.6	4.3 J	4.4 J	7.4
SODIUM, DISSOLVED	mg/L	--	14	12	5.0	6.1	3.8	3.8	4.8
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	0.017
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.016)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			MW-29B	MW-30B	MW-31B	MW-32B	MW-33B	MW-33B	P-1
Sample I.D.:			GW-WP-023	GW-WP-032	GW-WP-052	GW-WP-058	GW-WP-074	GW-WP-076	GW-WP-088
Date Sampled:			06/03/94	06/05/94	06/06/94	06/07/94	06/08/94	06/08/94	06/15/94
								Dupl.	
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	0.017	0.015	ND(0.010)	ND(0.010)	0.041	0.036	0.27
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
ZINC	mg/L	5	0.11	0.082 R	0.062 R	0.048 R	0.24	0.21	1.9
ZINC, DISSOLVED	mg/L	5	0.027	ND(0.020)	ND(0.027) U	0.021	ND(0.020)	ND(0.020)	0.020

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-1A	P-2A	P-2A	P-2B	P-2C2	P-4B	P-4C1
Sample I.D.:			GW-WP-044	GW-WP-054	GW-WP-056	GW-WP-079	GW-WP-081	GW-WP-004	GW-WP-006
Date Sampled:			06/08/94	06/07/94	06/07/94	06/08/94	06/08/94	06/01/94	06/01/94
					Dupl.				
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	80	0.89 J	1.2 J	0.42	3.7	57	47
ALUMINUM, DISSOLVED	mg/L	.2	ND(0.050)	ND(0.50)	ND(0.25)	ND(0.10)	ND(0.050)	ND(0.050)	ND(0.050)
ANTIMONY	mg/L	.006	ND(0.60)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
ARSENIC	mg/L	.05	0.056	0.018	0.018	0.022	0.011	0.076	0.040
ARSENIC, DISSOLVED	mg/L	--	ND(0.0050)	0.016	0.015	0.022	0.0087	ND(0.0050)	ND(0.0050)
BARIUM	mg/L	2	0.30	0.81	0.78	0.17	0.083	0.34	0.25
BARIUM, DISSOLVED	mg/L	--	0.085	0.74	0.75	0.17	0.057	0.060	0.047
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.0054	0.0054
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	640	380	370	100	100	840	530
CALCIUM, DISSOLVED	mg/L	--	120	370	380	100	80	110	77
CHROMIUM	mg/L	.1	0.14	0.012 J	0.021 J	ND(0.010)	0.016	0.15	0.12
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	0.089	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	0.063	0.051
COBALT, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COPPER	mg/L	1.3	0.11	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	0.15	0.091
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
IRON	mg/L	.3	170	75	73	2.7	7.9	170	110
IRON, DISSOLVED	mg/L	.3	0.025	74	74	2.2	1.8	ND(0.025)	ND(0.025)
LEAD	mg/L	.015	0.12	ND(0.0030) UJ	0.0083 J	ND(0.0030)	0.0052	0.11	0.091
LEAD, DISSOLVED	mg/L	.015	ND(0.0050)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(.0030)
MAGNESIUM	mg/L	--	300	63	61	50	40	390	220
MAGNESIUM, DISSOLVED	mg/L	--	52	61	62	49	31	58	27
MANGANESE	mg/L	.05	4.4	0.68	0.67	0.065	0.24	4.9	2.9
MANGANESE, DISSOLVED	mg/L	.05	0.16	0.64	0.64	0.052	0.080	0.038	0.11
MERCURY	mg/L	.002	ND(0.00050)	ND(0.00020)	ND(0.00020)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)
MERCURY, DISSOLVED	mg/L	.002	ND(0.00050)	ND(0.00020)	ND(0.00020)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)
NICKEL	mg/L	.1	0.22	0.013 J	0.021 J	ND(0.010)	0.019	0.17	0.13
NICKEL, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	0.010
POTASSIUM	mg/L	--	25	1.6	1.6	2.8	2.2	17	14
POTASSIUM, DISSOLVED	mg/L	--	3.9	1.4	1.4	2.8	1.2	2.4	1.2
SELENIUM	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SILVER	mg/L	.1	0.013	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SODIUM	mg/L	--	11	7.8	7.8	8.8	4.0	67	4.6
SODIUM, DISSOLVED	mg/L	--	11	8.2	8.0	8.8	4.0	77	3.2
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater
With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-1A	P-2A	P-2A	P-2B	P-2C2	P-4B	P-4C1
Sample I.D.:			GW-WP-044	GW-WP-054	GW-WP-056	GW-WP-079	GW-WP-081	GW-WP-004	GW-WP-006
Date Sampled:			06/08/94	06/07/94	06/07/94	06/08/94	06/08/94	06/01/94	06/01/94
					Dupl.				
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	0.13	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	0.11	0.090
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
ZINC	mg/L	5	0.61	0.045 R	0.071 R	ND(0.020)	0.039 R	0.54	0.40
ZINC, DISSOLVED	mg/L	5	0.025	0.045 J	0.022 J	ND(0.020)	0.039	0.027 R	0.022 R

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-4C2	P-4C3	P-5B	P-5C1	P-5C2	P-5C3	P-5C4
Sample I.D.:			GW-WP-008	GW-SC-49	GW-WP-040	GW-WP-057	GW-WP-059	GW-SC-040	GW-SC-44
Date Sampled:			06/01/94	10/19/95	06/05/94	06/06/94	06/06/94	10/18/95	10/19/95
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	0.20	--	ND(0.050)	0.14	0.72	--	--
ALUMINUM, DISSOLVED	mg/L	.2	ND(0.050)	--	ND(0.050)	ND(0.050)	ND(0.050)	--	--
ANTIMONY	mg/L	.006	ND(0.030)	ND(0.060)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.060)	ND(0.060)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.060)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.060)	ND(0.060)
ARSENIC	mg/L	.05	ND(0.0050)	ND(0.010)	0.068	0.0062	ND(0.0050)	ND(0.010)	0.016
ARSENIC, DISSOLVED	mg/L	--	ND(0.0050)	ND(0.010)	ND(0.0050)	0.0053	ND(0.0050)	ND(0.010)	ND(0.010)
BARIUM	mg/L	2	0.065	0.37	0.32	0.080 R	0.065 R	ND(0.20)	ND(0.20)
BARIUM, DISSOLVED	mg/L	--	0.062	ND(0.20)	0.046 R	0.072	0.054	ND(0.20)	ND(0.20)
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	78	--	970	110	90	--	--
CALCIUM, DISSOLVED	mg/L	--	75	--	93	100	85	--	--
CHROMIUM	mg/L	.1	ND(0.010)	ND(0.010)	0.13	ND(0.010)	ND(0.010)	0.036	0.025
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	ND(0.010)	--	0.070	ND(0.010)	ND(0.010)	--	--
COBALT, DISSOLVED	mg/L	--	ND(0.010)	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--
COPPER	mg/L	1.3	ND(0.020)	--	0.18	ND(0.020)	ND(0.020)	--	--
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	--	ND(0.020)	ND(0.020)	ND(0.020)	--	--
IRON	mg/L	.3	2.3	--	0.059 R	3.7	3.5	--	--
IRON, DISSOLVED	mg/L	.3	1.7	--	0.059 R	3.2	2.2	--	--
LEAD	mg/L	.015	0.015	0.0058	0.14	ND(0.0030)	0.0084	0.0053	0.018
LEAD, DISSOLVED	mg/L	.015	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	26	--	430	39	31	--	--
MAGNESIUM, DISSOLVED	mg/L	--	25	--	46	37	29	--	--
MANGANESE	mg/L	.05	0.095	--	5.8	0.12	0.11	--	--
MANGANESE, DISSOLVED	mg/L	.05	0.081	--	0.35	0.092	0.081	--	--
MERCURY	mg/L	.002	ND(0.00050)	ND(0.0002)	ND(0.00020)	ND(0.00020)	ND(0.00020)	ND(0.0002)	ND(0.0002)
MERCURY, DISSOLVED	mg/L	.002	ND(0.00050)	ND(0.0002)	ND(0.00050)	ND(0.00020)	ND(0.00020)	ND(0.0002)	ND(0.0002)
NICKEL	mg/L	.1	ND(0.010)	ND(0.040)	0.16	ND(0.010)	ND(0.010)	ND(0.040)	ND(0.040)
NICKEL, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.040)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.040)	ND(0.040)
POTASSIUM	mg/L	--	1.1	--	15	1.0	1.0	--	--
POTASSIUM, DISSOLVED	mg/L	--	1.0	--	1.5	0.98	0.92	--	--
SELENIUM	mg/L	.05	ND(0.0050)	--	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	--
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	--	ND(0.0060)	ND(0.0050)	ND(0.0050)	--	--
SILVER	mg/L	.1	ND(0.010)	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--
SODIUM	mg/L	--	2.9	--	5.3	4.9	2.9	--	--
SODIUM, DISSOLVED	mg/L	--	2.9	--	3.6	4.8	2.9 R	--	--
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.016)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-4C2	P-4C3	P-5B	P-5C1	P-5C2	P-5C3	P-5C4
Sample I.D.:			GW-WP-008	GW-SC-49	GW-WP-040	GW-WP-057	GW-WP-059	GW-SC-040	GW-SC-44
Date Sampled:			06/01/94	10/19/95	06/05/94	06/06/94	06/06/94	10/18/95	10/19/95
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	ND(0.010)	--	0.12	ND(0.010)	ND(0.010)	--	--
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--
ZINC	mg/L	5	0.027 J	--	0.58	ND(0.020)	ND(0.020)	--	--
ZINC, DISSOLVED	mg/L	5	0.027	--	ND(0.020)	ND(0.020)	0.025 R	--	--

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-7B	P-8A	P-8B	P-8B	P-8C1	P-8C2	P-8C3
Sample I.D.:			GW-WP-017	GW-WP-042	GW-WP-034	GW-WP-036	GW-WP-047	GW-WP-051	GW-SC-028
Date Sampled:			06/02/94	06/08/94	06/05/94	06/05/94	06/05/94	06/06/94	10/17/95
						Dupl.			
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	24	1.0	ND(0.050)	ND(0.050)	ND(0.050)	1.5	--
ALUMINUM, DISSOLVED	mg/L	.2	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	--
ANTIMONY	mg/L	.006	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.060)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.060)
ARSENIC	mg/L	.05	0.026	0.020	0.015	0.013	ND(0.0050)	0.0094	ND(0.010)
ARSENIC, DISSOLVED	mg/L	--	ND(0.0050)	0.012	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.0090	ND(0.010)
BARIUM	mg/L	2	0.25	0.21	0.054	0.050	0.050	0.071 R	ND(0.20)
BARIUM, DISSOLVED	mg/L	--	0.075	0.15	0.031 R	0.031 R	0.048 R	0.034	ND(0.20)
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	400	140	170	180	120	100	--
CALCIUM, DISSOLVED	mg/L	--	130	130	130	130	110	87	--
CHROMIUM	mg/L	.1	0.050	0.013	0.011 J	0.038 J	ND(0.010)	0.020	ND(0.010)
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	0.023	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
COBALT, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
COPPER	mg/L	1.3	0.062	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	--
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	--
IRON	mg/L	.3	57	12	0.66	0.74	3.5	6.2	--
IRON, DISSOLVED	mg/L	.3	0.16	4.4	0.66	0.75	3.5	1.5	--
LEAD	mg/L	.015	0.044	ND(0.0050)	0.022	0.021	ND(0.0030)	0.0034	ND(0.0030)
LEAD, DISSOLVED	mg/L	.015	ND(0.0030)	ND(0.0050)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	200	21	42	44	41	36	--
MAGNESIUM, DISSOLVED	mg/L	--	74	20	23	22	40	30	--
MANGANESE	mg/L	.05	1.8	0.91	1.5	1.5	0.38	0.19	--
MANGANESE, DISSOLVED	mg/L	.05	0.14	0.90	1.2	1.1	0.36	0.074	--
MERCURY	mg/L	.002	ND(0.00020)	ND(0.00050)	ND(0.00020)	ND(0.00020)	ND(0.00020)	ND(0.00020)	ND(0.0002)
MERCURY, DISSOLVED	mg/L	.002	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00020)	ND(0.0002)
NICKEL	mg/L	.1	0.067	0.016	0.028 R	0.042 R	ND(0.010)	0.013	ND(0.040)
NICKEL, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010) UJ	0.014 J	ND(0.010)	ND(0.010)	ND(0.040)
POTASSIUM	mg/L	--	10	3.2	3.8	3.7	1.9	1.5	--
POTASSIUM, DISSOLVED	mg/L	--	2.3	3.1	2.0	1.9	1.9	0.98	--
SELENIUM	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	--
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0060)	ND(0.0060)	ND(0.0060)	ND(0.0050)	--
SILVER	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
SODIUM	mg/L	--	110	28	5.2	5.1	12	4.1	--
SODIUM, DISSOLVED	mg/L	--	110	30	5.2	5.0	12	4.0	--
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.016)	ND(0.016)	ND(0.016)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-7B	P-8A	P-8B	P-8B	P-8C1	P-8C2	P-8C3
Sample I.D.:			GW-WP-017	GW-WP-042	GW-WP-034	GW-WP-036	GW-WP-047	GW-WP-051	GW-SC-028
Date Sampled:			06/02/94	06/08/94	06/05/94	06/05/94	06/05/94	06/06/94	10/17/95
						Dupl.			
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	0.051	ND(0.010)	0.012	0.012	ND(0.010)	ND(0.010)	--
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
ZINC	mg/L	5	0.23	0.036	0.096 R	0.096 R	ND(0.020)	0.039 R	--
ZINC, DISSOLVED	mg/L	5	ND(0.020)	0.032	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	--

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-8C4	P-8C4	P-10	P-11A	P-11A	P-12A	P-13A
Sample I.D.:			GW-SC-30	GW-SC-32	GW-WP-084	GW-SC-010	GW-SC-011	GW-WP-082	GW-WP-080
Date Sampled:			10/19/95	10/19/95	06/08/94	04/26/95	04/26/95	06/08/94	06/08/94
				Dupl.			Dupl.		
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	--	--	19 J	4.4	7.5	34 J	140 J
ALUMINUM, DISSOLVED	mg/L	.2	--	--	ND(0.050) UJ	ND(0.050)	ND(0.050)	ND(0.050) UJ	ND(0.50) UJ
ANTIMONY	mg/L	.006	ND(0.060)	ND(0.060)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	0.034
ANTIMONY, DISSOLVED	mg/L	--	ND(0.060)	ND(0.060)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
ARSENIC	mg/L	.05	ND(0.010)	ND(0.010)	0.020	0.0084	0.013	0.031	0.12
ARSENIC, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.0062	0.0058
BARIUM	mg/L	2	ND(0.20)	ND(0.20)	0.25	0.16	0.19	0.59	2.3
BARIUM, DISSOLVED	mg/L	--	ND(0.20)	ND(0.20)	0.12	0.12	0.12	0.36	0.42
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.0051
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.0089
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.0055
CALCIUM	mg/L	--	--	--	300	150	180	430	1100
CALCIUM, DISSOLVED	mg/L	--	--	--	170	110	110	220	770
CHROMIUM	mg/L	.1	0.011	0.012	0.060	0.040	0.060	0.080	0.32
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	--	--	0.023	0.013	0.018	0.091	0.27
COBALT, DISSOLVED	mg/L	--	--	--	ND(0.010)	ND(0.010)	ND(0.010)	0.021	0.043
COPPER	mg/L	1.3	--	--	0.10	ND(0.060) U	ND(0.057) U	0.11	0.54
COPPER, DISSOLVED	mg/L	1.3	--	--	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
IRON	mg/L	.3	--	--	47	23	33	81	400
IRON, DISSOLVED	mg/L	.3	--	--	ND(0.025)	5.3	5.7	1.8	0.77
LEAD	mg/L	.015	ND(0.0030)	ND(0.0030)	0.035	0.015	0.023	0.13	0.66
LEAD, DISSOLVED	mg/L	.015	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	0.028
MAGNESIUM	mg/L	--	--	--	96	46	58	160	400
MAGNESIUM, DISSOLVED	mg/L	--	--	--	42	28	29	66	200
MANGANESE	mg/L	.05	--	--	4.8	1.5	1.9	7.6	31
MANGANESE, DISSOLVED	mg/L	.05	--	--	3.9	1.2	1.2	1.8	21
MERCURY	mg/L	.002	ND(0.0002)	ND(0.0002)	ND(0.00050)	ND(0.0002)	ND(0.0002)	ND(0.00050)	0.011
MERCURY, DISSOLVED	mg/L	.002	ND(0.0002)	ND(0.0002)	ND(0.00050)	ND(0.0002)	ND(0.0002)	ND(0.00050)	ND(0.00050)
NICKEL	mg/L	.1	ND(0.040)	ND(0.040)	0.082	0.041	0.057	0.23	0.65
NICKEL, DISSOLVED	mg/L	.1	ND(0.040)	ND(0.040)	0.019 R	ND(0.010)	ND(0.010)	0.070 R	0.13
POTASSIUM	mg/L	--	--	--	9.8	4.3	4.8	43	160
POTASSIUM, DISSOLVED	mg/L	--	--	--	5.1	3.8	3.7	39	150
SELENIUM	mg/L	.05	--	--	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.0083
SELENIUM, DISSOLVED	mg/L	.05	--	--	ND(0.0050)	ND(0.0050)	ND(0.0050) U	ND(0.0050)	0.0083
SILVER	mg/L	.1	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SILVER, DISSOLVED	mg/L	.1	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SODIUM	mg/L	--	--	--	17 J	190	180	40 J	160 J
SODIUM, DISSOLVED	mg/L	--	--	--	17	220	210	40	160
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-8C4	P-8C4	P-10	P-11A	P-11A	P-12A	P-13A
Sample I.D.:			GW-SC-30	GW-SC-32	GW-WP-084	GW-SC-010	GW-SC-011	GW-WP-082	GW-WP-080
Date Sampled:			10/19/95	10/19/95	06/08/94	04/26/95	04/26/95	06/08/94	06/08/94
				Dupl.			Dupl.		
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	--	--	0.043	0.015	0.021	0.072	0.25
VANADIUM, DISSOLVED	mg/L	--	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
ZINC	mg/L	5	--	--	0.24	ND(0.010)	ND(0.013)	0.43	2.8
ZINC, DISSOLVED	mg/L	5	--	--	ND(0.020)	ND(0.020)	ND(0.020) U	0.028 R	0.12 R

Table 5.5
Comparison of TAL Metals Detections in Groundwater
With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-14A	P-23C1	P-23C2	P-23C3	P-23C4	P-24A	P-24C1
Sample I.D.:			GW-WP-064	GW-WP-028	GW-WP-030	GW-SC-026	GW-SC-024	GW-WP-046	GW-WP-065
Date Sampled:			06/07/94	06/03/94	06/03/94	10/17/95	10/17/95	06/06/94	06/06/94
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	50	0.37	4.2	--	--	220	0.24
ALUMINUM, DISSOLVED	mg/L	.2	ND(0.10)	ND(0.050)	ND(0.050)	--	--	ND(0.050)	ND(0.050)
ANTIMONY	mg/L	.006	ND(0.60)	ND(0.030)	ND(0.030)	ND(0.060)	ND(0.060)	ND(0.30)	ND(0.030)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.060)	ND(0.060)	ND(0.030)	ND(0.030)
ARSENIC	mg/L	.05	0.077	ND(0.0050)	0.013	0.016	0.010	0.19	0.0052
ARSENIC, DISSOLVED	mg/L	--	0.0081	ND(0.0050)	0.011	0.020	0.012	ND(0.0050)	0.0052
BARIUM	mg/L	2	0.36	0.049	0.12	ND(0.20)	ND(0.20)	0.69	0.064
BARIUM, DISSOLVED	mg/L	--	0.13	0.041	0.10	ND(0.20)	ND(0.20)	0.039	0.062
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.010	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.50)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	620	92	110	--	--	1200	81
CALCIUM, DISSOLVED	mg/L	--	180	90	91	--	--	110	79
CHROMIUM	mg/L	.1	0.10	ND(0.010)	0.18	0.024	ND(0.010)	0.37	ND(0.010)
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	0.062	ND(0.010)	0.011	--	--	0.24	ND(0.010)
COBALT, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--	ND(0.010)	ND(0.010)
COPPER	mg/L	1.3	0.12	ND(0.020)	ND(0.020)	--	--	0.53	ND(0.020)
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.020)	--	--	ND(0.020)	ND(0.020)
IRON	mg/L	.3	120	1.9	10	--	--	610	1.4
IRON, DISSOLVED	mg/L	.3	1.2	0.82	2.0	--	--	0.025	0.97
LEAD	mg/L	.015	0.096	ND(0.0030)	ND(0.0030) UJ	0.0043	ND(0.0030)	0.57	ND(0.0030)
LEAD, DISSOLVED	mg/L	.015	ND(0.0050)	ND(0.0030)	0.016	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	220	38	40	--	--	610	31
MAGNESIUM, DISSOLVED	mg/L	--	45	37	32	--	--	52	31
MANGANESE	mg/L	.05	5.6	0.074	0.24	--	--	12	0.086
MANGANESE, DISSOLVED	mg/L	.05	2.8	0.054	0.075	--	--	0.31	0.076
MERCURY	mg/L	.002	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.0002)	ND(0.0002)	ND(0.00020)	ND(0.00020)
MERCURY, DISSOLVED	mg/L	.002	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.0002)	ND(0.0002)	ND(0.00020)	ND(0.00020)
NICKEL	mg/L	.1	0.15	0.011	0.14	ND(0.040)	ND(0.040)	0.57	ND(0.010)
NICKEL, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	0.036	ND(0.040)	ND(0.040)	ND(0.010)	ND(0.010)
POTASSIUM	mg/L	--	24	1.3	2.3	--	--	34	1.0
POTASSIUM, DISSOLVED	mg/L	--	11	1.2	1.2	--	--	2.3	0.93
SELENIUM	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	--	ND(0.020)	ND(0.0050)
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	--	ND(0.0050)	ND(0.0050)
SILVER	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	--	--	0.012	ND(0.010)
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	--	--	ND(0.010)	ND(0.010)
SODIUM	mg/L	--	27	3.6	4.6	--	--	36	4.1
SODIUM, DISSOLVED	mg/L	--	27	3.5	4.6	--	--	36	4.0
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.040)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-14A	P-23C1	P-23C2	P-23C3	P-23C4	P-24A	P-24C1
Sample I.D.:			GW-WP-064	GW-WP-028	GW-WP-030	GW-SC-026	GW-SC-024	GW-WP-046	GW-WP-065
Date Sampled:			06/07/94	06/03/94	06/03/94	10/17/95	10/17/95	06/06/94	06/06/94
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	0.11	ND(0.010)	ND(0.010)	--	--	0.32	ND(0.010)
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--	ND(0.010)	ND(0.010)
ZINC	mg/L	5	0.59	0.037	0.052	--	--	2.7	0.027 R
ZINC, DISSOLVED	mg/L	5	0.028	ND(0.020)	0.037	--	--	ND(0.020)	ND(0.020)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-24C2	P-24C3	P-24C4	P-25A	P-25A	P-25C2	P-26A
Sample I.D.:			GW-WP-063	GW-SC-47	GW-SC-043	GW-WP-009	GW-SC-006	GW-WP-011	GW-WP-070
Date Sampled:			06/06/94	10/19/95	10/18/95	06/01/94	04/26/95	06/02/94	06/08/94
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	1.2	--	--	2.8	0.053	28	41 J
ALUMINUM, DISSOLVED	mg/L	.2	0.054	--	--	ND(0.10)	ND(0.050)	ND(0.050)	ND(0.050) UJ
ANTIMONY	mg/L	.006	ND(0.030)	ND(0.060)	ND(0.060)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.060)	ND(0.060)	0.033	ND(0.030)	ND(0.030)	ND(0.030)
ARSENIC	mg/L	.05	0.0060	ND(0.010)	0.021	ND(0.0050)	ND(0.0050)	0.017	0.040
ARSENIC, DISSOLVED	mg/L	--	ND(0.0050)	ND(0.010)	ND(0.010)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BARIUM	mg/L	2	0.059	ND(0.20)	ND(0.20)	0.24	0.083	0.16	0.27
BARIUM, DISSOLVED	mg/L	--	0.053	ND(0.20) U	ND(0.20)	0.026	0.047	0.022	0.073
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	77	--	--	230	120	240	340
CALCIUM, DISSOLVED	mg/L	--	76	--	--	220	140	76	140
CHROMIUM	mg/L	.1	0.018	0.012	0.050	0.21	ND(0.010)	0.11	0.090
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	ND(0.010)	--	--	ND(0.010)	ND(0.010)	0.027	0.053
COBALT, DISSOLVED	mg/L	--	ND(0.010)	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COPPER	mg/L	1.3	ND(0.020)	--	--	ND(0.020)	ND(0.020)	0.057	0.11
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	--	--	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
IRON	mg/L	.3	2.7	--	--	5.2	0.21	49	91
IRON, DISSOLVED	mg/L	.3	1.1	--	--	0.064	ND(0.036) U	ND(0.025)	ND(0.025)
LEAD	mg/L	.015	0.0041	ND(0.0030)	0.042	ND(0.0030)	ND(0.0030)	0.055	0.11
LEAD, DISSOLVED	mg/L	.015	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	28	--	--	91	46	100	140
MAGNESIUM, DISSOLVED	mg/L	--	28	--	--	90	54	34	38
MANGANESE	mg/L	.05	0.16	--	--	0.35	0.013	1.4	3.9
MANGANESE, DISSOLVED	mg/L	.05	0.13	--	--	0.15	ND(0.010)	0.097	0.80
MERCURY	mg/L	.002	ND(0.00020)	ND(0.0002)	ND(0.0002)	ND(0.00050)	ND(0.0002)	ND(0.00020)	ND(0.00050)
MERCURY, DISSOLVED	mg/L	.002	ND(0.00020)	ND(0.0002)	ND(0.0002)	ND(0.00050)	ND(0.0002)	ND(0.00050)	ND(0.00050)
NICKEL	mg/L	.1	0.017	ND(0.040)	0.069	0.15	ND(0.010)	0.10	0.13
NICKEL, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.040)	ND(0.040)	0.017	ND(0.010)	0.014	ND(0.010)
POTASSIUM	mg/L	--	1.3	--	--	5.6	3.4	8.5	14
POTASSIUM, DISSOLVED	mg/L	--	0.88	--	--	5.6	3.7	1.4	3.6
SELENIUM	mg/L	.05	ND(0.0050)	--	--	ND(0.0050)	ND(0.0050)	ND(0.0050)	0.0056
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	--	--	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SILVER	mg/L	.1	ND(0.010)	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SODIUM	mg/L	--	4.1	--	--	97	14	4.3	43 J
SODIUM, DISSOLVED	mg/L	--	4.1	--	--	98	23	3.4	49
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater
With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-24C2	P-24C3	P-24C4	P-25A	P-25A	P-25C2	P-26A
Sample I.D.:			GW-WP-063	GW-SC-47	GW-SC-043	GW-WP-009	GW-SC-006	GW-WP-011	GW-WP-070
Date Sampled:			06/06/94	10/19/95	10/18/95	06/01/94	04/26/95	06/02/94	06/08/94
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	ND(0.010)	--	--	ND(0.010)	ND(0.010)	0.041	0.083
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
ZINC	mg/L	5	0.029 R	--	--	0.049	ND(0.020)	0.26	0.34
ZINC, DISSOLVED	mg/L	5	0.038	--	--	0.048	ND(0.021) U	0.022	ND(0.020)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-27A	P-27C1	P-27C2	P-27C3	P-27C4	P-28A	P-28C1
Sample I.D.:			GW-SC-008	GW-WP-012	GW-WP-014	GW-SC-057	GW-SC-53	GW-WP-114	GW-WP-022
Date Sampled:			04/26/95	06/02/94	06/02/94	10/20/95	10/19/95	06/01/91	06/05/94
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	2.1	1.6	ND(0.050)	--	--	19	ND(0.050)
ALUMINUM, DISSOLVED	mg/L	.2	ND(0.050)	ND(0.050)	ND(0.050)	--	--	ND(0.050)	ND(0.050)
ANTIMONY	mg/L	.006	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.060)	ND(0.060)	ND(0.030)	ND(0.030)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.060)	ND(0.060)	ND(0.030)	ND(0.030)
ARSENIC	mg/L	.05	ND(0.0050)	0.0052	ND(0.0050)	ND(0.010)	0.010	0.018	ND(0.0050)
ARSENIC, DISSOLVED	mg/L	--	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.010)	ND(0.0050)	ND(0.0050)
BARIUM	mg/L	2	0.041	0.065	0.041	ND(0.20)	ND(0.20)	0.17	0.041
BARIUM, DISSOLVED	mg/L	--	0.028	0.054	0.040	ND(0.20)	ND(0.20) U	0.095	0.029 R
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.010)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	150	75	78	--	--	610	89
CALCIUM, DISSOLVED	mg/L	--	140	65	77	--	--	99	74
CHROMIUM	mg/L	.1	0.035	0.011	ND(0.010)	ND(0.010)	0.021	0.024	0.033
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--	0.024	ND(0.010)
COBALT, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--	ND(0.010)	ND(0.010)
COPPER	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.020)	--	--	0.047 R	ND(0.020)
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.020)	--	--	ND(0.020)	ND(0.020)
IRON	mg/L	.3	4.6	3.6	2.1	--	--	55	0.16 R
IRON, DISSOLVED	mg/L	.3	ND(0.025)	0.73	2.1	--	--	ND(0.025)	0.13 R
LEAD	mg/L	.015	ND(0.0030)	0.0063	ND(0.0030)	ND(0.0030)	0.014	0.066	ND(0.0030)
LEAD, DISSOLVED	mg/L	.015	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	71	43	26	--	--	250	44
MAGNESIUM, DISSOLVED	mg/L	--	67	40	26	--	--	34	38
MANGANESE	mg/L	.05	0.20	0.20	0.079	--	--	1.4	0.29
MANGANESE, DISSOLVED	mg/L	.05	ND(0.010)	0.11	0.076	--	--	0.60	0.19
MERCURY	mg/L	.002	ND(0.0002)	ND(0.00050)	ND(0.00050)	ND(0.0002)	ND(0.0002)	ND(0.00050)	ND(0.00020)
MERCURY, DISSOLVED	mg/L	.002	ND(0.0002)	ND(0.00050)	ND(0.00050)	ND(0.0002)	ND(0.0002)	ND(0.00050)	ND(0.00050)
NICKEL	mg/L	.1	0.030	0.016	ND(0.010)	ND(0.040)	ND(0.040)	0.032	0.029 R
NICKEL, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.040)	ND(0.040)	ND(0.010)	ND(0.010)
POTASSIUM	mg/L	--	1.5	1.8	1.2	--	--	8.4	1.4
POTASSIUM, DISSOLVED	mg/L	--	0.89	1.2	0.97	--	--	2.8	1.2
SELENIUM	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	--	ND(0.0050)	ND(0.0050)
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	--	ND(0.0050)	ND(0.0060)
SILVER	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	--	--	ND(0.010)	ND(0.010)
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	--	--	ND(0.010)	ND(0.010)
SODIUM	mg/L	--	12	4.6	2.6	--	--	37	6.8
SODIUM, DISSOLVED	mg/L	--	14	4.5	2.6	--	--	34	6.8
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.016)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-27A	P-27C1	P-27C2	P-27C3	P-27C4	P-28A	P-28C1
Sample I.D.:			GW-SC-008	GW-WP-012	GW-WP-014	GW-SC-057	GW-SC-53	GW-WP-114	GW-WP-022
Date Sampled:			04/26/95	06/02/94	06/02/94	10/20/95	10/19/95	06/01/91	06/05/94
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--	0.039	ND(0.010)
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--	ND(0.010)	ND(0.010)
ZINC	mg/L	5	ND(0.038) U	0.055 J	0.033 J	--	--	0.30	0.14 R
ZINC, DISSOLVED	mg/L	5	ND(0.020)	0.027	ND(0.020)	--	--	ND(0.020)	0.026 R

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-28C2	P-28C3	P-29A	P-29C2	P-30C1	P-30C2	P-30C3
Sample I.D.:			GW-WP-024	GW-SC-46	GW-WP-021	GW-WP-049	GW-WP-045	GW-WP-043	GW-SC-027
Date Sampled:			06/03/94	10/19/95	06/03/94	06/05/94	06/05/94	06/05/94	10/17/95
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	17	--	20	ND(0.050)	ND(0.050)	ND(0.050)	--
ALUMINUM, DISSOLVED	mg/L	.2	ND(0.050)	--	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	--
ANTIMONY	mg/L	.006	ND(0.030)	ND(0.060)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.060)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.060)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.060)
ARSENIC	mg/L	.05	0.018	ND(0.010)	0.023	0.0073	ND(0.0050)	0.010	0.011
ARSENIC, DISSOLVED	mg/L	--	ND(0.0050)	ND(0.010)	0.0099	0.0066	ND(0.0050)	0.010	0.011
BARIUM	mg/L	2	0.13	ND(0.20)	0.36	0.071	0.037	0.11	ND(0.20)
BARIUM, DISSOLVED	mg/L	--	0.034	ND(0.20) U	0.23	0.067 R	0.037 R	0.11 R	ND(0.20)
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	210	--	320	94	89	86	--
CALCIUM, DISSOLVED	mg/L	--	87	--	200	89	89	86	--
CHROMIUM	mg/L	.1	0.28	ND(0.010)	0.041	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	0.029	--	0.027	ND(0.010)	ND(0.010)	ND(0.010)	--
COBALT, DISSOLVED	mg/L	--	ND(0.010)	--	0.015	ND(0.010)	ND(0.010)	ND(0.010)	--
COPPER	mg/L	1.3	0.032	--	0.034	ND(0.020)	ND(0.020)	ND(0.020)	--
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	--	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	--
IRON	mg/L	.3	38	--	44	1.1	0.89	2.8	--
IRON, DISSOLVED	mg/L	.3	0.046 R	--	6.4	1.1	0.89	2.5	--
LEAD	mg/L	.015	0.050	ND(0.0030)	0.024	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
LEAD, DISSOLVED	mg/L	.015	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	91	--	130	35	38	28	--
MAGNESIUM, DISSOLVED	mg/L	--	32	--	87	33	38	28	--
MANGANESE	mg/L	.05	1.2	--	1.5	0.21	0.061	0.072	--
MANGANESE, DISSOLVED	mg/L	.05	0.17	--	0.84	0.17	0.056	0.071	--
MERCURY	mg/L	.002	ND(0.00020)	ND(0.0002)	ND(0.00020)	ND(0.00020)	ND(0.00020)	ND(0.00020)	ND(0.0002)
MERCURY, DISSOLVED	mg/L	.002	ND(0.00050)	ND(0.0002)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.0002)
NICKEL	mg/L	.1	0.22	ND(0.040)	0.065	0.011 R	ND(0.010)	0.014 R	ND(0.040)
NICKEL, DISSOLVED	mg/L	.1	0.031	ND(0.040)	0.022	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.040)
POTASSIUM	mg/L	--	5.4	--	9.8	1.3	0.89	0.98	--
POTASSIUM, DISSOLVED	mg/L	--	1.2	--	3.4	1.3	0.89	0.95	--
SELENIUM	mg/L	.05	ND(0.0050)	--	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	--
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	--	ND(0.0050)	ND(0.0060)	ND(0.0060)	ND(0.0060)	--
SILVER	mg/L	.1	ND(0.010)	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
SODIUM	mg/L	--	4.0	--	55	4.3	3.6	4.6	--
SODIUM, DISSOLVED	mg/L	--	4.0	--	55	4.3	3.6	4.6	--
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.016)	ND(0.016)	ND(0.016)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-28C2	P-28C3	P-29A	P-29C2	P-30C1	P-30C2	P-30C3
Sample I.D.:			GW-WP-024	GW-SC-46	GW-WP-021	GW-WP-049	GW-WP-045	GW-WP-043	GW-SC-027
Date Sampled:			06/03/94	10/19/95	06/03/94	06/05/94	06/05/94	06/05/94	10/17/95
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	0.030	--	0.043	ND(0.010)	ND(0.010)	ND(0.010)	--
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
ZINC	mg/L	5	0.16	--	0.17 R	ND(0.020)	ND(0.020)	ND(0.020)	--
ZINC, DISSOLVED	mg/L	5	0.056	--	0.036	ND(0.020)	ND(0.020)	ND(0.020)	--

Table 5.5
Comparison of TAL Metals Detections in Groundwater
With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-30C3	P-30C4	P-31A	P-31C1	P-31C2	P-31C3	P-31C4
Sample I.D.:			GW-SC-029	GW-SC-025	GW-SC-014	GW-WP-067	GW-WP-077	GW-SC-021	GW-SC-020
Date Sampled:			10/17/95	10/17/95	04/27/95	06/07/94	06/08/94	04/27/95	04/27/95
			Dupl.						
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	--	--	0.64	0.064	0.18	0.12	ND(0.050)
ALUMINUM, DISSOLVED	mg/L	.2	--	--	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
ANTIMONY	mg/L	.006	ND(0.060)	ND(0.060)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.060)	ND(0.060)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
ARSENIC	mg/L	.05	ND(0.010)	0.012	0.024	ND(0.0050)	0.011	0.010	0.015
ARSENIC, DISSOLVED	mg/L	--	ND(0.010)	0.010	0.016	ND(0.0050)	0.0085	ND(0.0093) U	ND(0.013) U
BARIUM	mg/L	2	ND(0.20)	ND(0.20)	0.046	0.060	0.11	0.12	0.14
BARIUM, DISSOLVED	mg/L	--	ND(0.20)	ND(0.20)	0.028	0.064	0.11	0.12	0.14
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	--	--	230	96	94	96	90
CALCIUM, DISSOLVED	mg/L	--	--	--	210	100	94	92	88
CHROMIUM	mg/L	.1	ND(0.010)	0.010	0.054	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	--	--	0.030	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT, DISSOLVED	mg/L	--	--	--	0.024	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COPPER	mg/L	1.3	--	--	ND(0.095) U	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
COPPER, DISSOLVED	mg/L	1.3	--	--	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
IRON	mg/L	.3	--	--	4.9	0.70	2.7	3.3	2.4
IRON, DISSOLVED	mg/L	.3	--	--	2.4	0.54	1.8	2.5	2.2
LEAD	mg/L	.015	ND(0.0030)	0.010	0.022	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
LEAD, DISSOLVED	mg/L	.015	ND(0.0030)	ND(0.0030)	0.0044	ND(0.0030)	ND(0.0030)	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	--	--	88	35	35	31	29
MAGNESIUM, DISSOLVED	mg/L	--	--	--	81	37	35	30	28
MANGANESE	mg/L	.05	--	--	8.4	0.047	0.065	0.058	0.061
MANGANESE, DISSOLVED	mg/L	.05	--	--	7.2	0.043	0.064	0.048	0.058
MERCURY	mg/L	.002	ND(0.0002)	ND(0.0002)	ND(0.0002)	ND(0.00020)	ND(0.00050)	ND(0.0002)	ND(0.0002)
MERCURY, DISSOLVED	mg/L	.002	ND(0.0002)	ND(0.0002)	ND(0.0002)	ND(0.00020)	ND(0.00050)	ND(0.0002)	ND(0.0002)
NICKEL	mg/L	.1	ND(0.040)	ND(0.040)	0.080	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
NICKEL, DISSOLVED	mg/L	.1	ND(0.040)	ND(0.040)	ND(0.035) U	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
POTASSIUM	mg/L	--	--	--	2.3	2.8	1.6	1.0	0.97
POTASSIUM, DISSOLVED	mg/L	--	--	--	1.5	2.9	1.5	1.0	1.0
SELENIUM	mg/L	.05	--	--	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SELENIUM, DISSOLVED	mg/L	.05	--	--	0.0066	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
SILVER	mg/L	.1	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SILVER, DISSOLVED	mg/L	.1	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
SODIUM	mg/L	--	--	--	130	9.1	7.0	5.4	5.2
SODIUM, DISSOLVED	mg/L	--	--	--	120	9.7	7.0	5.4	5.2
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	0.010	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-30C3	P-30C4	P-31A	P-31C1	P-31C2	P-31C3	P-31C4
Sample I.D.:			GW-SC-029	GW-SC-025	GW-SC-014	GW-WP-067	GW-WP-077	GW-SC-021	GW-SC-020
Date Sampled:			10/17/95	10/17/95	04/27/95	06/07/94	06/08/94	04/27/95	04/27/95
			Dupl.						
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
VANADIUM, DISSOLVED	mg/L	--	--	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
ZINC	mg/L	5	--	--	0.050 R	0.021 R	0.025 R	ND(0.033) U	ND(0.020) UJ
ZINC, DISSOLVED	mg/L	5	--	--	ND(0.020)	0.021	0.025	0.027	ND(0.020)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-32A	P-32C2	P-34*B	P-34*C1	P-34*C1	P-34*C2	P-34*C3
Sample I.D.:			GW-SC-009	GW-WP-069	GW-WP-062	GW-WP-073	GW-WP-075	GW-WP-071	GW-SC-039
Date Sampled:			04/26/95	06/07/94	06/07/94	06/08/94	06/08/94	06/08/94	10/18/95
							Dupl.		
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	14	ND(0.050)	21	0.0079 J	0.29 J	0.31	--
ALUMINUM, DISSOLVED	mg/L	.2	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.10)	ND(0.050)	--
ANTIMONY	mg/L	.006	ND(0.030)	ND(0.030)	ND(0.30)	ND(0.00060)	ND(0.030)	ND(0.030)	ND(0.060)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.060)
ARSENIC	mg/L	.05	0.018	0.0097	0.018	0.013	0.013	0.0092	ND(0.010)
ARSENIC, DISSOLVED	mg/L	--	ND(0.0050)	0.0093	ND(0.0050)	0.0085 J	0.011 J	0.0068	ND(0.010)
BARIUM	mg/L	2	0.22	0.10	0.22	0.10 J	0.10	0.087	ND(0.20)
BARIUM, DISSOLVED	mg/L	--	0.086	0.10	0.063	0.060	0.068	0.074	ND(0.20)
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.005)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	210	85	420	90	90	92	--
CALCIUM, DISSOLVED	mg/L	--	140	85	150	86	90	88	--
CHROMIUM	mg/L	.1	0.076	ND(0.010)	0.042	0.028	0.029	0.013	ND(0.010)
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
COBALT	mg/L	--	0.040	ND(0.010)	0.025	ND(0.010)	ND(0.010)	ND(0.010)	--
COBALT, DISSOLVED	mg/L	--	0.010	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
COPPER	mg/L	1.3	ND(0.074) U	ND(0.020)	0.046	ND(0.020)	ND(0.020)	ND(0.020)	--
COPPER, DISSOLVED	mg/L	1.3	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	--
IRON	mg/L	.3	35	3.3	47	1.9	1.9	3.1	--
IRON, DISSOLVED	mg/L	.3	0.22	3.3	0.053	0.026 J	0.14 J	1.2	--
LEAD	mg/L	.015	0.064	ND(0.0030)	0.039	ND(0.000060)	ND(0.0030)	ND(0.0050)	0.0038
LEAD, DISSOLVED	mg/L	.015	ND(0.0030)	ND(0.0030)	ND(0.0050)	ND(0.0030)	ND(0.0030)	ND(0.0050)	ND(0.0030)
MAGNESIUM	mg/L	--	82	29	180	37	37	31	--
MAGNESIUM, DISSOLVED	mg/L	--	46	29	54	35	37	30	--
MANGANESE	mg/L	.05	2.0	0.061	1.9	0.20	0.20	0.13	--
MANGANESE, DISSOLVED	mg/L	.05	1.2	0.064	0.24	0.16	0.19	0.11	--
MERCURY	mg/L	.002	ND(0.0002)	ND(0.00020)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.0002)
MERCURY, DISSOLVED	mg/L	.002	ND(0.0002)	ND(0.00020)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.00050)	ND(0.0002)
NICKEL	mg/L	.1	0.075	ND(0.010)	0.066	0.026	0.025	0.015	ND(0.040)
NICKEL, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	0.010	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.040)
POTASSIUM	mg/L	--	4.8	0.94	9.5	1.6	1.8	1.3	--
POTASSIUM, DISSOLVED	mg/L	--	2.3	1.0	1.9	1.5	1.6	1.1	--
SELENIUM	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.00010)	ND(0.0050)	ND(0.0050)	--
SELENIUM, DISSOLVED	mg/L	.05	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	--
SILVER	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	0.012	--
SILVER, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
SODIUM	mg/L	--	18	4.0	27	5.9	6.0	4.3	--
SODIUM, DISSOLVED	mg/L	--	19	4.1	27	5.9	6.0	4.3	--
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.00020)	ND(0.010)	ND(0.010)	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater
With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-32A	P-32C2	P-34*B	P-34*C1	P-34*C1	P-34*C2	P-34*C3
Sample I.D.:			GW-SC-009	GW-WP-069	GW-WP-062	GW-WP-073	GW-WP-075	GW-WP-071	GW-SC-039
Date Sampled:			04/26/95	06/07/94	06/07/94	06/08/94	06/08/94	06/08/94	10/18/95
							Dupl.		
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	0.035	ND(0.010)	0.039	ND(0.010)	ND(0.010)	ND(0.010)	--
VANADIUM, DISSOLVED	mg/L	--	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--
ZINC	mg/L	5	0.18	ND(0.020)	0.32	0.054 R	0.037 R	0.032	--
ZINC, DISSOLVED	mg/L	5	ND(0.026) U	0.021	0.022	0.054 J	ND(0.020) UJ	0.024	--

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-34*C4	RBLK(MW-28B)	RBLK(MW-31B)	RBLK(MW-33B)	RBLK(MW-33B)	RBLK(MW-33B)	RBLK(MW-33B)
Sample I.D.:			GW-SC-035	GW-WP-018	GW-WP-050	GW-WP-072	GW-WP-072R	GW-WP-072S	GW-WP-072Y
Date Sampled:			10/18/95	06/02/94	06/06/94	06/08/94	06/08/94	06/08/94	06/08/94
							Reanal 1		
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	--	ND(0.050)	ND(0.050)	0.058	--	ND(0.050)	--
ALUMINUM, DISSOLVED	mg/L	.2	--	ND(0.050)	ND(0.050)	--	0.073	--	ND(0.050)
ANTIMONY	mg/L	.006	ND(0.060)	ND(0.030)	ND(0.030)	ND(0.030)	--	ND(0.030)	--
ANTIMONY, DISSOLVED	mg/L	--	ND(0.060)	ND(0.030)	ND(0.030)	--	0.043	--	ND(0.030)
ARSENIC	mg/L	.05	0.018	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	--	--
ARSENIC, DISSOLVED	mg/L	--	0.010	ND(0.0050)	ND(0.0050)	--	ND(0.0050)	--	--
BARIUM	mg/L	2	ND(0.20)	ND(0.010)	ND(0.010)	ND(0.010)	--	ND(0.010)	--
BARIUM, DISSOLVED	mg/L	--	ND(0.20)	ND(0.010)	ND(0.010)	--	--	--	ND(0.010)
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	--	--
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	ND(0.0050)	--	--
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	--	--
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	ND(0.0050)	--	--
CALCIUM	mg/L	--	--	0.22	ND(0.20)	--	--	ND(0.20)	--
CALCIUM, DISSOLVED	mg/L	--	--	0.22	ND(0.20)	--	--	--	ND(0.20)
CHROMIUM	mg/L	.1	0.036	ND(0.010)	ND(0.010)	ND(0.010)	--	--	--
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	ND(0.010)	ND(0.010)	--	ND(0.010)	--	--
COBALT	mg/L	--	--	ND(0.010)	ND(0.010)	ND(0.010)	--	ND(0.010)	--
COBALT, DISSOLVED	mg/L	--	--	ND(0.010)	ND(0.010)	--	0.024	--	ND(0.010)
COPPER	mg/L	1.3	--	ND(0.020)	ND(0.020)	ND(0.020)	--	--	--
COPPER, DISSOLVED	mg/L	1.3	--	ND(0.020)	ND(0.020)	--	ND(0.020)	--	--
IRON	mg/L	.3	--	0.052	0.047	--	--	ND(0.025)	--
IRON, DISSOLVED	mg/L	.3	--	ND(0.025)	0.034	--	--	--	ND(0.025)
LEAD	mg/L	.015	0.028	ND(0.0030)	ND(0.0030)	0.0045	--	--	--
LEAD, DISSOLVED	mg/L	.015	ND(0.0030)	ND(0.0030)	ND(0.0030)	--	ND(0.0030)	--	--
MAGNESIUM	mg/L	--	--	ND(0.20)	ND(0.20)	0.40	--	0.31	--
MAGNESIUM, DISSOLVED	mg/L	--	--	ND(0.20)	ND(0.20)	--	--	--	0.21
MANGANESE	mg/L	.05	--	ND(0.010)	ND(0.010)	ND(0.010)	--	ND(0.010)	--
MANGANESE, DISSOLVED	mg/L	.05	--	ND(0.010)	ND(0.010)	--	0.027	--	ND(0.010)
MERCURY	mg/L	.002	ND(0.0002)	ND(0.00020)	ND(0.00020)	ND(0.00050)	--	--	--
MERCURY, DISSOLVED	mg/L	.002	ND(0.0002)	ND(0.00050)	ND(0.00020)	--	ND(0.00050)	--	--
NICKEL	mg/L	.1	ND(0.040)	ND(0.010)	ND(0.010)	ND(0.010)	--	ND(0.010)	--
NICKEL, DISSOLVED	mg/L	.1	ND(0.040)	ND(0.010)	ND(0.010)	--	--	--	ND(0.010)
POTASSIUM	mg/L	--	--	ND(0.20)	ND(0.20)	ND(0.20)	--	ND(0.20)	--
POTASSIUM, DISSOLVED	mg/L	--	--	ND(0.20)	ND(0.20)	--	--	--	ND(0.20)
SELENIUM	mg/L	.05	--	ND(0.0050)	ND(0.0050)	ND(0.0050)	--	--	--
SELENIUM, DISSOLVED	mg/L	.05	--	ND(0.0050)	ND(0.0050)	--	ND(0.0050)	--	--
SILVER	mg/L	.1	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--	--
SILVER, DISSOLVED	mg/L	.1	--	ND(0.010)	ND(0.010)	--	ND(0.010)	--	--
SODIUM	mg/L	--	--	0.28	0.26	0.27	--	--	--
SODIUM, DISSOLVED	mg/L	--	--	0.41	0.26	--	0.27	--	--
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	--	--	--
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	ND(0.010)	ND(0.010)	--	ND(0.010)	--	--

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			P-34*C4	RBLK(MW-28B)	RBLK(MW-31B)	RBLK(MW-33B)	RBLK(MW-33B)	RBLK(MW-33B)	RBLK(MW-33B)
Sample I.D.:			GW-SC-035	GW-WP-018	GW-WP-050	GW-WP-072	GW-WP-072R	GW-WP-072S	GW-WP-072Y
Date Sampled:			10/18/95	06/02/94	06/06/94	06/08/94	06/08/94	06/08/94	06/08/94
							Reanal 1		
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	--	ND(0.010)	ND(0.010)	ND(0.010)	--	--	--
VANADIUM, DISSOLVED	mg/L	--	--	ND(0.010)	ND(0.010)	--	ND(0.010)	--	--
ZINC	mg/L	5	--	ND(0.020)	0.021	0.046	--	--	--
ZINC, DISSOLVED	mg/L	5	--	ND(0.020)	0.021	--	0.044	--	--

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			RBLK(P-1)	RBLK(P-1)	RBLK(P-4C1)	RBLK(P-4C1)	RBLK(P-11A)	RBLK(P-11A)	RBLK(P-24C2)
Sample I.D.:			GW-WP-086	GW-WP-086R	GW-WP-002	GW-WP-002R	GW-WP-085	GW-WP-085R	GW-SC-015
Date Sampled:			06/14/94	06/14/94	06/01/94	06/01/94	06/08/94	06/08/94	04/26/95
				Reanal 1		Reanal 1		Reanal 1	
Parameters	*Units*	*MCL*							
ALUMINUM	mg/L	.2	ND(0.050)	--	ND(0.050)	--	0.10	--	ND(0.050)
ALUMINUM, DISSOLVED	mg/L	.2	--	ND(0.050)	--	ND(0.050)	--	0.071	--
ANTIMONY	mg/L	.006	ND(0.030)	--	ND(0.030)	--	ND(0.030)	--	ND(0.030)
ANTIMONY, DISSOLVED	mg/L	--	--	ND(0.030)	--	ND(0.030)	--	ND(0.030)	--
ARSENIC	mg/L	.05	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)
ARSENIC, DISSOLVED	mg/L	--	--	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)	--
BARIUM	mg/L	2	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)
BARIUM, DISSOLVED	mg/L	--	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--
BERYLLIUM	mg/L	.004	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	--	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)	--
CADMIUM	mg/L	.005	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	--	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)	--
CALCIUM	mg/L	--	ND(0.20)	--	ND(0.20)	--	0.39	--	ND(0.31) U
CALCIUM, DISSOLVED	mg/L	--	--	ND(0.20)	--	0.42	--	ND(0.20)	--
CHROMIUM	mg/L	.1	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)
CHROMIUM, DISSOLVED	mg/L	.1	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--
COBALT	mg/L	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)
COBALT, DISSOLVED	mg/L	--	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--
COPPER	mg/L	1.3	ND(0.020)	--	ND(0.020)	--	ND(0.020)	--	ND(0.020)
COPPER, DISSOLVED	mg/L	1.3	--	ND(0.020)	--	ND(0.020)	--	ND(0.020)	--
IRON	mg/L	.3	ND(0.025)	--	ND(0.025)	--	0.038	--	ND(0.062) U
IRON, DISSOLVED	mg/L	.3	--	ND(0.025)	--	ND(0.025)	--	ND(0.025)	--
LEAD	mg/L	.015	ND(0.0030)	--	ND(.0030)	--	ND(0.0030)	--	ND(0.0030)
LEAD, DISSOLVED	mg/L	.015	--	ND(0.0030)	--	ND(0.0030)	--	ND(0.0030)	--
MAGNESIUM	mg/L	--	ND(0.20)	--	ND(0.20)	--	0.21	--	ND(0.20)
MAGNESIUM, DISSOLVED	mg/L	--	--	ND(0.20)	--	0.21	--	ND(0.20)	--
MANGANESE	mg/L	.05	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)
MANGANESE, DISSOLVED	mg/L	.05	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--
MERCURY	mg/L	.002	ND(0.00050)	--	ND(0.00050)	--	ND(0.0050)	--	ND(0.0002)
MERCURY, DISSOLVED	mg/L	.002	--	ND(0.00050)	--	ND(0.00050)	--	ND(0.00050)	--
NICKEL	mg/L	.1	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--	0.018
NICKEL, DISSOLVED	mg/L	.1	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--
POTASSIUM	mg/L	--	ND(0.20)	--	0.25	--	ND(0.20)	--	ND(0.20)
POTASSIUM, DISSOLVED	mg/L	--	--	ND(0.20)	--	ND(0.20)	--	ND(0.20)	--
SELENIUM	mg/L	.05	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)
SELENIUM, DISSOLVED	mg/L	.05	--	ND(0.0050)	--	ND(0.0050)	--	ND(0.0050)	--
SILVER	mg/L	.1	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)
SILVER, DISSOLVED	mg/L	.1	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--
SODIUM	mg/L	--	0.37	--	0.54	--	0.47	--	0.30 R
SODIUM, DISSOLVED	mg/L	--	--	0.37	--	0.52	--	0.44	--
THALLIUM	mg/L	.002	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			RBLK(P-1)	RBLK(P-1)	RBLK(P-4C1)	RBLK(P-4C1)	RBLK(P-11A)	RBLK(P-11A)	RBLK(P-24C2)
Sample I.D.:			GW-WP-086	GW-WP-086R	GW-WP-002	GW-WP-002R	GW-WP-085	GW-WP-085R	GW-SC-015
Date Sampled:			06/14/94	06/14/94	06/01/94	06/01/94	06/08/94	06/08/94	04/26/95
				Reanal 1		Reanal 1		Reanal 1	
Parameters	*Units*	*MCL*							
VANADIUM	mg/L	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)
VANADIUM, DISSOLVED	mg/L	--	--	ND(0.010)	--	ND(0.010)	--	ND(0.010)	--
ZINC	mg/L	5	ND(0.020)	--	0.10	--	0.023	--	0.032 R
ZINC, DISSOLVED	mg/L	5	--	ND(0.020)	--	0.027	--	ND(0.020)	--

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			RBLK(P-27C4)	RBLK(P-29A)	RBLK(P-29A)	RBLK(P-34*C4)
Sample I.D.:			W-SC-51	GW-WP-019	GW-WP-019R	W-SC-033
Date Sampled:			10/19/95	06/03/94	06/03/94	10/18/95
					Reanal 1	
Parameters	*Units*	*MCL*				
ALUMINUM	mg/L	.2	--	ND(0.050)	--	--
ALUMINUM, DISSOLVED	mg/L	.2	--	--	ND(0.050)	--
ANTIMONY	mg/L	.006	ND(0.060)	ND(0.030)	--	ND(0.060)
ANTIMONY, DISSOLVED	mg/L	--	ND(0.060)	--	ND(0.030)	ND(0.060)
ARSENIC	mg/L	.05	ND(0.010)	ND(0.0050)	--	ND(0.010)
ARSENIC, DISSOLVED	mg/L	--	ND(0.010)	--	ND(0.0050)	ND(0.010)
BARIUM	mg/L	2	ND(0.20)	ND(0.010)	--	ND(0.20)
BARIUM, DISSOLVED	mg/L	--	ND(0.20)	--	ND(0.010)	ND(0.20)
BERYLLIUM	mg/L	.004	ND(0.0050)	ND(0.0050)	--	ND(0.0050)
BERYLLIUM, DISSOLVED	mg/L	.004	ND(0.0050)	--	ND(0.0050)	ND(0.0050)
CADMIUM	mg/L	.005	ND(0.0050)	ND(0.0050)	--	ND(0.0050)
CADMIUM, DISSOLVED	mg/L	.005	ND(0.0050)	--	ND(0.0050)	ND(0.0050)
CALCIUM	mg/L	--	--	ND(0.20)	--	--
CALCIUM, DISSOLVED	mg/L	--	--	--	ND(0.20)	--
CHROMIUM	mg/L	.1	ND(0.010)	ND(0.010)	--	ND(0.010)
CHROMIUM, DISSOLVED	mg/L	.1	ND(0.010)	--	ND(0.010)	ND(0.010)
COBALT	mg/L	--	--	ND(0.010)	--	--
COBALT, DISSOLVED	mg/L	--	--	--	ND(0.010)	--
COPPER	mg/L	1.3	--	ND(0.020)	--	--
COPPER, DISSOLVED	mg/L	1.3	--	--	ND(0.020)	--
IRON	mg/L	.3	--	ND(0.025)	--	--
IRON, DISSOLVED	mg/L	.3	--	--	ND(0.025)	--
LEAD	mg/L	.015	ND(0.0030)	ND(0.0030)	--	ND(0.0030)
LEAD, DISSOLVED	mg/L	.015	ND(0.0050)	--	ND(0.0030)	ND(0.0030)
MAGNESIUM	mg/L	--	--	ND(0.20)	--	--
MAGNESIUM, DISSOLVED	mg/L	--	--	--	ND(0.20)	--
MANGANESE	mg/L	.05	--	ND(0.010)	--	--
MANGANESE, DISSOLVED	mg/L	.05	--	--	ND(0.010)	--
MERCURY	mg/L	.002	ND(0.0002)	ND(0.00020)	--	ND(0.0002)
MERCURY, DISSOLVED	mg/L	.002	ND(0.0002)	--	ND(0.00050)	ND(0.0002)
NICKEL	mg/L	.1	ND(0.040)	ND(0.010)	--	ND(0.040)
NICKEL, DISSOLVED	mg/L	.1	ND(0.040)	--	ND(0.010)	ND(0.040)
POTASSIUM	mg/L	--	--	ND(0.20)	--	--
POTASSIUM, DISSOLVED	mg/L	--	--	--	ND(0.20)	--
SELENIUM	mg/L	.05	--	ND(0.0050)	--	--
SELENIUM, DISSOLVED	mg/L	.05	--	--	ND(0.0050)	--
SILVER	mg/L	.1	--	ND(0.010)	--	--
SILVER, DISSOLVED	mg/L	.1	--	--	ND(0.010)	--
SODIUM	mg/L	--	--	0.31	--	--
SODIUM, DISSOLVED	mg/L	--	--	--	0.31	--
THALLIUM	mg/L	.002	ND(0.010)	ND(0.010)	--	ND(0.010)
THALLIUM, DISSOLVED	mg/L	.002	ND(0.010)	--	ND(0.010)	ND(0.010)

Table 5.5
Comparison of TAL Metals Detections in Groundwater With USEPA Drinking Water Regulations
Four County Landfill Site
Fulton county, Indiana

Location:			RBLK(P-27C4)	RBLK(P-29A)	RBLK(P-29A)	RBLK(P-34*C4)
Sample I.D.:			W-SC-51	GW-WP-019	GW-WP-019R	W-SC-033
Date Sampled:			10/19/95	06/03/94	06/03/94	10/18/95
					Reanal 1	
Parameters	*Units*	*MCL*				
VANADIUM	mg/L	--	--	ND(0.010)	--	--
VANADIUM, DISSOLVED	mg/L	--	--	--	ND(0.010)	--
ZINC	mg/L	5	--	0.045	--	--
ZINC, DISSOLVED	mg/L	5	--	--	ND(0.020)	--

Organic Data Qualifiers

Data Validation Qualifiers

J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

U( ) - The analyte was analyzed for, but was not detected above the reported sample quantitation limit (in parentheses).

R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative idenitification".

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

NS - Not sampled.

Laboratory Qualifiers

J - Indicates that the compound was analyzed for and determined to be present in the sample. The mass spectrum of the compound meets the identification criteria of the method. The concentration listed is an estimated value, which is less than the specified minimum detection limit but is greater than zero.

B - This flag is used when the analyte is found in the blanks as well as the sample. It indicates possible sample contamination and warns the data user to use caution when applying the results of this analyte.

N - Indicates that the compound was analyzed for but not requested as an analyte. Value will not be listed on tabular result sheet.

S - Estimated due to surrogate outliers.

A - This flag indicates that a TIC is a suspected aldol condensation product.

E - Indicates that it exceeds calibration curve range.

D - This flag identifies all compounds identified in an analysis at a secondary dilution factor.

Inorganic and Indicator Parameter Data Qualifiers

Data Validation Qualifiers

U( ) - The analyte was analyzed for but was not detected above the level of the associated value in parentheses. The associated value is the Instrument Detection Limit (IDL) for all analytes except Cyanide (CN) and Mercury (Hg). For CN and Hg, the associated value is the Contract Required Detection Limit (CRDL)

J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample.

R - The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Resampling and reanalyses are necessary to confirm or deny the presence of the analyte.

UJ - A combination of the "U" and the "J" qualifier. The analyte was analyzed for but was not detected above the level of the associated value. The associated value may not accurately or precisely represent the sample detection limit.

NS - Not sampled.

Laboratory Qualifiers

B - The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but was greater than or equal to the Instrument Detection Limit (IDL).

E - The reported value is estimated because of the presence of interference.

M - Duplicate injection precision not met.

N - Spiked sample recovery not within control limits.

S - The reported value was determined by the Method of Standard Additions (MSA).

W - Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while the sample absorbance is less than 50% of spike absorbance.

* - Duplicate analysis not within control limits.

\+ - Correlation coefficient for the MSA is less than 0.995.

TABLE 5.6

SUMMARY OF GROSS ALPHA AND GROSS BETA
ACTIVITY IN GROUNDWATER
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Location	*Gross Alpha (pCi/L)* [1]	*Gross Beta (pCi/L)*
MW-4B	ND(3.0) [2] ± 3.4	ND(4.0) ± 5.1
MW-7B	ND(3.0) ± 3.2	ND(4.0) ± 5.9
MW-8	ND(3.0) ± 2.1	ND(4.0) ± 4.6
MW-21L	ND(3.0) ± 2.1	ND(4.0) ± 5.3
MW-21M	ND(3.0) ± 2.6	6.4 ± 5.3
MW-21S	ND(3.0) ± 2.6	ND(4.0) ± 5.1
MW-21S (Duplicate)	ND(3.0) ± 3.7	7.6 ± 5.8
MW-22	ND(3.0) ± 1.8	ND(4.0) ± 4.8
MW-23B	3.6J [3] ± 3.2	ND(4.0) ± 6.3
MW-23B (Duplicate)	ND(3.0)UJ [4] ± 2.4	ND(4.0) ± 6.2
MW-24L2	ND(3.0) ± 2.4	ND(4.0) ± 4.6
MW-24L2 (Duplicate)	ND(3.0) ± 2.2	ND(4.0) ± 4.7
MW-24S	ND(3.0) ± 2.4	ND(4.0) ± 4.7
MW-26	ND(3.0) ± 1.8	ND(4.0) ± 5.1
MW-27B	4.9 ± 3.7	ND(4.0) ± 6.1
MW-28B	6.6 ± 4.0	4.1 ± 5.8
MW-29B	3.2 ± 2.9	ND(4.0) ± 5.1
MW-31B	ND(3.0) ± 1.2	4.5 ± 5.5
MW-33B	5.7J ± 4.8	4.5 ± 5.9
P-1A	5.0J ± 4.0	ND(4.0) ± 5.9
P-2A	6.4J ± 4.1	9.4 ± 7.0
P-2B	ND(3.0) ± 4.2	8.6 ± 5.9
P-2C2	ND(3.0) ± 2.7	ND(4.0) ± 5.2
P-4C1	ND(3.0) ± 4.0	ND(4.0) ± 5.1
P-4C2	ND(3.0) ± 2.3	ND(4.0) ± 4.9
P-4C2 (Duplicate)	ND(3.0) ± 2.5	ND(4.0) ± 4.7
P-5B	6.6 ± 4.0	ND(4.0) ± 5.4
P-5C2	ND(3.0) ± 2.2	ND(4.0) ± 5.2
P-8A	ND(3.0)UJ ± 3.9	ND(4.0) ± 5.6
P-8B	ND(3.0)UJ ± 2.8	ND(4.0) ± 5.1
P-8B (Duplicate)	ND(3.0)UJ ± 4.4	ND(4.0) ± 5.3
P-8C1	ND(3.0)UJ ± 3.6	ND(4.0) ± 5.2
P-8C2	ND(3.0)UJ ± 2.5	ND(4.0) ± 5.8
P-12A	ND(3.0)UJ ± 5.7	29 ± 8.3
P-23C1	ND(3.0)UJ ± 1.8	ND(4.0) ± 5.3
P-23C2	ND(3.0)UJ ± 2.7	ND(4.0) ± 5.8
P-24A	3.6J ± 3.6	ND(4.0) ± 6.2
P-24C2	ND(3.0) ± 2.6	4.1 ± 5.1
P-27C1	ND(3.0) ± 1.1	ND(4.0) ± 4.2

TABLE 5.6

SUMMARY OF GROSS ALPHA AND GROSS BETA
ACTIVITY IN GROUNDWATER
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Location	*Gross Alpha (pCi/L)* [1]	*Gross Beta (pCi/L)*
P-27C2	ND(3.0) ± 2.0	ND(4.0) ± 4.7
P-28A	5.5 ± 4.1	4.3 ± 6.2
P-28C1	ND(3.0) ± 3.1	ND(4.0) ± 4.6
P-28C2	ND(3.0) ± 2.9	ND(4.0) ± 4.8
P-29A	4.3J ± 8.9	ND(4.0) ± 6.2
P-31C1	ND(3.0) ± 2.3	ND(4.0) ± 5.0
P-31C2	ND(3.0) ± 2.2	ND(4.0) ± 4.8
P-33A	3.6J ± 6.4	5.7 ± 6.2

[1] pCi/L - PicoCuries per Liter
[2] ND( ) - Not detected at quantitation limit stated in parentheses
[3] J - Analyte detected. Associated value is an estimated quantity.
[4] UJ - Not detected. Detection limit is estimated.

TABLE 7.1

SUMMARY OF SURFACE WATER DATA FOR ON- AND OFF-SITE SAMPLING LOCATIONS
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA [1]

Chemical	*On-Site NE Pond/ On-Site NE Pond Drainage* *Range*		*Mean*	*Background*	*Off-Site - North Sector* *S-11*	*S-10*	*S-20*
Aluminum	3.1	5.8	3.9	18	0.36/0.40	2.1	0.21
Arsenic	ND(0.005)	0.012	0.004	0.018	ND(0.005)/ND(0.005)	ND(0.005)	ND(0.005)
Barium	0.03	0.059	.040	0.017	0.058/0.058	0.073	0.051
Calcium	45	73	51	63	89/88	50	63
Iron	2.7	5.1	3.8	55	3.5/3.7	[illegible]	0.65
Lead	0.0031	0.0073	0.0051	0.067	ND(0.003)/ND(0.003)	0.0088	ND(0.003)
Magnesium	9.7	23	13	[illegible]	21/21	13	[illegible]
Manganese	0.049	1.1	0.23	[illegible]	0.65/0.65	[illegible]	0.15
Nickel	ND(0.01)	0.013R	ND	[illegible]	ND(0.01)/ND(0.01)	ND(0.01)	ND(0.01)
Potassium	4.4	6.2	5.6	8.6	5.6/5.5	[illegible]	1.1
Silver	ND(0.01)	0.013	0.0088	ND(0.01)	0.016/ND(0.01)	ND(0.01)	ND(0.01)
Sodium	6.8	33	12.3	3.7	21/21	6.4	2.2
Zinc	0.031	0.052R	0.035	0.29R	0.81/0.83	0.07	ND(0.02)

[1] Table modified from Table 6.1 of the approved Environmental Evaluation Report dated May 3, 1995.

Notes:

= Exceeds mean concentration when compared to On-Site Northeast Pond and On-Site NE Pond Drainage.

= Exceeds mean concentration and maximum concentration concentration when compared to On-Site Northeast Pond and On-Site NE Pond Drainage.

R = Rejected Value

TABLE 7.2

SUMMARY OF SEDIMENT DATA FOR ON- AND OFF-SITE SAMPLING LOCATIONS
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA [1]

Chemical	*On-Site Northeast Pond* Range		*On-Site NE Pond Drainage* S-6	S-7	Mean	*Off-Site - East Sector* S-12	S-13	S-14	*Off-Site - North Sector* S-11	S-10	S-9	S-20	*Off-Site - West Sector* S-18	S-17	S-19
Aluminum	5,800	13,000	10,000	4,100	9,479	10,000	15,000	11,000	11,000/7,700	4,300	1,000	3,000	[illegible]	9,200	9,100
Antimony	ND(3)	ND(30)	ND(30)	ND(30)	ND	ND(3)	ND(150)	ND(150)	ND(300)/ND(300)	ND(300)	ND(30)	ND(3)	[illegible]	[illegible]	[illegible]
Arsenic	4.3	6.5	4.8	2.8	5.2	[illegible]	[illegible]	5.2	6.1/5.7	2.1	0.91	0.6	[illegible]	4.1	[illegible]
Barium	20	39	41	22	31	[illegible]	[illegible]	[illegible]	33/30	[illegible]	16	25	[illegible]	[illegible]	[illegible]
Beryllium	ND(0.50)	0.53	ND(0.5)	0.79	0.45	ND(0.5)	0.79	ND(0.5)	0.67/ND(5)	ND(0.5)	ND(0.5)	ND(0.5)	[illegible]	[illegible]	0.53J
Cadmium	ND(2.5)	ND(2.5)	ND(2.5)	ND(2.5)	ND	ND(2.5)	ND(0.5)	ND(0.5)	ND(5)/ND(5)	ND(0.5)	ND(0.5)	ND(2.5)	[illegible]	[illegible]	[illegible]
Calcium	29,000	52,000	21,000	21,000	33,857	25,000	21,000	9,100	[illegible]	2,200	1,400	7,300	17,000	1,900	4,600
Chromium	13	28	20	8.8	20	[illegible]	[illegible]	20	11/11	7.7	3	6.3	[illegible]	13	16
Cobalt	6.3	10	4.3	9.2	8.1	[illegible]	[illegible]	7.4	7.3/7.5	2	ND(1)	2.7	[illegible]	5.8	8
Copper	14	27	18	12	20	[illegible]	[illegible]	19	13/12	7.4	2.7	ND(10)	16	9.9	14
Iron	13,000	23,000	15,000	8,700	17,529	[illegible]	[illegible]	16,000	17,000/17,000	4,900	1,300	4000	[illegible]	14,000	18,000
Lead	21	28	30	10	23.6	[illegible]	[illegible]	[illegible]	11/11	[illegible]	11	6.5	[illegible]	14	22
Magnesium	15,000	24,000	11,000	12,000	17,214	13,000	13,000	6,600	3,800J/12,000J	550	200	2,600	9,300	1,900	3,600
Manganese	320	400	150	340	334	1,600	670	430	210J/220J	43R	36R	65	410	140	280
Mercury	ND(0.12)	ND(0.12)	ND(0.12)	ND(0.12)	ND	ND(0.12)	ND(0.12)	ND(0.12)	ND(0.12)/ND(0.12)	ND(0.12)	ND(0.12)	ND(0.12)	ND(0.05)	ND(0.05)	ND (0.05)
Nickel	15R	41	17	12R	30	26	27	19	12U/12U	5.5	1.8	8.8R	25	13	18
Potassium	1,500	3,700	2,300	940	2,420	2,000	2,300	2,000	1,700/1,500	410	140	420	1,900J	860J	1,200J
Selinium	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)/ND(0.5)	0.51	ND(0.5)	0.74	ND(0.5)	0.54	0.59
Silver	ND(1)	ND(1)	ND(1)	ND(1)	ND	ND(1)	ND(1)	ND(1)	ND(1)/ND(1)	1.1	1.1	ND(1)	ND(1)	ND(1)	ND(1)
Sodium	100R	170R	71R	120R	71	240R	250R	150R	71R/84R	43R	24R	31R	130R	110R	140R
Thallium	ND(1)	ND(1)	ND(1)	ND(1)	ND	ND(1)	ND(1)	ND(1)	1.1J/ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)
Vanadium	12	22	8.9	19	17	18	26	20	21/16	7.3	1.8	6.9	20	20	19
Zinc	120	150	130	70	123	170	160	120	69/62	40R	21R	33R	140	47R	100
Cyanide	0.57	1.8	ND(0.25)	ND(0.25)	0.73	ND(0.25)	0.31R	ND(0.25)	ND(0.25)/ND(0.5)	ND(0.25)	ND(0.25)	ND(0.25)	ND(0.12)	0.18	0.18

[1] Table modified from Table 6.2 of the approved Environmental Evaluation Report dated May 3, 1995.

Notes:

= Exceeds mean concentration when compared to On-Site Northeast Pond and on-Site NE Pond Drainage.

= Exceeds mean concentration and maximum concentration when compared to On-Site Northeast Pond and on-Site NE Pond Drainage.

J = Associated Value is Estimated

R = Rejected Value

U = Compound was not detected above the level of the associated value due to blank contamination.

TABLE 7.3

SUMMARY OF DETECTION
FREQUENCIES AND COMPARISON TO MEAN BACKGROUND CONCENTRATIONS
ON-SITE SURFACE WATER DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA [1]

	NORTHEAST POND			SOUTHWEST POND			BACKGROUND			
PARAMETER	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	COCs
VOCs (mg/L)										
Acetone	6	1	0.00683	1	0	ND	1	1	0.027	
Dichloromethane	6	2	0.00095	1	0	ND	1	0	ND	
METALS (mg/L)										
Aluminum	6	6	3.875	1	1	0.54	1	1	18	
Antimony	6	0	ND	1	0	ND	1	0	ND	
Arsenic	6	1	0.00408	1	0	ND	1	1	0.018	
Barium	6	6	0.03967	1	1	0.019	1	1	0.17	
Beryllium	6	0	ND	1	0	ND	1	0	ND	
Cadmium	6	0	ND	1	0	ND	1	0	ND	
Calcium	6	6	51.167	1	1	29	1	1	63	
Chromium	6	0	ND	1	0	ND	1	1	0.024	
Cobalt	6	0	ND	1	0	ND	1	1	0.022	
Copper	6	0	ND	1	0	ND	1	0	R	
Iron	6	6	3.7833	1	1	1.1	1	1	55	
Lead	6	6	0.00514	1	1	0.0034	1	1	0.067	
Magnesium	6	6	13.1	1	1	15	1	1	17	
Manganese	6	6	0.2285	1	1	0.057	1	1	1.4	
Mercury	6	0	ND	1	0	ND	1	0	ND	
Nickel	6	0	ND	1	1	0.016	1	1	0.032	
Potassium	6	6	5.567	1	1	2.0	1	1	8.6	
Selenium	6	0	ND	1	0	ND	1	0	ND	
Silver	6	3	0.00883	1	0	ND	1	0	ND	X
Sodium	6	6	12.3	1	1	4.5	1	1	3.7	X
Thallium	6	0	ND	1	0	ND	1	0	ND	
Vanadium	6	0	ND	1	0	ND	1	1	0.039	
Zinc	6	2	0.0352	1	0	ND	1	0	R	X
Cyanide	6	0	ND	1	0	ND	1	0	ND	

1 Modified from Table 3.3 of the approved Environmental Evaluation Report dated May 3, 1995.

TABLE 7.4

SUMMARY OF DETECTION
FREQUENCIES AND COMPARISON TO MEAN BACKGROUND CONCENTRATIONS
OFF-SITE SURFACE WATER DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA[1]

	NORTH SECTOR			BACKGROUND			
PARAMETER	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	COCs
VOCs (mg/L)							
Acetone	3	2	0.0132	1	1	0.027	
Butanone, 2-	3	0	ND	1	1	0.0029	
Carbon Disulfide	3	0	ND	1	1	0.0023	
Dichloromethane	3	0	ND	1	0	ND	
Toluene	3	1	0.0035	1	1	0.0061	
METALS (mg/L)							
Aluminum	3	3	0.8967	1	1	18	
Antimony	3	0	ND	1	0	ND	
Arsenic	3	0	ND	1	1	0.018	
Barium	3	3	0.0607	1	1	0.17	
Beryllium	3	0	ND	1	0	ND	
Cadmium	3	0	ND	1	0	ND	
Calcium	3	3	67.167	1	1	63	
Chromium	3	0	ND	1	1	0.024	
Cobalt	3	0	ND	1	1	0.022	
Copper	3	0	ND	1	0	R	
Iron	3	3	3.717	1	1	55	
Lead	3	1	0.0033	1	1	0.067	
Magnesium	3	3	17	1	1	17	
Manganese	3	3	0.5283	1	1	1.4	
Mercury	3	0	ND	1	0	ND	
Nickel	3	0	ND	1	1	0.032	
Potassium	3	3	4.317	1	1	8.6	
Selenium	3	0	ND	1	0	ND	
Silver	3	1	0.0087	1	0	ND	X
Sodium	3	3	9.867	1	1	3.7	X
Thallium	3	0	ND	1	0	ND	
Vanadium	3	0	ND	1	1	0.039	
Zinc	3	1	0.415	1	0	R	X
Cyanide	3	0	ND	1	0	ND	

NOTES :

-- = Not Available
ND = Not Detected
On-site surface water samples in the east sector and west sector were not tested due to no surface water present.
1 Modified from Table 3.4 of the approved Environmental Evaluation Report dated May 3, 1995.

TABLE 7.5

SUMMARY OF DETECTION
FREQUENCIES AND COMPARISON TO MEAN BACKGROUND CONCENTRATIONS
ON-SITE SEDIMENT DATA
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA [1]

	NORTHEAST POND			SOUTHWEST POND			BACKGROUND			
PARAMETER	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	COCs
VOCs (mg/kg)										
Acetone	7	4	0.0841	1	1	0.031	1	0	ND	
Dichloromethane	7	4	0.0082	1	0	ND	2	1	ND	
Toluene	7	1	0.004	1	0	ND	2	0	ND	
SVOCs (mg/kg)										
Butylbenzyl Phthalate	7	3	0.4029	1	0	ND	1	0	ND	
METALS (mg/kg)										
Aluminum	7	7	9479	1	1	6900	2	2	5450	
Antimony	7	0	ND	1	0	ND	2	0	ND	
Arsenic	7	7	5.193	1	1	5.3	2	2	3.15	
Barium	7	7	31.429	1	1	28	2	2	47	
Beryllium	7	4	0.4471	1	0	ND	2	0	ND	X
Cadmium	7	0	ND	1	0	ND	2	0	ND	
Calcium	7	7	33857	1	1	28000	2	2	800	X
Chromium	7	7	19.971	1	1	13	2	2	7.65	X
Cobalt	7	7	8.107	1	1	8	2	2	3.8	X
Copper	7	7	20	1	1	16	2	2	3.45	X
Iron	7	7	17529	1	1	17000	2	2	5450	X
Lead	7	7	22.643	1	1	16	2	2	13.85	
Magnesium	7	7	17214	1	1	14000	2	2	800	X
Manganese	7	7	333.57	1	1	350	2	2	495	
Mercury	7	0	ND	1	0	ND	2	0	ND	
Nickel	7	5	30.00	1	1	19	2	2	6.55	X
Potassium	7	7	2420	1	1	1400	2	1	390	X
Selenium	7	0	ND	1	0	ND	2	1	0.3075	
Silver	7	0	ND	1	0	ND	2	0	ND	
Sodium	7	1	71.00	1	0	R	2	0	R	X
Thallium	7	0	ND	1	0	ND	2	0	ND	
Vanadium	7	7	17.2	1	1	13	2	2	14.45	
Zinc	7	7	122.86	1	1	81	2	1	40	X
Cyanide	7	5	0.7271	1	0	ND	2	0	ND	

NOTES :

ND = Not Detected
ER-L = Effects Range-Low; a concentration at the low end of reported concentrations in which biological effects have been observed.
ER-M = Effects Range-Moderate; a concentration approximately midway in the range of reported concentrations associated with biological effects.

[1] Modified from Table 3.5 from the approved Environmental Evaluation Report dated May 3, 1995.

TABLE 7.6

SUMMARY OF DETECTION
FREQUENCIES AND COMPARISON TO MEAN BACKGROUND CONCENTRATIONS
OFF-SITE SEDIMENT DATA
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA [1]

	NORTH SECTOR			EAST SECTOR			WEST SECTOR			BACKGROUND			
PARAMETER	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	TOTAL SAMPLES	POSITIVE DETECTS	MEAN	COCs
VOCs (mg/kg)													
Acetone	4	3	0.03375	3	0	ND	3	0	ND	1	0	ND	
Dichloromethane	4	1	0.00575	3	2	0.0058	3	2	0.0055	2	1	0.00875	
4-Methyl-2-Pentanone	4	1	0.0185	3	0	ND	3	0	ND	1	0	ND	
METALS (mg/kg)													
Aluminum	4	4	4412.5	3	3	12000	3	3	9767	2	2	5450	X
Antimony	4	0	ND	3	0	ND	3	3	4.567	2	0	ND	X
Arsenic	4	4	2.3775	3	3	6.133	3	3	5.333	2	2	3.15	
Barium	4	4	30.625	3	3	60	3	3	56.667	2	2	47	
Beryllium	4	1	0.3375	3	1	0.43	3	3	0.58	2	0	ND	X
Cadmium	4	0	ND	3	0	ND	3	3	0.9733	2	0	ND	X
Calcium	4	4	8125	3	3	18367	3	3	7833	2	2	800	X
Chromium	4	4	7.0	3	3	24	3	3	17	2	2	7.65	X
Cobalt	4	4	3.15	3	3	8.833	3	3	7.567	2	2	3.8	X
Copper	4	4	6.9	3	3	24.667	3	3	13.3	2	2	3.45	X
Iron	4	4	6800	3	3	19667	3	3	17667	2	2	5450	X
Lead	4	4	13.125	3	3	32.333	3	3	21	2	2	13.85	
Magnesium	4	4	2812.5	3	3	10867	3	3	4933	2	2	800	X
Manganese	4	4	89.75	3	3	900	3	3	277	2	2	495	
Mercury	4	0	ND	3	0	ND	3	0	ND	2	0	ND	
Nickel	4	2	4.43	3	3	24	3	3	18.667	2	2	6.55	X
Potassium	4	4	642.5	3	3	2300	3	3	1320	2	1	390	X
Selenium	4	2	0.4375	3	0	ND	3	2	0.46	2	1	0.3075	
Silver	4	2	0.8	3	0	ND	3	0	ND	2	0	ND	X
Sodium	4	0	R	3	0	R	3	0	R	2	0	R	
Thallium	4	1	0.65	3	0	ND	3	0	ND	2	0	ND	X
Vanadium	4	4	8.625	3	3	21.333	3	3	19.667	2	2	14.45	
Zinc	4	1	65.5	3	3	150	3	2	120	2	1	40	X
Cyanide	4	0	ND	3	0	ND	3	2	0.14	2	0	ND	

NOTES :

ND = Not Detected
ER-L = Effects Range-Low; a concentration at the low end of reported concentrations in which biological effects have been observed.
ER-M = Effects Range-Moderate; a concentration approximately midway in the range of reported concentrations associated with biological effects.

1 Modified from Table 3.6 from the approved Environmental Evaluation Report dated May 6, 1996.

TABLE 9.1

RECOMMENDED REMEDIAL ACTION OBJECTIVES
OPERABLE UNIT 1
FOUR COUNTY LANDFILL SITE
FULTON COUNTY, INDIANA

Environmental Media	*Remedial Action Objectives*
Soils/Landfill Contents	Prevent direct and dermal contact with, and ingestion of, contaminated soil/landfill contents
Air/Dust	Prevent inhalation
Landfill Gas	Prevent inhalation and explosion
Surface Water	Prevent ingestion, adsorption, and bioconcentration
Sediment	Prevent ingestion, adsorption, and bioconcentration
Leachate and Source-Area Groundwater	Prevent ingestion and direct contact Prevent migration to surface waters