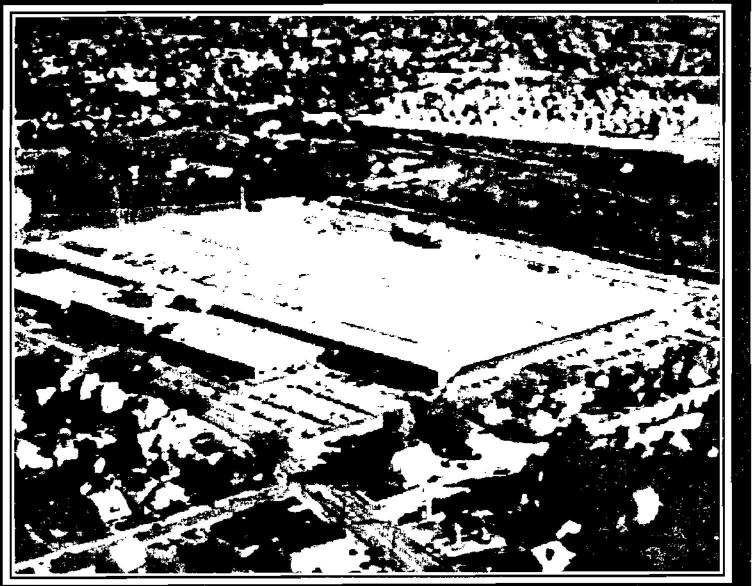
September 1999

RECORD OF DECISION



Air Force Plant 59
Johnson City, New York

United States Air Force
Aeronautical Systems Center
Environmental Restoration Program

INSTALLATION RESTORATION PROGRAM

RECORD OF DECISION

for Air Force Plant 59, Johnson City, New York

Prepared for:

Aeronautical Systems Center (ASC/ENV)
Wright-Patterson Air Force Base, Ohio 45433-7626
and
Air Force Center for Environmental Excellence (AFCEE/ERD)
Brooks Air Force Base, Texas 78235-5363

Prepared by:

Earth Tech, Inc.
1420 King Street, Suite 600
Alexandria, Virginia 22314

Contract No. F41624-94-D-8055
Delivery Order No. 0039

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Preface

This R*ecord of Decision* was written by Earth Tech to identify the selected remedy for volatile organic compounds in groundwater at Air Force Plant 59. It follows guidelines established in the New York State Department of Environmental Conservation (NYSDEC) Division Technical and Administrative Guidance Memorandum entitled *Records of Decision for Remediation of Class 2 Inactive Hazardous Waste Disposal Sites* (NYSDEC, 1989). All work was completed under the Air Force Center for Environmental Excellence (AFCEE) Contract Number F41624-94-D-8055, Delivery Order 0039.

The AFCEE Restoration Team Chief is John McCown. The Aeronautical Systems Center Integrated Product Team Chief is John Doepker. The Earth Tech Project Manager is Dave Parse.

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Vice President
Program Manager

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This Record of Decision was prepared to: 1) certify that the remedy selection was carried out in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act; 2) outline the components and remediation goals of the selected remedy; and 3) provide the public with a consolidated source of information about the history, characteristics, and risks posed by the conditions at the site, as well as a summary of the cleanup alternatives considered, their evaluation, and the rationale behind selection of the remedy.

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TABLE OF CONTENTS

Section **Page No.**

TABLE OF CONTENTS

(Continued)

Section **Page No.**

TABLE OF CONTENTS

(Continued)

Section **Page No.**

TABLE OF CONTENTS

(Continued)

List of Figures

Figure **Page No.**

TABLE OF CONTENTS

(Continued)

List of Tables

LIST OF ACRONYMS AND ABBREVIATIONS

A&E	Architecture and Engineering
AFCEE	Air Force Center for Environmental Excellence
AFP 59	Air Force Plant 59
ARAR	Applicable or Relevant and Appropriate Requirement
AST	Aboveground Storage Tank
BEHP	bis(2-ethylhexyl)phthalate
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-Dichloroethene
1,1-DCA	1,1-Dichloroethane
FS	Feasibility Study
GAC	Granular Activated Carbon
GC	Gas Chromatography
GE	General Electric
gpm	Gallons per Minute
HQ	Hazard Quotient
IRP	Installation Restoration Program
ITIR	Informal Technical Information Report
MCL	Maximum Contaminant Level
mgd	Million Gallons per Day
MOU	Memorandum of Understanding
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSEG	New York State Electric and Gas
O&M	Operation and Maintenance
OHM	OHM Remediation Services Corp.
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
ppb	Parts per Billion
ppm	Parts per Million
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act

LIST OF ACRONYMS AND ABBREVIATIONS

(Continued)

RI	Remedial Investigation
ROD	Record of Decision
SSI	Supplemental Site Inspection
STAS	Shallow Tray Aeration System
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TBC	To Be Considered
1,1,1-TCA	1,1,1-Trichloroethane
TCE	Trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

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Executive Summary

ES.1 Statement of Basis and Purpose

This Record of Decision (ROD) presents the selected remedial action for volatile organic compounds (VOCs) in groundwater at Air Force Plant 59 (AFP 59), chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Current and past activities at AFP 59 have generated a variety of waste products, including cutting, lubricating, and coolant oils; degreasing agents; plating acids, caustics, chromium, and cyanide solutions; and paint residues (United States Air Force [USAF], 1993a). As a result of these activities and potentially activities related to adjacent sites, the groundwater beneath AFP 59 contains VOCs. If not addressed by implementing the remedial action selected in this ROD, the VOCs may present current or potential threats to public health or the environment.

ES.2 Description of the Selected Remedy

The USAF has decided that the preferred method for cleanup of VOCs in groundwater related to historical activities at AFP 59 is the upgrade of the current groundwater treatment system at the Camden Street Well Field. This decision was based on the conclusions presented in the *Remedial Alternatives Informal Technical Information Report* (ITIR) (Earth Tech, 1996a), a condensed version of a feasibility study (FS), and other documents in the administrative record. With the consent of the New York State Department of Environmental Conservation (NYSDEC), the *Remedial Alternatives ITIR* has been substituted for the FS at AFP 59.

The upgrade of the current groundwater treatment system at the Camden Street Well Field will provide the best protection of human health and the environment, will assure all groundwater at the Camden Street Well Field complies with applicable or relevant and appropriate requirements, and is the easiest to implement. Groundwater is currently pumped from Production Well 2 through an air stripper treatment system at approximately 3 million gallons per day, which represents the maximum capacity of both the production well and the groundwater treatment system. The treatment system is designed to remove VOCs from the groundwater prior to distribution. Groundwater discharge from Production Wells 1 and 3 is not currently routed to the air stripper; therefore, these wells cannot operate without pumping untreated groundwater into the distribution system.

The primary function of the system upgrade is to intercept the discharge lines from all three production wells at the Camden Street Well Field and route them to the treatment system. Such routing will provide a measure of safety in the event that one of the production wells becomes inoperable. Therefore, the system upgrade is designed to prevent untreated groundwater from reaching the distribution system.

ES.3 Signature

Robert F. Raggio
Lieutenant General, USAF
Commander
Aeronautical Systems Center

Section 1

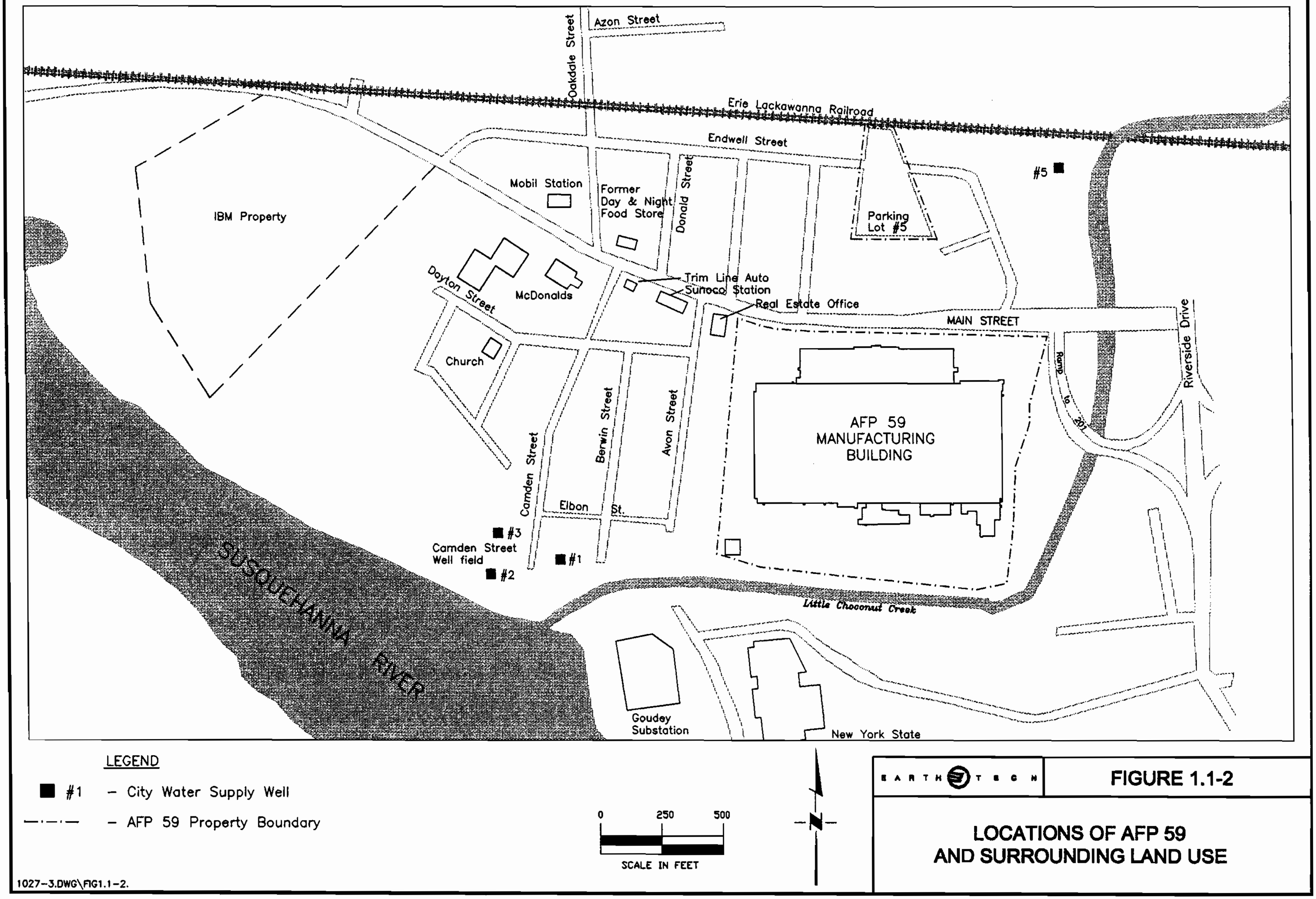


FIGURE 1.1-2

LOCATIONS OF AFP 59 AND SURROUNDING LAND USE

1027-3.DWG\FIG1.1-2.

1.0 Site Location and Description

The United States Air Force (USAF) has decided that the preferred method for cleanup of volatile organic compounds (VOCs) in groundwater related to historical activities at Air Force Plant 59 (AFP 59) is the upgrade of the current groundwater treatment system at the Camden Street Well Field. The remediation objectives presented in this Record of Decision (ROD) address potential risks to human health and the environment. This ROD has been prepared to serve the following three purposes:

- Certify that the remedy selection was carried out in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
- Outline the engineering components and remediation goals of the selected remedy.
- Provide the public with a consolidated source of information about the history, characteristics, and risks posed by the site, as well as a summary of the cleanup alternatives considered, their evaluation, and the rationale behind selection of the remedy.

This ROD contains seven sections. Section 1 provides information on the environmental setting at AFP 59. Section 2 summarizes the environmental investigations that have been conducted at and adjacent to AFP 59. Section 3 summarizes the remedial investigation (RI) and risk assessment conducted at AFP 59. Section 4 provides the remedial action objectives for the selected remedy. Section 5 summarizes the evaluation of all remedial alternatives identified in the *Remedial Alternatives Informal Technical Information Report* (Earth Tech, 1996a). Section 6 provides a comparative evaluation of the two remedial alternatives identified in Section 5 as being capable of satisfying the remedial action objectives outlined in Section 4. Section 7 provides the Responsiveness Summary, a written summary of comments and criticisms generated during the public hearing.

1.1 Installation Location and Description

The following section describes the physical setting of AFP 59, including physiography, geology, hydrogeology, and surface water features.

1.1.1 Physiography and Topography

AFP 59 is located in south-central New York in the Westover area of the Town of Union, Broome County, immediately west of Johnson City. The mailing address is: 600 Main Street, Johnson City, New York 13790. The site is about 3 miles west of the Central Business District of the City of Binghamton and about 4 miles east of the center of the Village of Endicott (Figure 1.1-1). The plant occupies 29.6 acres (including Parking Lot #5 located north of Main Street) and is situated in a highly urbanized area (Figure 1.1-2). Parking Lot #5 was classified as a Category 1 site during the Environmental Baseline Survey conducted by Earth Tech (Earth Tech, 1995), meaning it is an area where no storage, release, or disposal of hazardous substances or petroleum products has occurred

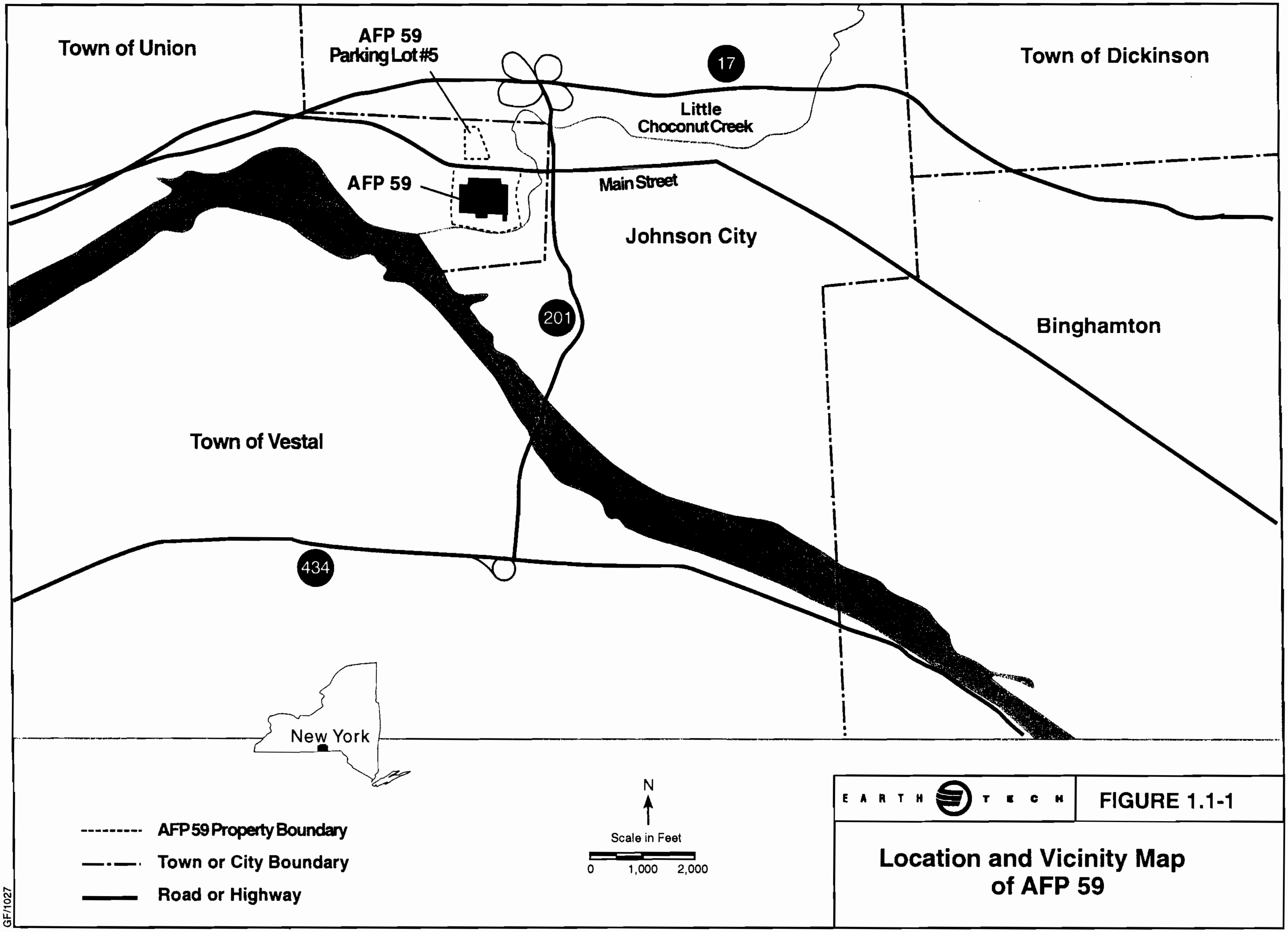
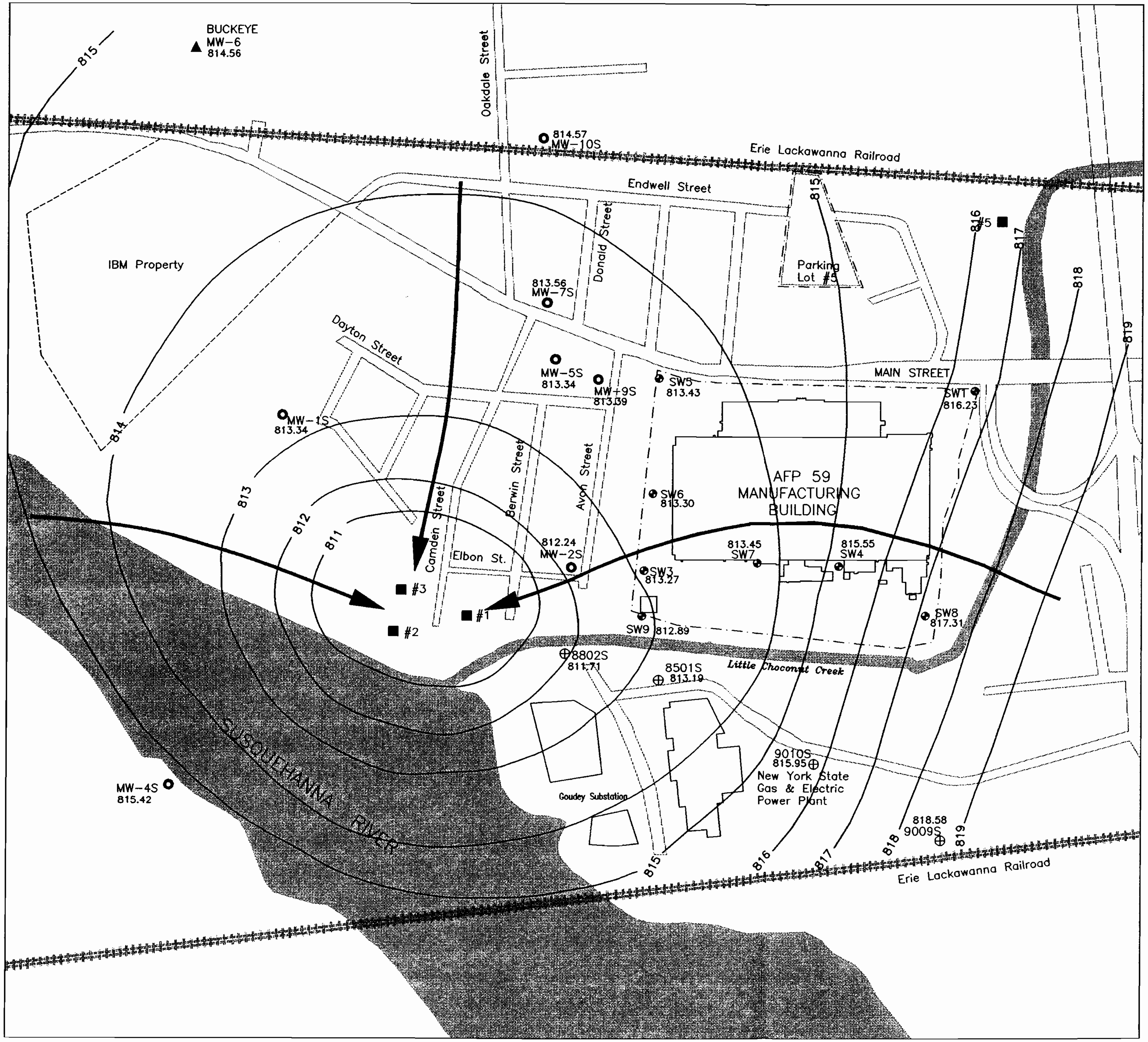


FIGURE 1.1-1

Location and Vicinity Map of AFP 59

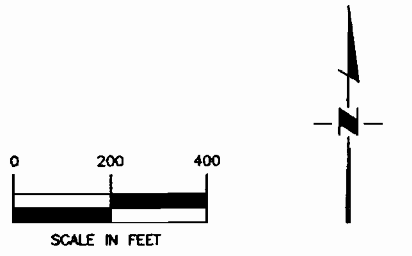


LEGEND

◐SW4	AFP 59 MONITORING WELL
○MW-3S	NYSDEC MONITORING WELL
⊕8507S	NYSEG MONITORING WELL
▲MW-6	MONITORING WELL AT BUCKEYE PIPELINE CO.
■#2	JOHNSON CITY WATER SUPPLY WELL
819.23	GROUNDWATER ELEVATION (FEET MSL)
⁀	GROUNDWATER ELEVATION CONTOUR (FEET MSL)
←	GROUNDWATER FLOW DIRECTION
— · —	AFP 59 BOUNDARY

NOTE: GROUNDWATER ELEVATIONS WERE MEASURED FROM AUGUST 22-24, 1994

CONTOUR INTERVAL = 1FT.

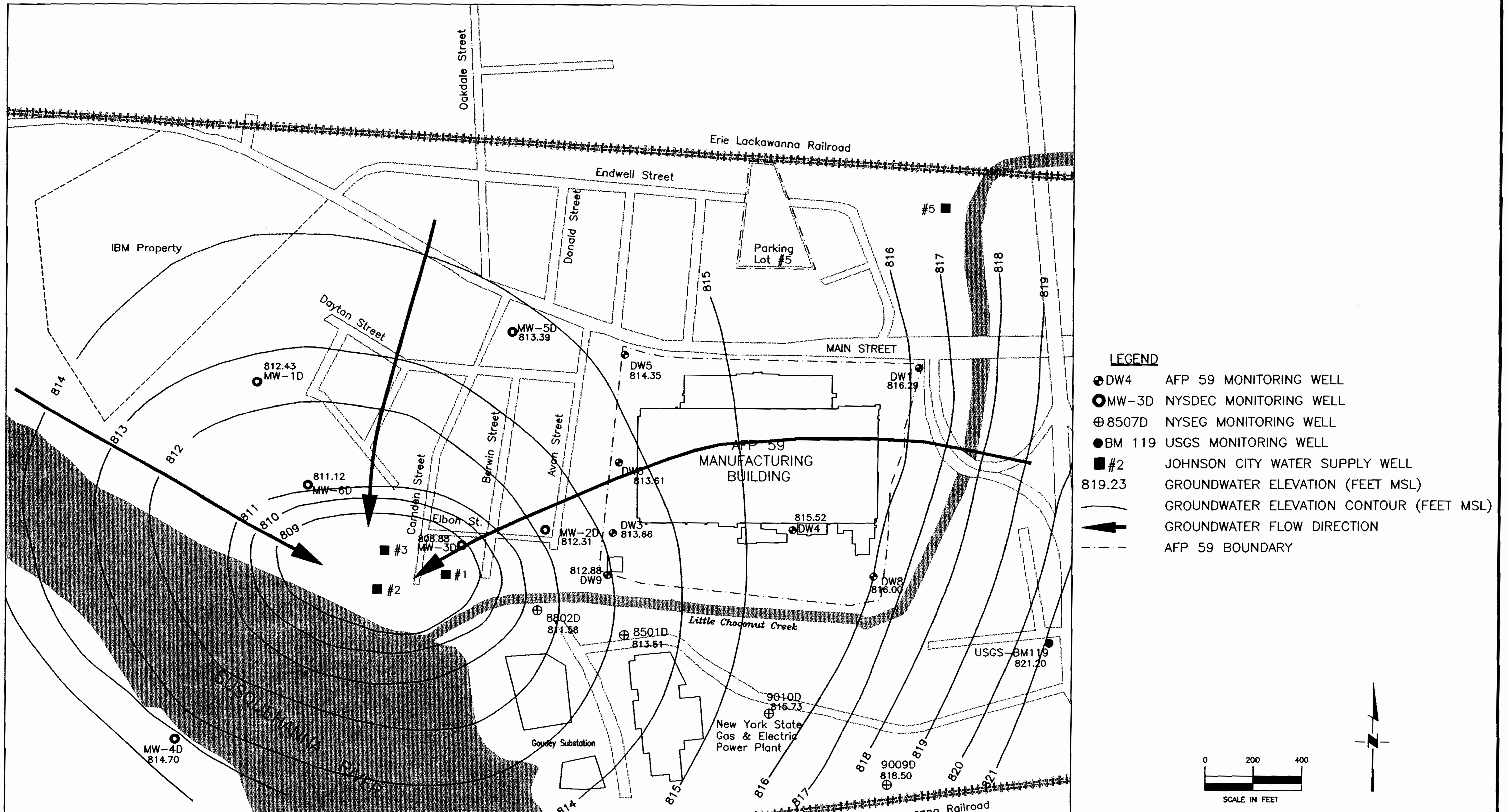


EARTH TECH

FIGURE 1.1-3

POTENTIOMETRIC SURFACE AND GROUNDWATER FLOW (SHALLOW WELLS) IN THE VICINITY OF AFP 59 AUGUST 22-24, 1994

1027-4.DWG\FIG1.1-3



EARTH TECH

FIGURE 1.1-4

POTENTIOMETRIC SURFACE AND GROUNDWATER FLOW (DEEP WELLS) IN THE VICINITY OF AFP 59
AUGUST 22-24, 1994

1027-4.DWG\FIG1.1-4

(including no migration of these substances from adjacent areas). Consequently, Parking Lot #5 was not investigated during the RI and is not included in this ROD.

The plant is bounded on the east and south by Little Choconut Creek (see Figure 1.1-2). Areas adjacent to AFP 59 include residential, industrial, and commercial properties. In general, the areas immediately west and north of the plant are residential but include several commercial- and industrial-zoned properties. Immediately east of the plant are unzoned areas, areas zoned for conservation, and residential and commercial properties. Immediately south of the plant is the New York State Electric and Gas (NYSEG) power plant, which is zoned as heavy industrial. The only school within 0.5 miles of AFP 59 is the C.F. Johnson Junior High School, which is located approximately 2,000 feet east-southeast of the plant. The nearest hospital is the Wilson Memorial Hospital, which is located approximately 3,000 feet east-southeast of the plant. The Camden Street Well Field, an important source of water for Johnson City, is located approximately 1,000 feet southwest of the plant.

AFP 59 is located within the Appalachian Plateau physiographic province, which is characterized by relatively undisturbed, nearly horizontal sedimentary rocks bisected by stream and river valleys. The topography of the installation is nearly flat and ranges in elevation from 830 to 840 feet above mean sea level (USAF, 1993a).

1.1.2 Geology

The subsurface geology in the vicinity of AFP 59 generally consists of approximately 75 to 100 feet of stratified, unconsolidated glacial deposits overlying glacial till and shale and siltstone bedrock. The lithologic units found in the vicinity of AFP 59 are described below in order from youngest to oldest.

FILL. The fill is composed of natural sand and gravel deposits, in addition to some garbage and ashes. The fill has been placed into natural and excavated depressions at thicknesses of 5 to 20 feet.

ALLUVIUM. Alluvium occurs as flood plain deposits and alluvial fans. The flood plain deposits consist of approximately 15 feet of silt to fine sand that commonly overlie and are interbedded with 10 to 15 feet of a noncalcareous sandy pebble-cobble gravel. The alluvial fans are composed of 10 to 20 feet of silty, noncalcareous gravel. In some locations, older alluvial deposits interfinger with postglacial lakebeds.

POSTGLACIAL LAKEBEDS. Postglacial lake beds formed in kettle holes and are scattered throughout the area. Water entering into the lakes from bordering streams and flood episodes deposited very fine sand, silt and clay. Sediment thicknesses in some postglacial lakebeds have been measured to be as much as 80 feet.

GLACIAL OUTWASH. Glacial outwash deposits are composed of 10 to 40 feet of sandy-pebble gravel and pebbly coarse to fine sand. Trace to moderate amounts of highly calcareous silts are also present. In some areas, the thickness of this deposit reaches 100 feet. The material for the coarse sediments was derived from the Chenango Valley and has been termed "bright" because 20 to 40 percent of these materials are colorful.

FINE-GRAINED GLACIAL DEPOSITS. Fine-grained glacial deposits are composed of silt, silty clay, and silty-fine sand and may be a significant barrier to vertical groundwater flow. The thickness of the fine-grained glacial deposits varies from 0 to 80 feet. The deposits, generally interpreted as glacial lakebed deposits, typically occur as lenses of limited areal extent; however, extensive deposits are present west of Johnson City. Fine-grained glacial deposits typically overlie ice-contact deposits, but have been found in some areas to interfinger with or overlie glacial outwash deposits.

ICE-CONTACT DEPOSITS. Ice-contact deposits in the Susquehanna River Valley are composed of sandy pebble to cobble gravel and pebbly sand with slight to abundant quantities of silt. The thickness of the ice-contact deposits varies from 0 to 100 feet. The ice-contact deposits are locally overlain by either glacial lakebed deposits or outwash deposits. The coarse sediments were derived from local olive-gray colored bedrock; therefore, the term "drab" has been applied.

GLACIAL TILL. The glacial till deposits are the oldest formation above bedrock and were deposited directly by glacial ice. These deposits range from 1 to 2 feet thick on steep slopes and are tens of feet thick beneath hillsides. The glacial till is a tough, compact, unsorted silt, clay, sand, and gravel.

BEDROCK. Shales and siltstones make up the bedrock material that underlies the glacial deposits throughout southern New York. These strata originated from the uplift of the Appalachian Range during the Acadian Orogeny (Devonian Period, 345 to 410 million years ago), with the clastic source area lying to the east. Large volumes of sediment eroded from the uplifted area were deposited in the shallow oceanic environment lying to the west of the growing mountain range. These sediments accumulated to form a thick sequence now known as the Catskill Clastic Wedge. Subsequent uplifting from a later orogenic event exposed the clastic bedrock to erosional forces, shaping the material to preglaciation form.

1.1.3 Hydrogeology

AFP 59 is located on the western edge of the Clinton Street-Ballpark Aquifer. The Clinton Street-Ballpark Aquifer is a highly productive aquifer, yielding 400 to 2,290 gallons per minute (gpm), that underlies 3 square miles within the Greater Binghamton area (CH_2M Hill, 1984). The formations that make up the Clinton Street-Ballpark Aquifer are the glacial outwash deposits and the underlying ice-contact deposits, with occurrences of fine-grained glacial deposits that may locally restrict vertical groundwater movement. The aquifer is locally separated into two zones (shallow and deep) in areas where the fine-grained glacial deposits are present. In general, the shallow zone of the aquifer is comprised of glacial outwash deposits and the deep zone of the aquifer is comprised of ice-contact deposits.

The Johnson City Water Department maintains seven deep production wells (Production Wells 1 through 7) that supply potable water to the Village of Johnson City as well as to a portion of the Town of Union that lies north of the village (URS Consultants, Inc., 1992). Three of the Johnson City Water Department municipal production wells are located southwest of AFP 59 at the Camden Street Well Field, and one municipal production well is located northeast of AFP 59 (see Figure 1.1-2). The overall capacity of the seven production wells is 8 million gallons per day (mgd). The current capacity of the 3 production wells at the Camden Street Well Field is 3 mgd.

Figures 1.1-3 and 1.1-4 show potentiometric maps of the shallow and deep zones of the aquifer in the vicinity of AFP 59 that were created from groundwater level data collected in August 1994. The potentiometric surface and groundwater flow directions in both the shallow and deep zones of the aquifer indicate that groundwater flow is radial toward the Camden Street Well Field in the vicinity of AFP 59 and that groundwater flow is in a generally westerly to southwesterly direction beneath AFP 59.

1.1.4 Surface Water

Two surface water bodies are within 1,000 feet of AFP 59: Little Choconut Creek and the Susquehanna River (see Figure 1.1-2). Little Choconut Creek borders the plant to the east and south. The creek flows to the west and converges with the Susquehanna River approximately 1,000 feet west of the southwest corner of the plant. The United States Army Corps of Engineers considers Little Choconut Creek to be State waters for purposes of permitting under Section 404 of the Clean Water Act. The United States Fish and Wildlife Service classifies the stream as an upper perennial riverine wetland with an unconsolidated bottom that is permanently flooded. In addition, there are areas of palustrine forested wetlands on islands and along the margins of the Susquehanna River downstream from the confluence with Little Choconut Creek.

No municipal users of surface water have been reported within 3 miles downstream of AFP 59 (CH_2M Hill, 1984). The City of Binghamton is the nearest municipal user of water from the Susquehanna River, and the surface water intakes are approximately 5 miles upstream of AFP 59.

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Section 2

2.0 Site History

AFP 59 is a government-owned, contractor-operated facility. Remington Rand, Inc., the first manufacturer to occupy the plant, produced aluminum aircraft propellers at the plant from 1942 to 1945. The plant closed at the end of World War II and remained idle until April 1949, when it reopened as an aircraft controls manufacturing facility. General Electric (GE) Aerospace was contracted to operate the facility and to direct manufacturing (primarily of parts for electro-mechanical aircraft control systems). Martin Marietta Aircraft Controls acquired GE Aerospace in 1993 and took over the operation of the facility and the manufacturing activities. Lockheed Martin Control Systems currently manufactures flight control, laser, weapons control, internal navigation, and guidance systems at AFP 59.

AFP 59 is listed as a Class 2 Site on the NYSDEC List of Inactive Hazardous Waste Disposal Sites (Site Code 7-04-020). A Class 2 Site is categorized as posing a "significant threat to the public health or environment - action required." AFP 59 is not on the National Priorities List and is not under a Federal Facility Agreement.

Current and past activities at AFP 59 have generated a variety of waste products, including cutting, lubricating, and coolant oils; degreasing agents; plating acids, caustics, chromium, and cyanide solutions; and paint residues (USAF, 1993a).

At the Johnson City municipal well field (i.e., the Camden Street Well Field), 1,1,1-trichloroethane (1,1,1-TCA) has been detected at concentrations exceeding the New York State drinking water standard. The aquifer has been designated a sole-source aquifer by the United States Environmental Protection Agency (USEPA) because it supplies drinking water to the area's 128,000 residents. The NYSDEC conducted a source investigation to determine potential sources of VOCs in groundwater, and Johnson City installed an air stripper. The USAF voluntarily entered into a Memorandum of Understanding (MOU) with Johnson City to provide partial financial support (subject to the availability of funds) for the operation of the air stripper. However, the MOU does not constitute a finding by the State of New York or Johnson City that AFP 59 is a source of the VOCs (USAF, 1993a).

2.1 On-site Investigations

The USAF initiated an Installation Restoration Program (IRP) investigation at AFP 59 in March 1984. Several IRP sites and areas of concern have been identified and investigated at AFP 59 (see Figure 2.1-1) during the IRP investigations conducted at the site. These investigations include: an IRP Phase I Records Search conducted by CH_2M Hill in 1984; a Phase II Stage I Confirmation/Quantification Study conducted by Fred C. Hart Associates, Inc., in 1988; a Phase II Stage II Confirmation/Quantification Study conducted by Argonne National Laboratory in 1994; and the RI conducted by Earth Tech. As illustrated in Figure 2.1-1, potential source areas include the Former Underground Waste Oil Storage Tanks, the Drum Storage Area, the Plating Room, the Storage Tank and Settling Pond, the Former Gasoline Storage Tank, the JP-4 Piping Area, and the

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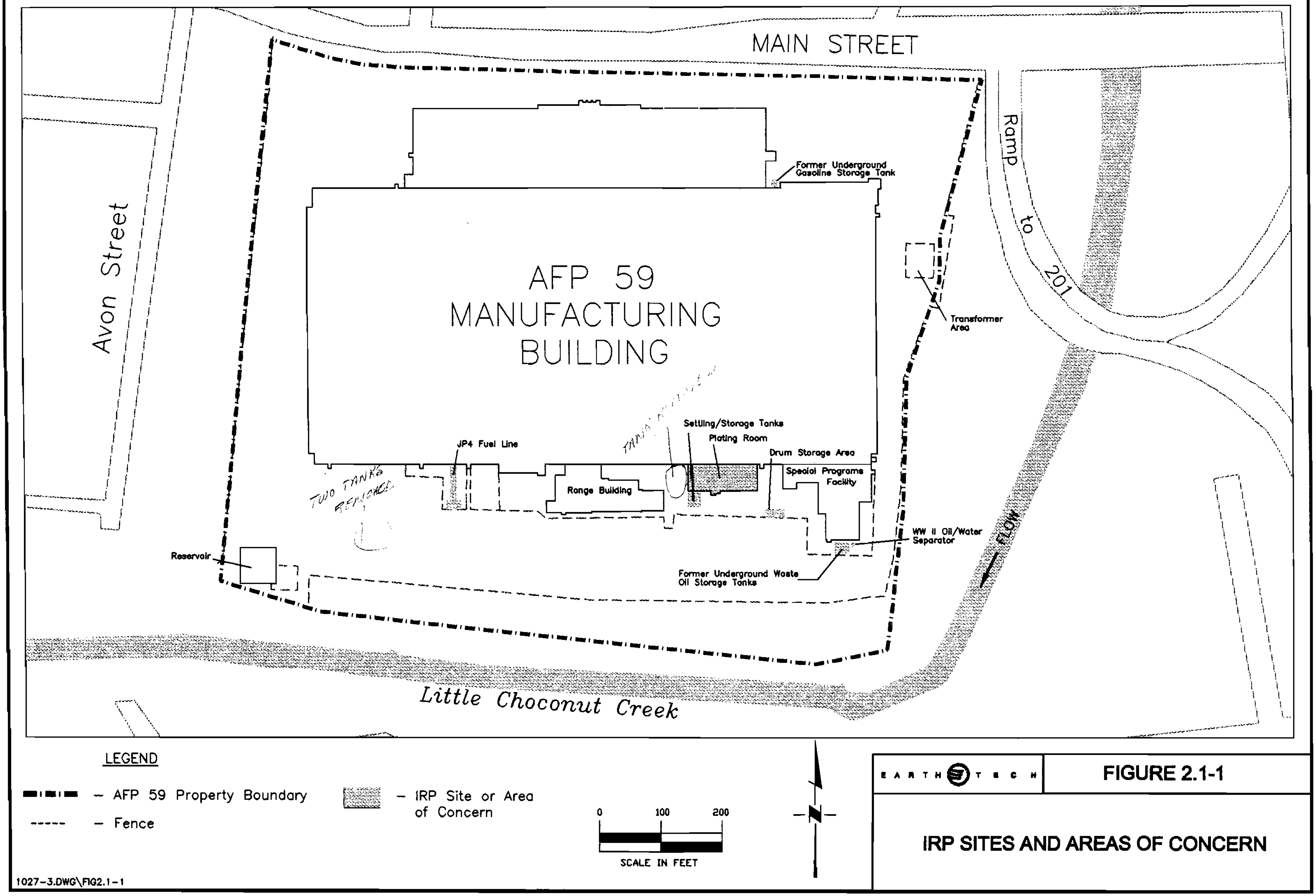

EARTH TECH

FIGURE 2.1-1

IRP SITES AND AREAS OF CONCERN

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Abandoned Oil/Water Separator. Seven additional soil investigations related to the closure of the Storage Tank/Settling Pond and/or the Plating Room have been conducted outside the IRP process in coordination with the NYSDEC. Table 2-1.1 provides a chronological history of all investigations that have been conducted at AFP 59.

2.1.1 Summary of IRP Investigations

With the exception of the RI conducted by Earth Tech, the results of the IRP investigations are summarized below. The results of the RI are summarized in Section 3.

PHASE I RECORDS SEARCH (CH2M HILL, 1984). CH2M Hill conducted the Phase I Records Search to compile all information on hazardous materials use and disposal practices and to identify potential problems associated with those practices. The results of the investigation identified and prioritized sites posing a potential threat to public health or the environment through contaminant migration, and recommended that field sampling and laboratory analyses be performed to confirm or deny the presence of environmental contamination at AFP 59. The two sites identified during the Phase I study were the Underground Waste Oil Storage Tanks and the Drum Storage Area (see Figure 2.1-1).

PHASE II, STAGE 1 INVESTIGATION (FRED C. HART ASSOCIATES, 1988). Fred C. Hart Associates, Inc. performed the Phase II, Stage 1 Confirmation/Quantification Study to provide a characterization of the site as well as areas of suspected contamination noted during the Phase I investigation. Additionally, the Plating Room was identified as a potential source of contamination during the Phase II, Stage 1 investigation. The investigation included the installation of three monitoring wells, collection of groundwater samples from the monitoring wells and the on-site production well, and collection of soil samples.

Groundwater samples were analyzed for VOCs, metals, total petroleum hydrocarbons (TPH), and cyanide. The following organic compounds were detected in the groundwater sample from the on-site production well: 1,1-dichloroethane (1,1-DCA) (16 micrograms per liter [µg/L]), trans-1,2-dichloroethene (66 µg/L), 1,1,1-TCA (9 µg/L), and trichloroethene (TCE) (11 µg/L). TCE was also detected in the groundwater sample from monitoring well SW3 at a concentration of 6 µg/L. No VOCs were detected in the groundwater samples from monitoring wells SW1 or SW2. TPH was detected only in the groundwater sample from the on-site production well at a concentration of 0.6 milligrams per liter (mg/L). Lead was detected in all groundwater samples, with the highest concentration of 0.30 mg/L in the groundwater sample from monitoring well SW1. Arsenic, barium, and cadmium were detected in groundwater samples at low concentrations. Cyanide was not detected in any of the groundwater samples.

Total chromium was detected in all soil samples analyzed for chromium at concentrations ranging from 5.43 milligrams per kilogram (mg/kg) to 67.4 mg/kg. In general, barium and cadmium were found at higher concentrations in the deeper soil samples from monitoring well boreholes (maximum concentrations of 0.52 and 0.06 mg/L, respectively) than in the shallow soil borings south of the Plating Room (maximum concentrations of 0.19 and nondetect, respectively). Lead was detected in 14 of 15 soil samples; the highest concentrations of lead were detected at the SW1 background sample. TPH was detected in only one sample.

Table 2.1-1
Chronological History of Investigations at AFP 59

Date; Contractor	Investigation
1984; CH2M Hill	Phase I Records Search
1988; Hart	Phase II, Stage I Confirmation/Quantification Study
1991; Marcor	Settling Tank/Spent Plating Storage Tank Soil Study
1992; OHM Remediation Services Corp.	Storage Tank Soil Investigation
1993; OHM Remediation Services Corp.	Plating Room Soil Investigation
1993; OHM Remediation Services Corp.	Storage Tank/Settling Pond Soil Investigation
1994; Argonne National Laboratory	Phase II Stage II Confirmation/Quantification Study; Supplemental Site Inspection
1994; OHM Remediation Services Corp.	Plating Room Soil Investigation
1994; Blasland, Bouck & Lee	Plating Room Soil Investigation
1995; Blasland, Bouck & Lee	Settling Pond Investigation
1996; Earth Tech	Remedial Investigation

SUPPLEMENTAL SITE INSPECTION (ARGONNE NATIONAL LABORATORY, 1994). Argonne National Laboratory conducted the IRP Phase II, Stage 2 Confirmation/ Quantification Study, a Supplemental Site Inspection (SSI), to determine whether previous plant activities had contributed to, or might contribute to, groundwater contamination. During the SSI, an additional 14 monitoring wells were installed: deep wells next to existing shallow monitoring wells SW1 and SW3; a shallow well next to the existing onsite production well; five well pairs consisting of one deep and one shallow monitoring well; and an intermediate-depth well at one well pair location. Groundwater samples were collected from 13 of the 14 new monitoring wells (a sample was not collected from the intermediate-depth well), two existing shallow wells (SW1 and SW3), and the onsite production well. A regional background groundwater sample was collected from Johnson City municipal well #7 (Argonne National Laboratory, 1994).

Six soil borings were drilled and sampled, and 18 hand auger soil samples were collected during the SSI. Additionally, soil samples were collected from eight of the well boreholes. Soil samples from the well boreholes were taken from the shallow well in each well pair; if a deep well was drilled next to an existing shallow well, the soil sample was taken from the deep well. One background surface soil sample was collected in the southwest corner of AFP 59. Three surface water samples and three sediment samples were collected from Little Choconut Creek, and water samples were collected from Outfalls 001 and 002 (Argonne National Laboratory, 1994).

During the SSI, all groundwater, creek surface water, and outfall water samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), and inorganics. Chlorinated compounds with elevated concentrations included: 1,1-DCA (5 μg/L) at monitoring well SW3; 1,1,1-TCA (15.2 μg/L) at monitoring well SW9; and TCE (97 μg/L) at monitoring well SW4. These wells are all located along the southern portion of AFP 59. No SVOCs or pesticides/PCBs were detected in the groundwater samples.

Aluminum, barium, calcium, iron, magnesium, manganese, potassium, and sodium were detected in all groundwater samples, with maximum concentrations of 19,800 μg/L (SW6), 211 μg/L (SW6), 186,000 μg/L (SW6), 26,700 μg/L (SW6), 36,600 μg/L (SW6), 4,400 μg/L (SW8), 50,300 μg/L (DW8), and 301,000 μg/L (SW1), respectively. The highest concentrations of manganese (4,400 μg/L), zinc (195.0 μg/L), nickel (115 μg/L), and lead (14.6 μg/L) were found at well clusters 5, 6, 8, and 9 on the western border and southeastern corner of the plant, generally in the shallow wells. The highest concentrations of chromium were found on the western side of AFP 59 (SW5, DW5, and SW6) and near the Plating Room (SW4). Lead and chromium were detected in most of the groundwater samples.

Soil samples from the soil borings and monitoring well boreholes were analyzed for VOCs, SVOCs, pesticides/PCBs, and inorganics. TCE and 1,1,1-TCA were detected at SW9 in concentrations of 14 micrograms per kilogram (μg/kg) and 1 μg/kg, respectively. TCE was also detected at a concentration of 6 μg/kg in the sample collected from 15.2 to 17.2 feet below ground surface (bgs) at SW4. No other VOCs were detected in site soil samples except acetone and methylene chloride, both of which are common laboratory contaminants.

Many SVOCs were detected in the soil samples. The samples with the most SVOCs were found at depths ranging from 8 to 16 feet bgs. Monitoring well borehole soil samples from SW3, SW6, SW7, and SW8 contained numerous SVOCs. These locations are spread across the facility in the western, southeastern, and south-central portions of AFP 59. Pesticides/PCBs detected in soil samples included aldrin, 4,4'-DDE, heptachlor epoxide, gamma chlordane, endosulfan II, and aroclor-1260. These compounds were detected across the site at low concentrations and appear unrelated to past activities.

Results from the soil boring and monitoring well borehole soil samples showed the highest concentrations of inorganics at shallow depths. The highest concentrations of antimony, arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium, and zinc were detected in a soil sample collected from beneath the porch of the Plating Room. Elevated levels of barium, chromium, cobalt, copper, nickel, and lead were also detected at other soil sampling locations. Cyanide was detected in three soil samples located near the Plating Room.

Hand auger soil samples were analyzed using field screening techniques for organics and metals. These results are not summarized here because they represent screening level results. Refer to the SSI (Argonne National Laboratory, 1994) for a discussion of the results.

Three sediment samples were collected during the SSI: one upstream of AFP 59 (regional background); one on the eastern boundary of AFP 59 (local background); and one downstream of the plant. The only VOC detected in creek sediment samples was methylene chloride (8 µg/kg), which was detected in the creek sediment sample downstream of the plant. SVOCs were detected in two of the three sediment samples along the southern and eastern boundaries of the plant at concentrations ranging from 110 µg/kg to 2,300 µg/kg. Aldrin was the only pesticide detected; it was detected in the sediment samples upstream and downstream of the plant. Copper (16.3 to 20.5 mg/kg) and vanadium (13.4 to 14.1 mg/kg) were detected at slightly elevated concentrations in site and background sediment samples. No VOCs, SVOCs, or pesticides/PCBs were detected in the surface water sample collected from the creek downstream of the plant; however, mercury was detected at a concentration of 4.9 µg/L. Aluminum, iron, magnesium, manganese, potassium, and sodium were the only other metals detected in the surface water.

TCE was detected in both outfall samples at concentrations of 0.3 µg/L at Outfall 001 and 4 µg/L at Outfall 002. At Outfall 001, 1,1,1-TCA and bromoform were also detected at concentrations less than 1 µg/L. Acetone and SVOCs were detected at Outfall 002.

VOCs were detected in all background groundwater samples at low concentrations. The highest concentration of 1,1,1-TCA was detected at Johnson City Municipal Well #7 with a concentration of 3 µg/L. No SVOCs or pesticides/PCBs were detected in any of the background groundwater samples. Metals found in background groundwater samples were consistently high for aluminum, iron, and manganese. No VOCs, SVOCs, or pesticides/PCBs were detected in background surface water samples. The regional background surface water sample exceeded regulatory limits for iron, aluminum, and zinc; however, the local background surface water sample only exceeded the limits for aluminum. Background sediment samples contained no VOCs, low levels of SVOCs, and almost no pesticides/PCBs. The local background sediment sample contained aldrin at 8.8 µg/kg. Inorganic constituents detected in background sediment samples were within the normal range of concentrations for the eastern United States (Argonne National Laboratory, 1994).

2.1.2 Summary of Closure Investigations

Investigations conducted outside the IRP process are summarized below and include the soil investigations of the Plating Room and the Storage Tank/Settling Pond south of the Plating Room.

SETTLING TANK/SPENT PLATING STORAGE TANK SOIL STUDY (MARCOR, 1991). Marcor collected two composite samples from locations adjacent to the Storage Tank and Settling Pond. The samples from both borings were analyzed for heavy metals and volatiles using the Toxicity Characteristic Leaching Procedure (TCLP) and pH. Results from the two soil borings indicated the presence of some metals and tetrachloroethene; however, levels were below the TCLP regulatory level. The following metals were detected: barium, cadmium, and chromium.

PLATING ROOM SOIL INVESTIGATIONS (OHM REMEDIATION SERVICES CORP., 1992, 1993a,b, 1994). OHM Remediation Services (OHM) conducted four investigations as part of the Storage Tank/Settling Pond and Plating Room closures. The first investigation consisted of the collection of subsurface soil samples from three transfer pits to the west, south, and east of the Storage Tank. The second investigation consisted of subsurface soil sampling from locations adjacent to the Storage Tank and Settling Pond; OHM collected 4 soil samples, one sample on each side (east and west) of the Storage Tank and Settling Pond. The third investigation consisted of the collection of 22 soil samples inside the Plating Room in October 1993. Most samples were taken from 6 inches below the concrete floor along former drain lines; at two locations samples were collected from 1 and 2 feet below the concrete. During the final investigation, further soil sampling was conducted at three locations inside the Plating Room at a depth of 6 to 12 inches bgs.

The soil samples collected during the first investigation (OHM, 1992) were analyzed for VOCs, TCLP volatiles, TCLP SVOCs, TCLP pesticides and herbicides, total metals, and TCLP metals. Results indicated the presence of several metals above the New York State recommended soil cleanup levels, including chromium, lead, manganese, nickel and zinc. The highest detection of chromium was found in the soil sample south of the Storage Tank at 265 mg/kg; lead, nickel, and zinc also had the highest detections at this sampling location with concentrations of 99.0, 68.8, and 53.8 mg/kg, respectively. No metals were found above the TCLP limit. The VOC analyses indicated that no volatile compounds were above the detection limits.

The second investigation performed by OHM (OHM, 1993b) included the collection of 22 soil samples from the inside of the Plating Room. Soil samples were analyzed for VOCs, SVOCs, metals, TCLP metals, and/or TCLP VOCs. Results from the soil investigation indicated the presence of the following organics: TCE, acetone, and bis(2-ethylhexyl)phthalate (BEHP). TCE was found above the detection limit in seven soil samples, with concentrations ranging from 0.005 mg/kg to 0.071 mg/kg. The metals analyses indicated the presence of chromium, lead, nickel, and zinc, with the highest levels found near the east side of the middle section of the Plating Room. The only metal to exceed the Federal TCLP regulatory standards was cadmium, which was detected at 1.19 mg/L.

During the third investigation performed by OHM (OHM, 1993a), four soil samples were collected adjacent to the Storage Tank/Settling Pond and analyzed for metals and VOCs. Results indicated the presence of TCE, acetone, and methylene chloride, but all detections were below the NYSDEC soil cleanup levels. Metals detected above the NYSDEC cleanup levels and above soil background levels included arsenic (38.8 mg/kg), cadmium (5.80 mg/kg), chromium (268 mg/kg), copper (111 mg/kg), lead (275 mg/kg), nickel (106 mg/kg), and zinc (143 mg/kg).

In addition to the 22 soil samples collected in the Plating Room in 1993, OHM collected and analyzed three soil samples from the south-central portion of the Plating Room during the fourth investigation (OHM, 1994). The soil samples were collected from 6 to 12 inches bgs and analyzed for VOCs, SVOCs, total pesticides and PCBs, and TCLP metals. TCE and methylene chloride were each detected in two samples; acetone was detected in all three samples. However, all detections were below NYSDEC cleanup levels. No SVOCs or pesticides/PCBs were detected in the samples. Cadmium and chromium were each detected in two samples; barium was detected in all three samples. However, the metals concentrations were all below TCLP limits.

SETTLING POND AND PLATING ROOM SOIL INVESTIGATIONS (BLASLAND, BOUCK & LEE, 1994, 1995). Blasland, Bouck & Lee conducted two investigations as part of the Storage Tank/Settling Pond and Plating Room closures. The first investigation (Blasland, Bouck & Lee, 1994) consisted of the collection of two subsurface soil samples, one sample from each of two soil borings in the Plating Room. The samples were each collected from 2 to 4 feet bgs and analyzed for VOCs. TCE was detected in both samples; acetone was detected in one sample. However, all detections were below NYSDEC cleanup levels.

The second investigation conducted by Blasland, Bouck & Lee (Blasland, Bouck & Lee, 1995) consisted of the collection of one soil sample from a soil boring in the settling pond. The sample was collected from 0 to 2 feet bgs and analyzed for VOCs. TCE, total xylenes, acetone, methylene chloride, methyl ethyl ketone, and styrene were detected in the sample. However, all detections were below NYSDEC cleanup levels.

2.2 Off-site Investigations

In addition to the on-site investigations, several off-site investigations have been conducted to identify potential sources of contamination contributing to the Camden Street Well Field contamination. These investigations include: a Contaminant Source Investigation by URS Consultants, Inc., in 1992; an additional Contaminant Source Investigation by URS Consultants, Inc., in 1993; and a hydrogeologic/groundwater quality investigation of the Clinton Street-Ballpark Aquifer by the United States Geological Survey (USGS) in 1996. The results of these investigations are summarized below. Table 2.2-1 provides a chronological history of all investigations that have been conducted in the vicinity of AFP 59.

CONTAMINANT SOURCE INVESTIGATION (URS CONSULTANTS, INC., 1992). URS Consultants, Inc. performed a Contaminant Source Investigation of the Johnson City Camden Street Well Field for the NYSDEC between September and December 1991 (URS Consultants, Inc., 1992). The investigation was designed to provide emergency engineering recommendations in order to minimize the impact of chemical contamination at the Johnson City Camden Street Well Field, and to develop and implement a plan to identify the source of groundwater contamination. The investigation included: a review of NYSDEC files to identify potential sources of contamination in the vicinity

Table 2.2-1
Chronological History of Investigations in the Vicinity of AFP 59

Date; Contractor	Investigation
1992; URS Consultants, Inc.	Contaminant Source Investigation
1993; URS Consultants, Inc.	Contaminant Source Investigation Addendum
1996; United States Geological Survey	Hydrogeology and Groundwater Quality of the Clinton Street-Ballpark Aquifer System Near Johnson City, New York

of the Johnson City Camden Street Well Field; monitoring well installation; groundwater sampling and analysis; and aquifer testing. Four shallow and six deep monitoring wells were installed in the vicinity of the Camden Street Well Field. Two rounds of groundwater samples from the ten monitoring wells and Johnson City Municipal Well #2 were collected and analyzed.

The following is a summary of the review of NYSDEC files. Three sites were identified from the NYSDEC registry of inactive hazardous waste disposal sites and files: AFP 59, located approximately 1,000 feet northeast of the Johnson City Camden Street Well Field; Robintech Site, located on Commerce Road in the Town of Vestal; and Monarch Chemical, located on Prentiss Road in the Town of Vestal.

AFP 59 has been categorized by the NYSDEC as a Class 2 site, representing a significant threat to the public health or environment and requiring action. The Robintech Site has also been categorized as a Class 2 site. Groundwater and soil contaminants identified at the Robintech Site include: arsenic, cyanide, polycyclic aromatic hydrocarbons (PAHs), and 1,1,1-TCA. Monarch Chemical has been assigned priority classification 3, indicating that the site does not present a significant threat to the public health or environment, and that action may be deferred.

Several additional potential sources not registered as inactive hazardous waste disposal sites were identified in the vicinity of the Camden Street Well Field: Tri-Cities Shopping Center Dump, located approximately 1,500 feet to the northwest; Endicott Johnson Dump, located approximately 2,000 feet to the southeast; and Trim Line Auto Pro Center, located approximately 1,250 feet to the north. The files also include several State Pollutant Discharge Elimination System-permitted discharges in the vicinity of the Camden Street Well Field: IBM, located approximately 1,500 feet to the northwest; NYSEG Goudey Substation, located approximately 1,500 feet to the southeast; and Champion Oil, located 2,500 feet to the northeast.

Review of a USGS topographic map of the area revealed an industrial waste pond located across the Susquehanna River and approximately 2,500 feet west of the Johnson City Camden Street Well Field. The waste pond was situated near a gravel-mining operation.

Groundwater samples from the ten monitoring wells installed during the investigation were analyzed for VOCs, freon, acetone, methyl ethyl ketone, Target Analyte List (TAL) metals, cyanide, and Target Compound List (TCL) PCBs during the October 1991 groundwater sampling event. Groundwater samples collected in December 1991 were analyzed for the same analyte suite as the

October samples with the exception of TCL PCBs. 1,1,1-TCA was detected in two wells sampled in October 1991 at concentrations of 8.1 and 11.0 µg/L. 1,1,1-TCA was detected in three wells sampled in December 1991 at concentrations ranging from 7.1 to 13.0 µg/L. Benzene was detected in four wells sampled in December 1991 at concentrations ranging from 0.1 to 3.3 µg/L. During the aquifer test, conducted as part of the investigation, concentrations of 1,1,1-TCA steadily increased in Johnson City Municipal Well #3: 11.0 µg/L after 24 hours, 12.0 µg/L after 48 hours, and 14.0 µg/L after 72 hours.

Chromium was detected in more than half of the groundwater samples. Increased concentrations of chromium were detected in the shallow wells during the December 1991 sampling round. Manganese was detected in less than half of the groundwater samples. Iron and sodium were detected in almost all of the groundwater samples collected in both October and December 1991. Antimony was detected in four groundwater samples during the December 1991 sampling event, but was not detected in samples collected in October 1991. The results of the metals analyses did not show any trends or patterns except for an increase in chromium concentrations in the shallow wells. Magnesium, iron, and sodium concentrations fluctuated over the study area.

CONTAMINANT SOURCE INVESTIGATION ADDENDUM (URS CONSULTANTS, INC., 1993). The additional investigation of the Camden Street Well Field was performed to provide additional data to define the source of contamination. The investigation included: field gas chromatograph (GC) analysis of 58 groundwater samples collected using a geoprobe at potential contaminant source areas near the well field; installation of four additional monitoring wells; groundwater sample collection and analysis; and collection of a nearly contemporaneous set of groundwater level measurements in sampled monitoring wells for potentiometric maps. Groundwater from potential source areas identified by the NYSDEC was screened with a portable GC for VOCs to determine the placement of monitoring wells. Based on the results of the VOC survey, three shallow and one intermediate monitoring well were installed. One round of groundwater samples from the four new and ten existing monitoring wells installed during the initial investigation were collected and analyzed.

The results of the geoprobe sampling indicated two potential source areas: the former Day and Night Food Store and 100 Oakdale Avenue (see Figure 1.1-2). Two geoprobe groundwater samples, one from each area, were sent to a NYSDEC laboratory for confirmation analysis. The following contaminants were detected in the sample sent to the NYSDEC laboratory from the former Day and Night Food Store: benzene (10,500 µg/L), toluene (9,310 µg/L), xylene (4,400 µg/L), and 1,1,1-TCA (<1,000 µg/L). A concentration of 7,000 µg/L for 1,1,1-TCA was determined in the field with the portable GC. The sample, however, had to be diluted 100 times in the field, so the elevated concentration of 1,1,1-TCA may have been due to interference from other compounds. NYSDEC laboratory analysis for the sample sent from 100 Oakdale Avenue revealed 1,1,1-TCA at 41 µg/L. The field analysis revealed 1,1,1-TCA at 59 µg/L.

Groundwater samples from the ten existing and four new monitoring wells were analyzed for VOCs, TAL metals, and cyanide during the December 1992 groundwater sampling event. VOCs were detected in all but one of the monitoring wells sampled. 1,1,1-TCA was detected in eight wells with concentrations ranging from 2.4 µg/L to 28 µg/L. TCE was detected in eight wells with concentrations ranging from 0.2 µg/L to 3.1 µg/L. 1,1-DCA was detected in seven wells with concentrations ranging from 0.2 µg/L to 2 µg/L. The highest concentrations of 1,1,1-TCA and 1,1-DCA were found north of the well field. Cis-1,2-dichloroethene (cis-1,2-DCE) was detected in four wells with concentrations ranging from 0.9 μg/L to 49 μg/L. The highest concentration of cis-1,2-DCE was detected in the southern portion of the well field. The only contaminants that exceeded the NYSDEC drinking water standards were 1,1,1-TCA and cis-1,2-DCE.

TAL metals were detected in excess of NYSDEC drinking water standards in all 14 monitoring wells during this investigation. Chromium ranged from 9.6 μg/L to 2,200 μg/L, manganese ranged from 20.4 μg/L to 59,900 μg/L, and lead ranged from 3.1 μg/L to 606 μg/L. Other metals that were found to exceed NYSDEC drinking water standards were: barium, beryllium, copper, iron, magnesium, sodium, and zinc. The results of the metals analyses do not appear to show any trends.

The results of the Contaminant Source Investigations indicated that 1,1,1-TCA was detected at elevated concentrations north of the Johnson City Camden Street Well Field. The Trim Line Auto Pro Center was a suspected potential source of contamination because organic compounds were detected above NYSDEC drinking water standards in a sump sample from that property. The maximum 1,1,1-TCA concentrations were detected at 100 Oakdale Avenue. The NYSEG Goudey Station and the former Endicott Johnson Dump sites were eliminated as potential contaminant sources; however, the other sites mentioned above were not ruled out as potential sources.

UNITED STATES GEOLOGICAL SURVEY, 1996. The USGS hydrogeologic/groundwater quality investigation (USGS, 1996) was conducted between 1994 and 1996 to determine the probable source of 1,1,1-TCA contamination at the Camden Street Well Field. The investigation included the following activities: installation of eight monitoring wells; collection and analysis of one round of groundwater samples from monitoring wells in the vicinity of the well field; downhole geophysical logging of select monitoring wells in the area; and field GC analysis of groundwater samples collected using a geoprobe at potential contaminant source areas north of the well field.

Groundwater samples collected from monitoring wells were analyzed for VOCs and metals; groundwater samples collected using the geoprobe were analyzed for VOCs through headspace analysis. Elevated concentrations of 1,1,1-TCA, TCE, and other VOCs were detected in monitoring well and direct push samples collected north of the Camden Street Well Field. VOC concentrations were shown to increase northward and upgradient of the well field. Elevated VOC concentrations were also detected at AFP 59; however, the USGS reported that no contiguous area with VOC concentrations above background levels appeared to exist. The USGS concluded that the probable source of the 1,1,1-TCA detected at the well field is located approximately 3,000 feet north of the well field, bounded to the south by Field Street, to the north by Harry L Drive, to the east by NY State Route 201, and to the west by Marie Street. Elevated concentrations of iron, magnesium, and manganese were also detected in several groundwater samples collected from monitoring wells.

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Section 3

3.0 Current Status

This section provides a summary of the following from the RI: investigative procedures; source characterization and identification of chemicals of potential concern for each environmental medium; identification of potential receptors; the human health risk assessment; and site chemicals of potential concern compared to applicable or relevant and appropriate requirements (ARARs).

3.1 Investigative Procedures and Time Sequence

Several types of investigative procedures were used during the RI to refine understanding of subsurface conditions, hydrogeology, and distribution of chemicals of potential concern at the site. The field investigation was conducted using a phased approach in order to efficiently characterize the site. The first phase of the investigation, a Reconnaissance Survey, was conducted in July 1994. Soil and groundwater samples were collected during the Reconnaissance Survey using a direct push sampling technique and analyzed at an on-site mobile laboratory for VOCs. A total of 33 groundwater and 56 soil samples were collected from 39 direct push locations for on-site analysis (see Figure 3.1-1). The screening data were used to locate potential source areas and delineate areas of contamination. Twenty-five soil samples were analyzed off-site for VOCs or metals at a fixed laboratory to provide data for site characterization, including definition of background. Twenty-six groundwater samples from on-site and off-site monitoring wells were also analyzed on-site during the first phase to obtain screening data on existing groundwater quality. Two of the 26 groundwater samples were split for off-site VOC analysis.

The data collected during the Reconnaissance Survey were analyzed to determine optimal locations to place monitoring wells and soil borings during the second phase of the investigation, which was initiated in October 1994 and continued through December 1994. The second phase of the investigation consisted of the installation of nine monitoring wells, soil and groundwater sampling, sediment and surface water sampling of Little Choconut Creek, and an aquifer test. Figure 3.1-2 shows locations sampled during the second phase of the investigation.

Groundwater samples were collected from the 25 on-site monitoring wells between November 28 and December 5, 1994 (the on-site production well was sampled on December 7, 1994 during the aquifer test). The groundwater samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, cyanide, and hardness. A total of 53 soil samples (15 from monitoring well boreholes and 38 from soil borings) were collected and analyzed for VOCs, SVOCs, pesticides/PCBs, metals, cyanide, and total organic carbon (TOC). Sediment and surface water samples were collected from 5 locations in Little Choconut Creek to determine the impact of installation activities on the creek and to assess background conditions. All samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, and cyanide. Additionally, sediment samples were analyzed for TOC, and surface water samples were analyzed for hardness.

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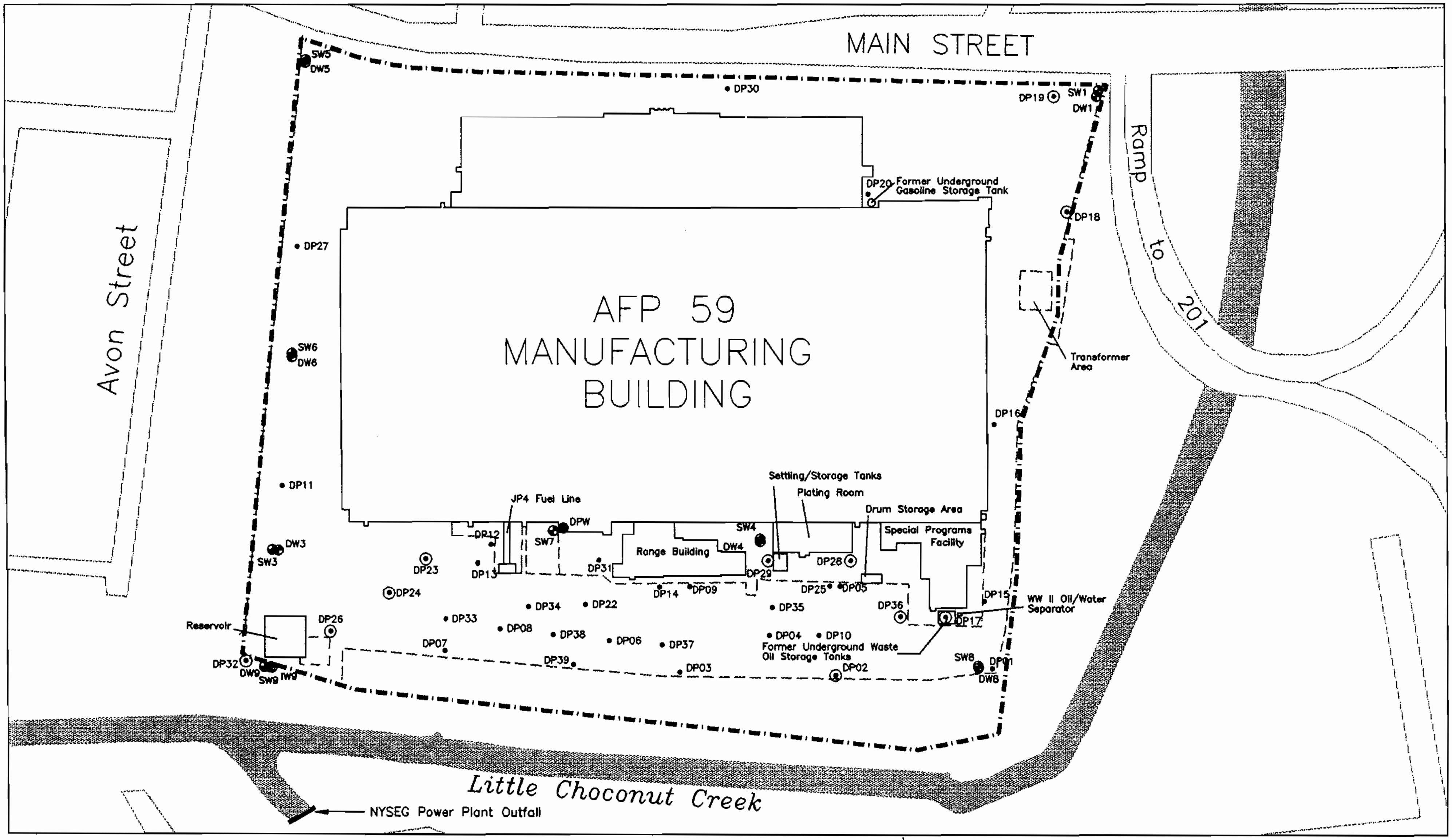

LEGEND

● DW3 – Existing Monitoring Well
● DPW – AFP 59 Industrial Production Well
• – Direct Push Sampling Location (Onsite Analyses Only)
⦿ – Direct Push Sampling Location (Onsite and Offsite Analyses)
—·—·— – AFP 59 Property Boundary
------ – Fence

1027-3.DWG\FIG3.1-1

EARTH TECH

FIGURE 3.1-1

AFP 59 RECONNAISSANCE SURVEY DIRECT PUSH SAMPLING LOCATIONS

JULY 1994

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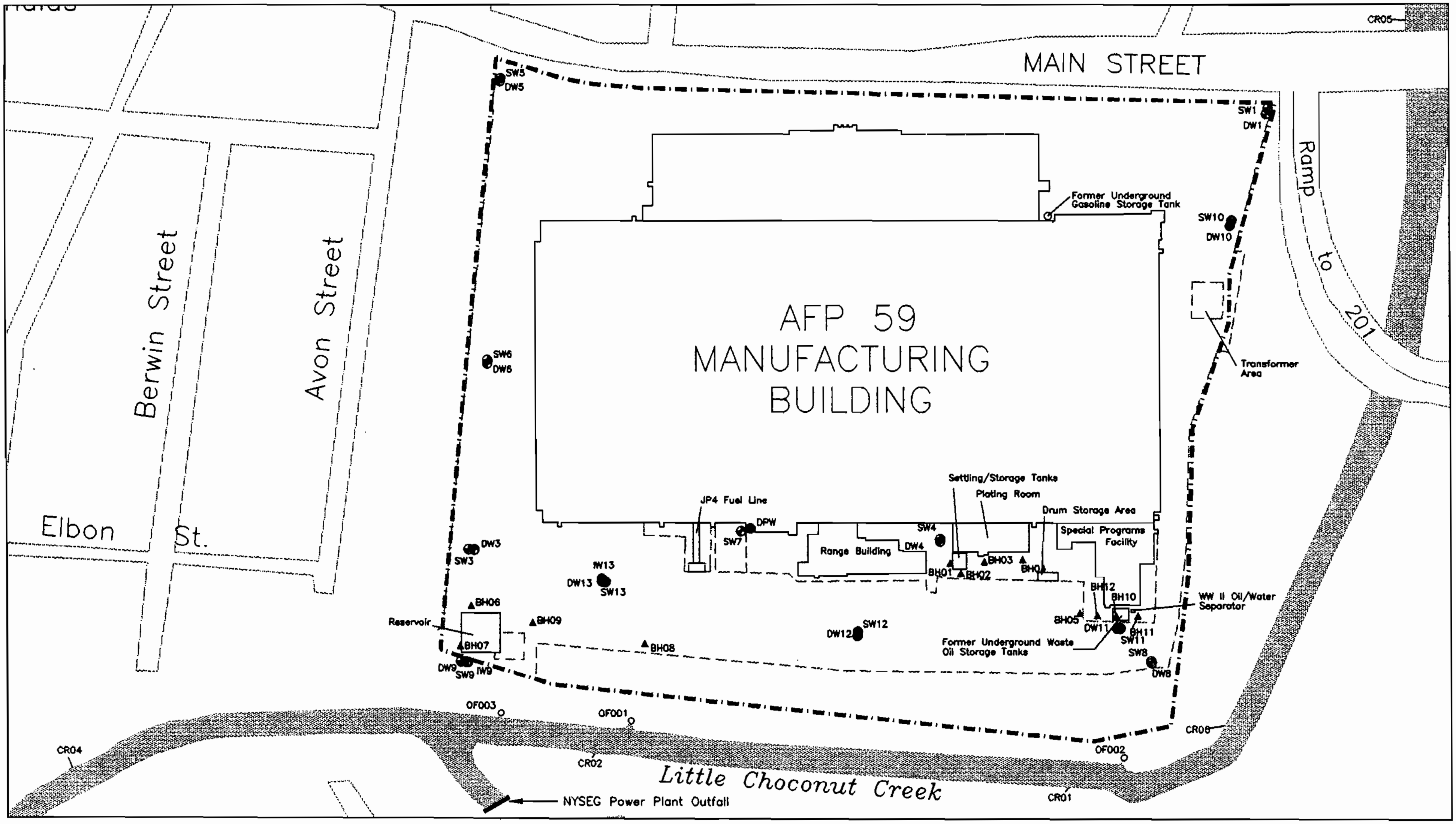

LEGEND

▬ ▪ ▬ ▪ ▬ – AFP 59 Property Boundary

-------- – Fence

○ OF003 – AFP 59 Outfall

● DPW – AFP 59 Industrial Production Well

⊕ DW3 – Existing Monitoring Well

● DW12 – RI Monitoring Well

▲ BH8 – RI Soil Boring

⊖ CR04 – RI Surface Water/Sediment Sampling Location

0 115 230

SCALE IN FEET

N

1027-3.DWG\FIG3.1-2

EARTH TECH

FIGURE 3.1-2

AFP 59 REMEDIAL INVESTIGATION SAMPLING LOCATIONS OCTOBER - DECEMBER 1994

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Groundwater, surface water, and sediment sampling was conducted in December 1995 during the third phase of the investigation (see Figure 3.1-3). The third phase was completed to accomplish the following objectives: provide another round of groundwater samples from select locations to further characterize the extent of VOCs in site groundwater; verify or eliminate those chemicals of potential concern identified in the *Final RI Report* (Earth Tech, 1996b) that contributed to unacceptable risk; and further evaluate the direction of groundwater flow beneath AFP 59 in the shallow and deep zones of the aquifer.

Groundwater samples were collected from ten monitoring wells and analyzed for VOCs. Sediment and surface water samples were collected from 2 locations in Little Choconut Creek. Surface water samples were analyzed for SVOCs, pesticides/PCBs, and arsenic. Sediment samples were analyzed for SVOCs, pesticides/PCBs, and metals.

3.2 Conceptual Site Model

The AFP 59 conceptual site model presented in this section provides a summary of the following: source characterization and identification of chemicals of potential concern for each environmental medium, potential migration pathways for each medium, and identification of potential receptors.

3.2.1 Source Characterization and Identification of Chemicals of Potential Concern

Three areas of soil contamination were identified during the RI field investigations: the Waste Oil Tank Area; the Plating Room Area; and the Reservoir Area (see Figure 3.2-1). Another potential (secondary) source is the subsurface storm drainage system. These multiple source areas may potentially impact groundwater quality. Because of the proximity of these source areas and the similar chemicals found across the site, groundwater has been identified as a single investigative area (which includes both the shallow and deep zones of the aquifer). A summary of each source area is provided below. Although chemicals of potential concern are identified in this section, no concentrations are provided; refer to Section 3.4.4 for a comparison of site chemicals of potential concern to ARARs.

SVOCs were detected across the site, in the creek, and at background locations. Their widespread presence does not appear to be related to an individual source area. Two potential explanations for the widespread nature of SVOCs have been identified. First, most of the SVOCs were detected in shallow soil samples (<5 feet bgs) collected beneath asphalt-covered areas. If small pieces of asphalt were inadvertently included in soil samples sent for laboratory analysis, elevated concentrations of SVOCs would be detected. Additionally, elevated SVOC concentrations may be related to long-term leaching of SVOCs from the asphalt into the soil.

Second, SVOCs at AFP 59 and the surrounding areas could be related to the NYSEG coal-burning power plant located immediately south of AFP 59. Combustion of fossil fuels results in the emission of various chemicals, including SVOCs. Because NYSEG has been in operation since at least 1935 (USGS, 1968), the SVOCs detected beneath the AFP 59 parking lots and in the surrounding areas may be related to NYSEG activities that predate the existence of AFP 59 and strict emissions regulations.

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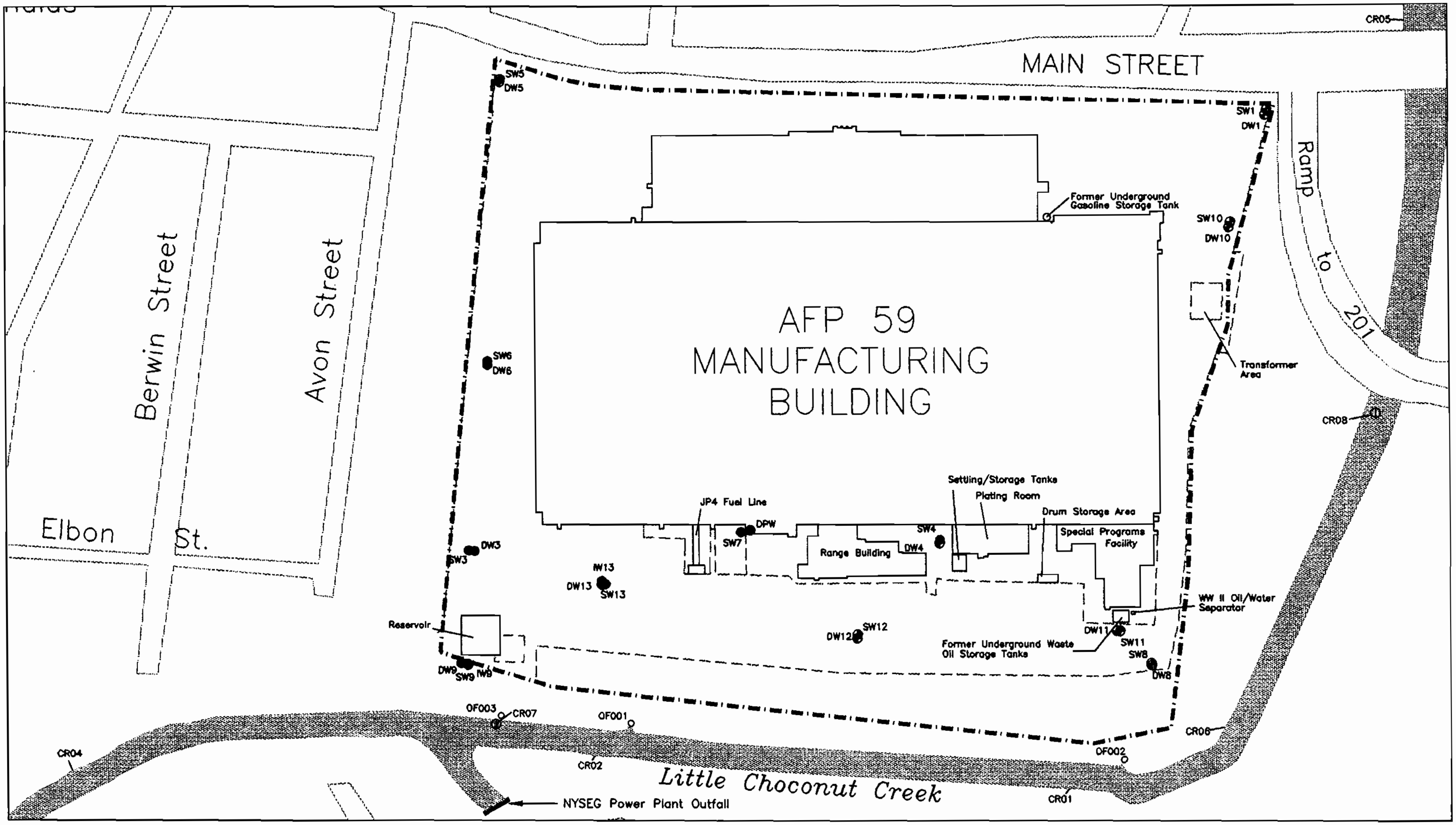

LEGEND

▬ ▪ ▬ – AFP 59 Property Boundary

-------- – Fence

○ OF003 – AFP 59 Outfall

● DPW – AFP 59 Industrial Production Well

◐ DW12 – AFP 59 Monitoring Well

● DW3 – AFP 59 Monitoring Well Sampled in December 1995

⊖ CR04 – RI Surface Water/Sediment Sampling Location

⦶ CR08 – December 1995 Surface Water/ Sediment Sampling Location

0 115 230
SCALE IN FEET

E A R T H T E C H

FIGURE 3.1-3

AFP 59 SAMPLING LOCATIONS DECEMBER 1995

1027.DWG/FIG3.1-1

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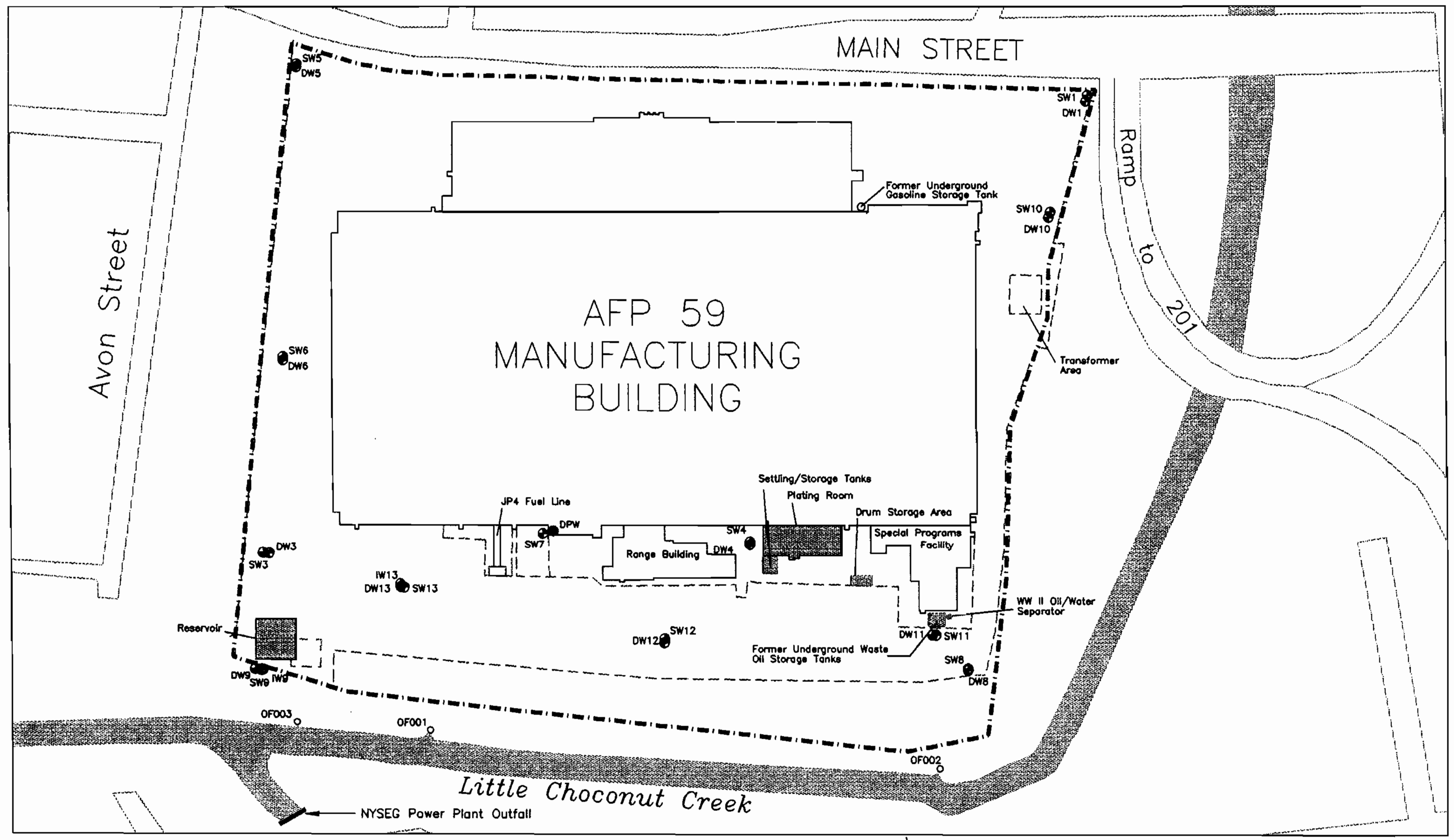

EARTH TECH

FIGURE 3.2-1

POTENTIAL SOURCE LOCATIONS

1027-3.DWG\FIG3.2.1

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WASTE OIL TANK AREA. The Former Underground Waste Oil Storage Tanks are an IRP site located south of the Special Programs Facility (see Figure 3.2-1). Two interconnected 1,000-gallon underground storage tanks (USTs) were used to store waste cutting oils on a temporary basis. Prior to 1969, nonchlorinated, kerosene-based degreasing solvents used at the plant were stored in the USTs along with the waste oils. Use of halogenated solvents such as TCE, 1,1,1-TCA, and freon was introduced in 1969. These waste solvents were drummed and recycled on-site where possible or transported off-site by a contractor. The USTs were in operation from 1953 to 1985, at which time they were removed (USAF, 1993a).

A 3,000-gallon, double-walled, aboveground storage tank (AST) and a former oil/water separator are located adjacent to the former waste oil UST location. The AST, installed approximately 30 feet west of the UST location to replace the USTs, was used to collect waste oil from 1985 to 1992. The AST was drained and cleaned in 1992 and certified closed by the NYSDEC in 1994. The oil/water separator, located immediately east of the UST location, was in operation from 1942 to 1953. Waste oils and kerosene-based degreasing solvents were discharged to the oil/water separator, and effluent was discharged to the storm sewer system that emptied into Little Choconut Creek via Outfall 002. In the 1970s, the separator was filled with sand and capped with concrete (USAF, 1993a).

Several VOCs were detected in the soil in the vicinity of the Waste Oil Tank Area, including both chlorinated and petroleum hydrocarbon compounds. Numerous SVOCs were also detected in soil samples. Only one pesticide was detected above the laboratory practical quantitation limit (PQL) in the area, and PCB-1254 and PCB-1260 were each detected at one sampling location. Aluminum, barium, copper, molybdenum, and zinc were the only inorganics that were detected in the soil at concentrations exceeding background.

PLATING ROOM AREA. Three IRP sites are located near this potential source area: the Plating Room; the Storage Tank and Settling Pond; and the Drum Storage Area. These sites are located south of the Manufacturing Building (see Figure 3.2-1).

Operations in the Plating Room produced various wastes, including plating acids, caustic sludges, and chromium and cyanide solutions. The plating acid wastes were typically mixed sulfuric, nitric, muriatic, and chromic acids. Spent plating solutions included copper cyanide, nickel cyanide, and cadmium cyanide. Various degreasing activities also occurred in the Plating Room. Plating operations were discontinued in 1991, and the plating equipment was removed in 1992.

The Storage Tank and Settling Pond are located adjacent to the southwestern corner of the Plating Room. The Storage Tank stored spent plating liquids that were later removed by an outside disposal contractor. Bernite DB22 (ethylenediaminetetracetic acid) was also stored in the tank from December 1990 to June 1991. Use of the Storage Tank was discontinued in June 1991 (USAF, 1993a).

From 1969 to 1984, plating rinsewater was discharged to the settling pond for metals precipitation and then discharged to Little Choconut Creek via Outfall 001. In 1984, a new plating rinsewater treatment and reuse system was installed. The brine generated during this process was placed in the Storage Tank and removed from the site by a contractor. In 1988, the treatment system became contaminated and was abandoned.

The Drum Storage Area is located in the maintenance area southeast of the Plating Room (see Figure 3.2-1). The site has been used as a Drum Storage Area from 1942 to the present. Waste paints, waste oils, and spent kerosene-based degreasers were stored at this area prior to off-site disposal by an outside contractor. In 1963, the top 8 inches of soil were removed from the Drum Storage Area, and the site was paved (USAF, 1993a); however, employees reported spills prior to the paving in 1963.

Data from the RI and data provided by Martin Marietta from closure-related sampling were used to characterize the Plating Room Area. The three most commonly detected VOCs in the soil were TCE, acetone, and methylene chloride. Several other VOCs and SVOCs were also detected in the soil. Three pesticides were detected below the PQLs at one location, and PCB-1254 was detected in two soil samples. Cadmium, calcium, cyanide, and molybdenum were the only inorganics that were detected in the soil at concentrations exceeding background.

RESERVOIR AREA. Contaminated soil was also identified in the southwestern portion of the plant. No existing IRP sites are present in this area, and no known previous storage or disposal activities have occurred in this area. A 500,000-gallon water reservoir is located in this area (see Figure 3.2-1). The water level in the reservoir is maintained by pumping groundwater from the on-site production well directly to the reservoir. Chlorinated hydrocarbons have been detected in groundwater samples collected from the production well. Leaks from the reservoir and/or associated piping system are a potential source in this area.

The only VOCs detected in Reservoir Area soil samples were TCE, 1,2,3-trichlorobenzene, and methylene chloride. Several SVOCs were detected; benzo(a)anthracene and fluoranthene were the most common. Limited pesticide contamination was detected, and PCB-1260 was detected in two soil samples. Copper, molybdenum, selenium, sodium, and zinc were the only inorganics that were detected in the soil at concentrations exceeding background.

STORM DRAINAGE SYSTEM. The subsurface storm drainage system collects surface runoff and then discharges to Little Choconut Creek via Outfalls 001 and 002. Noncontact cooling water drawn from the on-site production well is discharged via Outfall 003. All three outfalls are permitted under a State Pollutant Discharge Elimination System Permit (NY0004073). Any chemicals in the storm water system could migrate to and impact sediment and surface water in the creek. Additionally, leaks of storm water from the subsurface drains could potentially impact subsurface soils.

The only VOC detected in creek sediment samples was methylene chloride, a common laboratory contaminant. Five VOCs were detected in the surface water sample from CR02, all of which are typical of a chlorinated water source. Several SVOCs were detected in sediment samples, whereas only one SVOC (BEHP) was detected in surface water samples. Limited pesticide contamination was detected in both sediment and surface water samples. No PCBs were detected. Sediment samples exceeded background for all inorganic analytes except calcium, cyanide, manganese, mercury, and silver. Surface water analyte concentrations exceeded background for all inorganic analytes except chromium, copper, cyanide, lead, and potassium.

SHALLOW ZONE OF AQUIFER. Chlorinated hydrocarbons were detected across the site in the shallow zone of the aquifer, with maximum concentrations generally occurring at SW4 and SW7. VOCs detected in groundwater samples collected during the December 1994 and December 1995 sampling events are shown in Figures 3.2-2 and 3.2-3, respectively. During the December 1994 sampling event, petroleum hydrocarbons were detected in the groundwater sample collected at SW11, near the former waste oil tanks. Limited pesticide and no SVOC or PCB contamination was detected in groundwater samples collected from the shallow zone of the aquifer. Shallow groundwater analyte concentrations exceeded background for the following inorganic analytes: barium, beryllium, calcium, chromium, magnesium, nickel, potassium, silver, and vanadium.

DEEP ZONE OF THE AQUIFER. VOC concentrations detected in groundwater samples from the deep monitoring wells were consistently lower than VOC concentrations detected in groundwater samples from the shallow monitoring wells. During the December 1994 sampling event, the maximum concentrations of 1,1,1-TCA, DCA, and TCE in the deep zone of the aquifer were all detected in the groundwater sample from the on-site deep production well (see Figure 3.2-2). Cis-1,2-DCE was detected at a maximum concentration at DW3. BEHP was the only SVOC detected in groundwater samples from the deep wells. Two pesticides were detected above the PQLs, and several others were detected below the PQLs. No PCBs were detected in groundwater samples from the deep wells. Deep groundwater analyte concentrations exceeded background for all inorganic analytes except arsenic, cyanide, lead, sodium, and vanadium.

During the December 1995 sampling event, the only VOCs detected in deep monitoring wells were cis-1,2-DCE, ethylbenzene, m,p-xylene, and o-xylene (see Figure 3.2-3).

3.2.2 Potential Migration Pathways

The following section, summarized from the NYSDEC-approved *Final RI Report* (Earth Tech, 1996b), evaluates the potential groundwater, surface water and air migration pathways for chemical transport. Each potential migration pathway is evaluated on the basis of relevant environmental characteristics. The potential migration pathways from the source areas identified in Section 3.2.1 are not addressed separately because the source areas have similar environmental characteristics and are in proximity to one another. The migration pathways discussed below apply to the entire southern zone of AFP 59.

GROUNDWATER PATHWAY. Migration potential through the groundwater pathway is dictated by the geology and hydrogeology of the site and surrounding areas. Consequently, geologic and hydrogeologic information gathered during the RI and previous investigations was integrated to evaluate the potential groundwater migration pathway.

The stratigraphy underlying AFP 59 generally consists of 2 to 5 feet of artificial fill, 3 to 34 feet of glacial outwash deposits, 0 to 54 feet of fine-grained glacial deposits, and 15 to 64 feet of ice-contact deposits. The fine-grained glacial deposits are not present in the northeast portion of the site where glacial outwash deposits are in direct contact with ice-contact deposits. A thin layer of fine-grained alluvium overlies the glacial outwash deposits on the eastern portion of the site.

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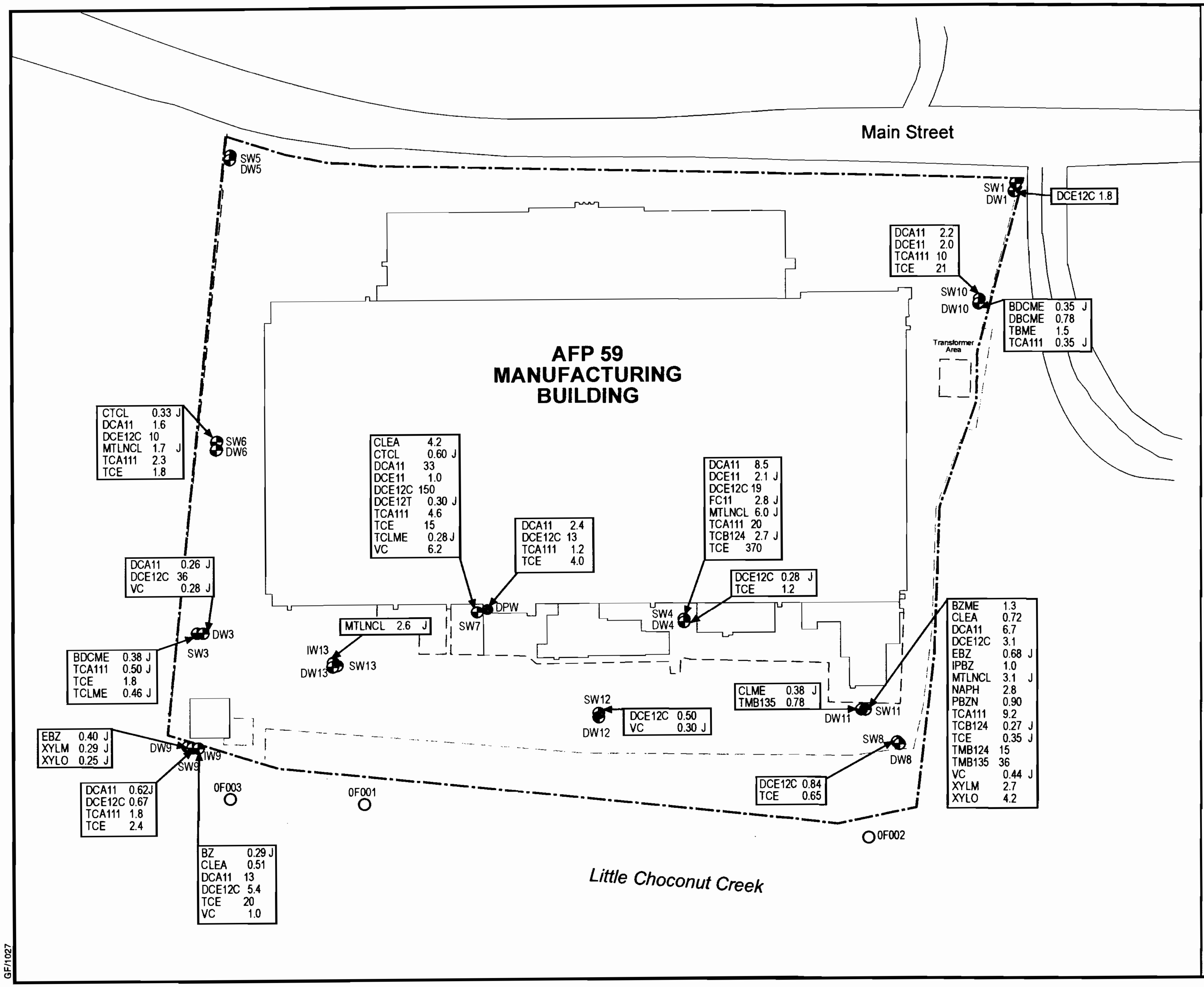


-·-·- Boundary
- - - Fence
● Industrial Production Well
⊕ Monitoring Well
⊕ Monitoring Well Sampled December 1994
○ AFP 59 Outfall

KEY

BDCME	=	bromodichloromethane
BZ	=	benzene
BZME	=	toluene
CLEA	=	chloroethane
CLME	=	chloromethane
CTCL	=	carbon tetrachloride
DBCME	=	dibromochloromethane
DCA11	=	1,1-dichloroethane
DCE11	=	1,1-dichloroethene
DCE12C	=	cis-1,2-dichloroethene
DCE12T	=	trans-1,2-dichloroethene
EBZ	=	ethylbenzene
FC11	=	trichlorofluoromethane
IPBZ	=	isopropylbenzene
MTLNCL	=	methylene chloride
NAPH	=	naphthalene
PBZN	=	n-propylbenzene
TBME	=	bromoform
TCA111	=	1,1,1-trichloroethane
TCB124	=	1,2,4-trichlorobenzene
TCE	=	trichloroethene
TCLME	=	chloroform
TMB124	=	1,2,4-trimethylbenzene
TMB135	=	1,3,5-trimethylbenzene
VC	=	vinyl chloride
XYLM	=	m,p-xylene
XYLO	=	o-xylene

J = Estimated

Notes: Concentrations are reported in µg/L. If no data are presented at a monitoring well location, no VOCs were detected in the groundwater.

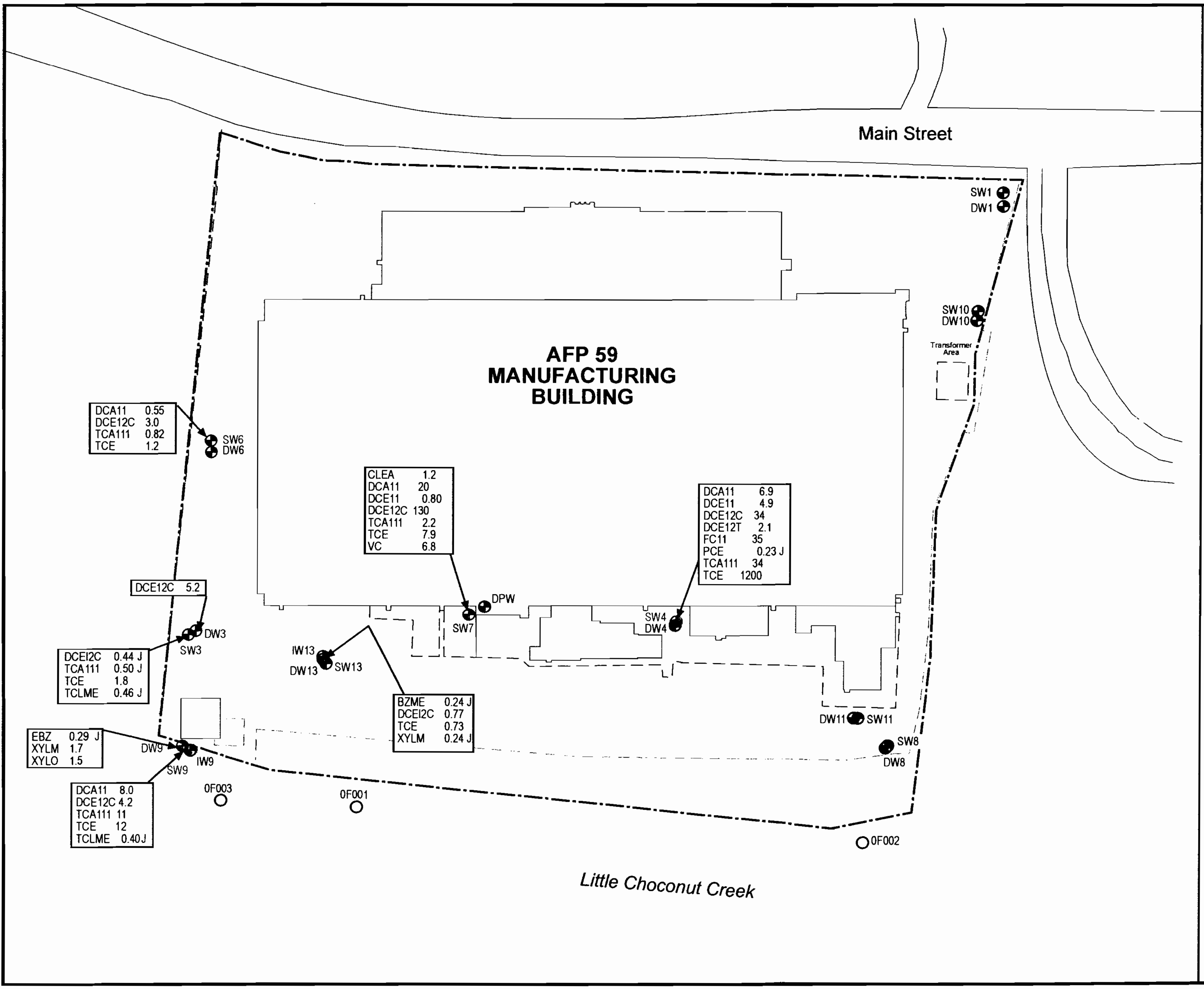
At locations were duplicates were collected, the maximum concentration is presented.

100 50 0 100
Scale in Feet
N ↑

EARTH TECH

FIGURE 3.2-2

VOCs Detected in Groundwater December 1994



—·—·— Boundary

- - - - Fence

● Industrial Production Well

● Monitoring Well

● Monitoring Well Sampled December 1995

○ AFP 59 Outfall

BZME = toluene
CLEA = chloroethane
DCA11 = 1,1-dichloroethane
DCE11 = 1,1-dichloroethene
DCE12C = cis-1,2-dichloroethene
DCE12T = trans-1,2-dichloroethene
EBZ = ethylbenzene
FC11 = trichlorofluoromethane
TCA111 = 1,1,1-trichloroethane
TCE = trichloroethene
TCLME = chloroform
VC = vinyl chloride
XYLM = m,p-xylene
XYLO = o-xylene

J = Estimated

Notes: Concentrations are reported in µg/L. If no data are presented at a monitoring well location, no VOCs were detected in the groundwater.

At locations where duplicates were collected, the maximum concentration is presented.

EARTH TECH

FIGURE 3.2-3

VOCs Detected in Groundwater December 1995

AFP 59 is located on the western edge of the Clinton Street-Ballpark Aquifer. Where present, the fine-grained glacial deposits separate the aquifer into a deep zone comprised of ice-contact deposits and a shallow zone comprised of glacial outwash deposits. Vertical groundwater flow is restricted by the fine-grained glacial deposits in areas of aquifer zonation. Where absent, ice-contact and glacial outwash deposits are in direct hydraulic contact with one another, and no zonation of the aquifer exists. As discussed above, this occurs in the northeast portion of the property where there are no fine-grained glacial deposits.

Hydrogeologic conditions were evaluated primarily through the interpretation of groundwater level data collected from monitoring wells in the vicinity of AFP 59. Groundwater contour maps generated from groundwater level data indicate that groundwater flow is radial toward the Camden Street Well Field in the vicinity of AFP 59 and that flow in both the shallow and deep zones of the aquifer is in a westerly to southwesterly direction beneath AFP 59 (see Figures 1.1-3 and 1.1-4).

Since the installation of the Camden Street Well Field and the associated pumping-induced lowering of the groundwater table, both Little Choconut Creek and the Susquehanna River have become losing streams in the region. The potentiometric surface of both the shallow and deep zones of the aquifer are lower in elevation than the Little Choconut Creek bed. Consequently, surface water from the creek infiltrates down to recharge the aquifer (losing stream) rather than groundwater from the aquifer recharging the creek (gaining stream). Therefore, chemicals in surface water may impact groundwater, but chemicals in groundwater cannot impact Little Choconut Creek or the Susquehanna River.

Geological and hydrogeological data collected during the RI indicate that AFP 59 is within the capture zone of the Camden Street Well Field. Chemicals in both the shallow and deep zones of the aquifer have the potential to impact the Camden Street Well Field. Because Production Well 2, the primary pumping well at the well field, is screened in both the shallow and deep zones of the aquifer, groundwater is supplied from both zones of the aquifer (Production Well 2 is screened primarily in the deep zone of the aquifer; therefore, the majority of the water is supplied by the deep zone of the aquifer). Additionally, the fine-grained glacial deposits, which act to hydraulically separate the two zones, are discontinuous both at AFP 59 and in the vicinity of the well field (URS Consultants, Inc., 1992). Therefore, cross-contamination between the shallow and deep zones of the aquifer is possible wherever there are no fine-grained glacial deposits.

SURFACE WATER PATHWAY. Two surface water bodies are within 1,000 feet of AFP 59: Little Choconut Creek and the Susquehanna River. Little Choconut Creek borders the plant to the east and south. The creek flows to the west and converges with the Susquehanna River approximately 1,000 feet west of the southwest corner of the plant. No municipal users of surface water have been reported within 3 miles downstream of AFP 59 (CH_2M Hill, 1984). The City of Binghamton is the nearest municipal user of water from the Susquehanna River, and the surface water intakes are approximately 5 miles upstream of AFP 59.

As discussed above, both Little Choconut Creek and the Susquehanna River have become losing streams in the area since the installation of the Camden Street Well Field. Consequently, surface water from the creek/river infiltrates down to recharge the aquifer rather than groundwater from the aquifer recharging the creek/river. Therefore, Little Choconut Creek and the Susquehanna River are isolated from any site-derived chemicals migrating through the groundwater pathway.

Surface water from a large part of the southern portion of the plant and noncontact cooling water drawn from the on-site production well are discharged to Little Choconut Creek through the three permitted outfalls. Potential use of Little Choconut Creek waters is restricted to recreational activities, including wading and fishing. Shallow depths of the creek, typically less than 1 foot, limit the potential for swimming.

AIR PATHWAY. The climate in the area is typically humid maritime, with mild summers and long, cold winters. The average annual temperature for nearby Binghamton is 46°F. Monthly mean temperatures vary from 22°F in January to 70°F in July (International Station Meteorological Climate Summary, 1990). The prevailing wind direction is west-southwest, with an annual mean wind speed of 9 knots. Mean annual precipitation recorded in the vicinity of AFP 59 is 36.7 inches per year. Mean annual lake evaporation, commonly used to estimate the mean annual evapotranspiration rate, is estimated to be 28 inches per year. Mean annual net precipitation (mean annual precipitation minus mean annual evapotranspiration) is approximately 9 inches per year (CH_2M Hill, 1984).

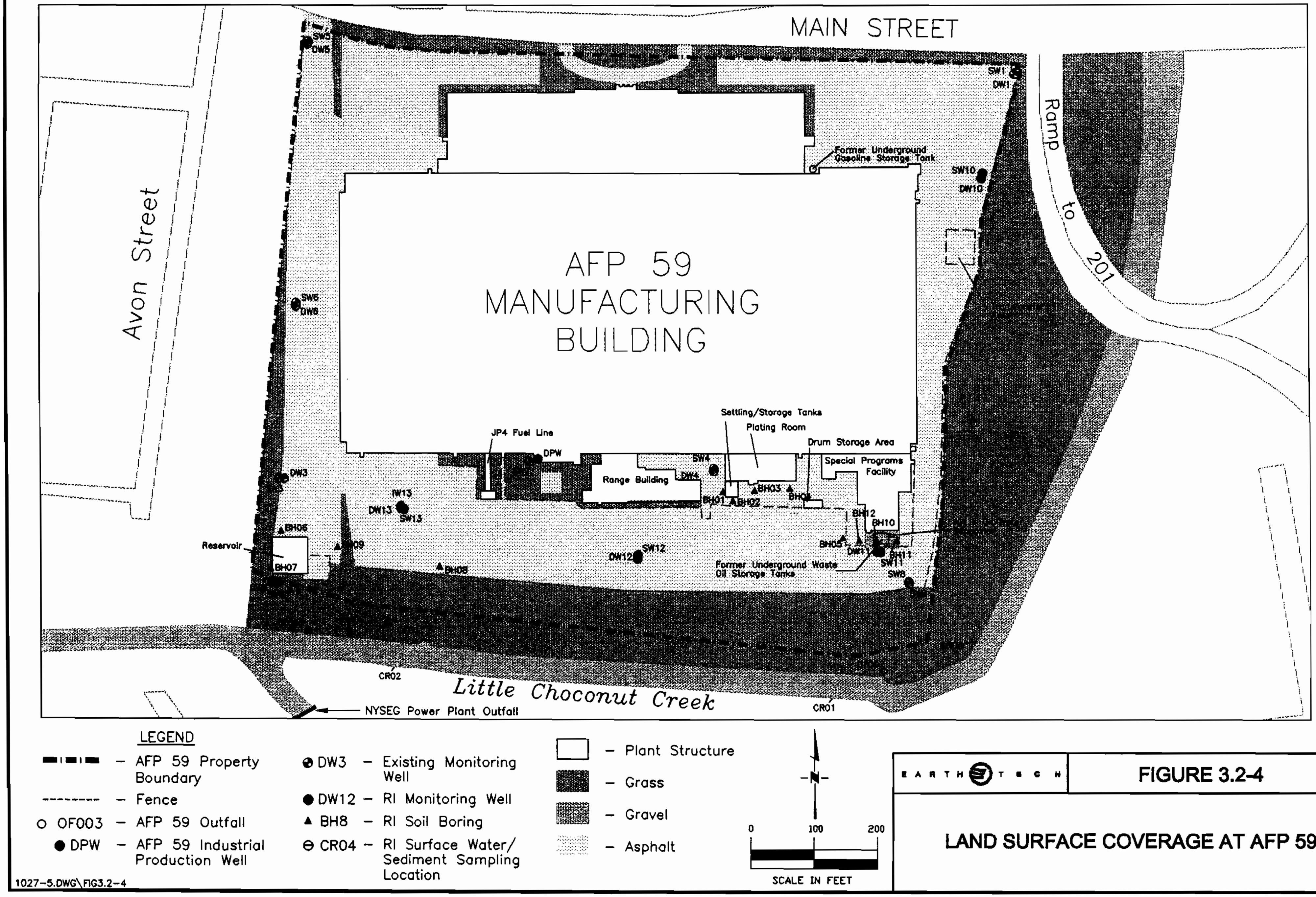
Although chemicals of potential concern have been identified in the soil at AFP 59, the surface is almost completely covered by the plant and surrounding parking lots (see Figure 3.2-4). The gravel-covered Waste Oil Tank Area represents the only complete air migration pathway that currently exists (i.e., migration of VOCs from subsurface soil to air). Future construction activities at the site exposing chemicals of potential concern in soil could also result in complete air migration pathways (either migration of VOCs from subsurface soil to air or migration of contaminated fugitive dust).

3.2.3 Potential Receptors

Potential human receptors for the identified, complete migration pathways are presented below as part of the AFP 59 conceptual site model. Figure 3.2-5 presents a release, transport, and exposure diagram summarizing sources, release mechanisms, migration pathways, exposure pathways, and potential receptors; complete pathways are identified. The following discussion is a summary from the NYSDEC-approved *Final RI Report* (Earth Tech, 1996b).

As part of the RI, a Fish and Wildlife Impact Analysis for AFP 59 and the surrounding area was performed through Step IIB (Criteria-Specific Analysis) under the guidance of the NYSDEC Division of Fish and Wildlife. Potential ecological receptors and exposure pathways were identified and discussed in the Fish and Wildlife Impact Analysis, which concluded that no terrestrial (animals and vegetation on land), riparian (animals and vegetation along a creek/river bank), or aquatic communities were threatened by AFP 59-related chemicals. As a result, an environmental risk assessment was not conducted and only potential human receptors are discussed below.

Figure 3.2-6 presents a zoning map that provides land use for property within 0.5 miles of AFP 59. As illustrated in the figure, the areas adjacent to AFP 59 include residential, industrial, and commercial properties. In general, areas immediately west and north of the plant are residential but include several commercial- and industrial-zoned properties. Immediately east of the plant are



EARTH TECH

FIGURE 3.2-4

LAND SURFACE COVERAGE AT AFP 59

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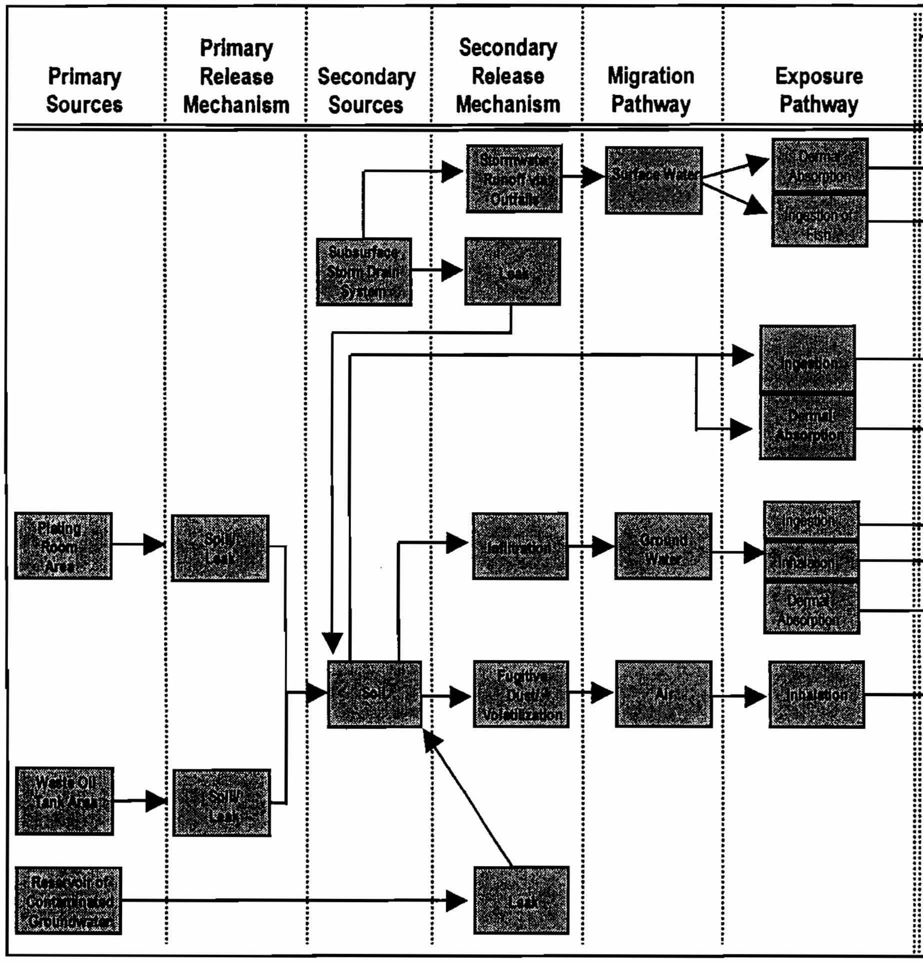

	Current Human Receptors			Future Human Receptors		
Exposure Pathway	Industrial (Plant) Workers	Recreational Users of Creek	Offsite Residents	Industrial Workers	Construction Workers	Offsite Residents
Dermal Absorption	NA	●	NA	NA	NA	NA
Ingestion of Fish	NA	●	NA	NA	NA	NA
Ingestion	X	NA	NA	●	●	NA
Dermal Absorption	X	NA	NA	●	●	NA
Ingestion	●	NA	●	●	NA	●
Inhalation	NA	NA	●	NA	NA	●
Dermal Absorption	NA	NA	●	NA	NA	●
Inhalation	●	NA	X	●	●	●

Explanation:

- ● Complete Pathway
- X Incomplete Pathway
- NA Not Applicable

EARTH TECH

FIGURE 3.2-5

AFP 59
Release, Transport, and Exposure Diagram

P:\PROJECTS\22680 AFP59\REPORTS\Record of Decision\WP\1027\1027 Figure 3.2-5.PPT

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SOURCES: JOHNSON CITY PLANNING DEPARTMENT
TOWN OF UNION PLANNING DEPARTMENT
VESTAL TOWN CLERKS OFFICE

1027-6.DWG\FIG3.2-6

EARTH TECH

FIGURE 3.2-6

ZONING CLASSIFICATION FOR PROPERTIES WITHIN 0.5 MILES OF AFP 59

unzoned areas, areas zoned for conservation, and residential and commercial properties. Immediately south of the plant is the NYSEG power plant, which is zoned as heavy industrial.

The only school within 0.5 miles of AFP 59 is the C.F. Johnson Junior High School, which is located approximately 2,000 feet east-southeast of the plant. The nearest hospital is the Wilson Memorial Hospital, which is located approximately 3,000 feet east-southeast of the plant. School students and hospital patients were not considered separately as potential receptors because the maximally exposed receptor (residents living immediately adjacent to AFP 59) was identified. Off-site residents were considered maximally exposed because they live adjacent to the site and their exposure periods are longer.

CURRENT RECEPTORS. Three potential on-site and off-site current human receptors were identified: industrial workers (i.e., plant employees), recreational users of Little Choconut Creek, and off-site residents. For industrial workers, the complete exposure pathways (see Figure 3.2-5) identified are ingestion of groundwater and inhalation of VOCs migrating from soil to air in the vicinity of the Waste Oil Tank Area. The soil and air pathways are not complete pathways for the Plating Room Area and the Reservoir Area because both areas are predominantly covered by the Manufacturing Building, asphalt parking lots, and grass (see Figure 3.2-4).

Drinking water at the plant is supplied by the Johnson City municipal well field (i.e., the Camden Street Well Field). While the groundwater pathway (ingestion) for industrial workers is complete, it was not necessary to quantify risk during the risk assessment because an air stripper is in place to reduce concentrations to levels below ARARs. Additionally, reported VOC concentrations in the groundwater at the well field have been below ARARs in recent years.

Recreational users of Little Choconut Creek were also identified as potential current receptors. People fish and wade in the creek in the vicinity of AFP 59; therefore, dermal absorption of chemicals from surface water and ingestion of contaminated fish are considered complete exposure pathways for these receptors. Swimming, which might result in incidental ingestion of surface water, was not considered during the risk assessment because water levels in the creek are generally too shallow.

Finally, off-site residents in the vicinity of AFP 59 were identified as potential current receptors. Ingestion of chemicals in groundwater, inhalation of VOCs while showering, and dermal absorption of chemicals while showering are potential groundwater exposure pathways. As stated above, it was not possible to quantify risk for the current groundwater pathway. However, although the groundwater exposure pathways are considered complete, groundwater from the Camden Street Well Field currently meets ARARs.

Inhalation of contaminated fugitive dust and VOCs migrating from soil to air are considered incomplete exposure pathways for current off-site residents because the property is predominantly covered by the Manufacturing Building, asphalt parking lots, and grass (see Figure 3.2-4).

FUTURE RECEPTORS. In evaluating potential future receptors, several assumptions were made during the risk assessment. First, it was assumed that the property will continue to be used as an industrial facility rather than for residential development. An agreement to transfer the property to Broome County has been approved, and Lockheed Martin intends to remain at the facility to continue similar industrial operations. Second, it was assumed that the potable water will continue to be supplied to the facility by the Camden Street Well Field. No on-site drinking water wells are anticipated because of the plant's proximity to the existing well field and the status of the aquifer as a sole-source aquifer. Finally, it was assumed that chemicals of potential concern in soil at the facility might be exposed in the future, both at the surface and subsurface (i.e., during excavation for construction activities).

Three potential on-site and off-site future human receptors were identified: industrial workers, on-site construction workers, and off-site residents. Exposure of future recreational users to chemicals of potential concern in surface water in Little Choconut Creek could not be addressed because future concentrations of chemicals in the surface water are unknown. Assuming that contaminated surface soil could be exposed in the future, the soil ingestion and dermal absorption pathways are considered complete for future industrial workers. Additionally, inhalation of contaminated fugitive dust and VOCs migrating from soil to air are considered complete pathways. Ingestion of chemicals of potential concern in groundwater from the Camden Street Well Field is also considered a complete exposure pathway for future industrial workers.

Future on-site construction workers could be exposed to subsurface soil (ingestion and dermal absorption of chemicals) during construction activities. Contact with groundwater during construction was not considered a complete pathway because of the depth to groundwater in the area (generally 12 to 25 feet bgs at AFP 59) and typical depths of excavation (0 to 12 feet bgs) during construction activities. Inhalation of contaminated fugitive dust and VOCs migrating from soil to air during construction activities are also complete pathways for future construction workers.

Future off-site residents in the vicinity of the plant could be exposed to chemicals of potential concern in groundwater through ingestion, inhalation of VOCs while showering, and dermal absorption while showering. Additionally, off-site migration of contaminated fugitive dust and VOCs in air could occur if the surface soil is exposed in the future. Therefore, off-site residents could be impacted by these exposure pathways.

3.3 Site Risk

The risk assessment considered the findings from the RI to determine if exposure to chemicals of potential concern in groundwater, soil, creek surface water, and air could be a risk to humans. As discussed in Section 3.2.3, no environmental risk assessment was conducted because the Fish and Wildlife Impact Analysis concluded that no terrestrial (animals and vegetation on land), riparian (animals and vegetation along a creek/river bank), or aquatic communities were threatened by AFP 59-related chemicals. A baseline risk assessment is a scientific procedure that uses facts and assumptions to estimate the potential for adverse effects on humans from exposure to chemicals, assuming no cleanup occurs. The risk assessment is used to determine if a site requires cleanup.

Risk was estimated by determining the amount of a chemical (in groundwater, soil, surface water, and air) that a person may ingest, inhale, or contact over a period of time (exposure) and comparing the exposure to a dose of the chemical known to cause harm. The risk potential was expressed in terms of the chance of a disease occurring. To calculate this chance, conservative (worst case) assumptions were made to protect public health.

Because cancer can result from exposure to chemicals at levels lower than that which cause other health problems, the greatest concern is that exposure may result in cancer. Therefore, the exposure is compared to the probability of increasing cancer. A risk level of 1 in 1,000,000 means that one additional person out of one million people exposed could develop cancer as a result of the exposure. In accordance with Federal regulations (40 Code of Federal Regulations [CFR] 300.430(e)(2)(i)(A)(2) [CFR, 1991a]), carcinogenic risk within the benchmark range of 1 cancer case in 10,000 (10^{-4}) to 1 cancer case in 1,000,000 (10^{-6}) is considered acceptable. Therefore, carcinogenic risk exceeding $1x10^{-6}$ was considered unacceptable.

Non-cancer causing effects are measured in terms of their hazard index, which is an index of the potential for adverse, non-cancer health effects. The hazard index acceptable to regulatory agencies for protection of human health is less than or equal to 1.

3.3.1 Conclusions from the Final RI Report Concerning Site Risk

This section presents the conclusions from the NYSDEC-approved *Final RI Report* (Earth Tech, 1996b) as they relate to the risk to human health. Section 3.4.4 presents the conclusions from the RI as they relate to the comparison of site chemicals of potential concern to ARARs. The conclusions are presented below by environmental medium. Although three source areas of soil contamination were identified at AFP 59, the conclusions treat the plant as a single investigative site because of its small size and similar environmental characteristics. Tables 3.3-1 and 3.3-2 present a summary of the human health risk assessment.

Only those analytes that contribute to unacceptable risk (i.e., carcinogenic risk exceeding $1x10^{-6}$ or hazard quotient (HQ) exceeding 1) are included in the discussion of risk in this section.

3.3.1.1 Soil

Carcinogenic and noncarcinogenic risk related to chemicals of potential concern in soil at AFP 59 are discussed below.

CARCINOGENIC RISK. Carcinogenic risk due to chemicals in soil was identified for future on-site industrial workers (see Table 3.3-1). The only exposure pathway and analyte that contributed to unacceptable risk for on-site industrial workers was dermal absorption of beryllium in surface soil at the Plating Room Area. However, beryllium was identified in 100 percent of the site surface soil samples collected in the Plating Room Area and in 100 percent of the background surface soil samples. Additionally, the site concentrations did not statistically exceed the background concentrations. Therefore, beryllium likely represents an area-wide problem (potentially related to emissions from the NYSEG coal-burning power plant located south of AFP 59) and the *Final RI Report* (Earth Tech, 1996b) eliminated it as a chemical of potential concern in surface soil at AFP 59.

NONCARCINOGENIC RISK. The presence of molybdenum in surface soil near the Plating Room Area (see Table 3.3-2) was also identified as a noncarcinogenic risk for future on-site industrial workers. Because the HQs for manganese (HQ=0.4) and total chromium (HQ=0.1) did not exceed 1, the potential for adverse noncarcinogenic health effects as a result of manganese or chromium was considered minimal. Although the HQ for molybdenum (HQ=2) did exceed 1, the potential for adverse noncarcinogenic health effects as a result of molybdenum was considered minimal for the following reasons: it was detected in only 1 of the 16 soil samples collected at the Plating Room Area; it was detected in the replicate sample of a normal soil sample, but not in the normal sample;

Table 3.3-1
Total Human Receptor Cancer Risk

Receptor	Total Cancer Risk Range			Factors Contributing to Risk >1E-06		
	Average Case	Reasonable Maximum Case	Receptor at Risk (>1E-06)	Pathway Contributing to Risk	Pathway Reasonable Maximum Case Risk	Chemical Contributing to Pathway Risk
CURRENT LAND USE						
Recreational Users of Little Choconut Creek	7E-05	4E-05	Yes	Ingestion of Contaminated Fish (from Little Choconut Creek)	4E-05	Arsenic bis(2-Ethylhexyl)phthalate p,p'-DDD
Recreational Users of Little Choconut Creek Background	1E-05	1E-05	Yes	Ingestion of Contaminated Fish (from Background for Little Choconut Creek)	1E-05	Arsenic
On-site Industrial Workers Impacted by the Waste Oil Tank Area	1E-08	1E-08	No	NA	NA	NA
FUTURE LAND USE						
Off-site 30-Year Residents	4E-05	2E-03(1)	Yes	Dermal Absorption of Chemicals in Shower Water	3E-05	Beryllium p,p'-DDE Trichloroethene Vinyl Chloride
				Ingestion of Chemicals in Drinking Water	1E-04	1,1-Dichloroethene Beryllium Trichloroethene Vinyl Chloride
				Inhalation of VOCs While Showering	2E-03	1,1-Dichloroethene Bromodichloromethane Carbon Tetrachloride Chloroform Methylene Chloride Trichloroethene Vinyl Chloride
On-site Industrial Workers	3E-05	9E-05(1)	Yes	Plating Room - Dermal Absorption of Chemicals in Surface Soil	3E-05	Beryllium
				Ingestion of Chemicals in Drinking Water	6E-05	1,1-Dichloroethene Beryllium Trichloroethylene Vinyl Chloride

Table 3.3-1
Total Human Receptor Cancer Risk (Continued)

Receptor	Total Cancer Risk Range			Factors Contributing to Risk >1E-06		
	Average Case	Reasonable Maximum Case	Receptor at Risk (>1E-06)	Pathway Contributing to Risk	Pathway Reasonable Maximum Case Risk	Chemical Contributing to Pathway Risk
On-site Construction Workers Impacted by the Plating Room	2E-07	2E-07	No	NA	NA	NA
On-site Construction Workers Impacted by the Reservoir	2E-07	2E-07	No	NA	NA	NA
On-site Construction Workers Impacted by the Waste Oil Tanks	1E-06	8E-07	No	NA	NA	NA
On-site Construction Workers (2) Impacted by All Source Areas	1E-06	1E-06	No	NA	NA	NA

Key: NA = Not Applicable

(1) In calculating the reasonable maximum case risk, the shallow and deep groundwater pathway risks were combined by selecting the highest shallow or deep zone risk for each analyte.

(2) The same on-site construction workers were assumed to work at each source area for the full two month exposure duration. Consequently, risk from exposure at each source area was summed to determine total risk.

Note: For some of the receptors, the average case cancer risk exceeds the reasonable maximum case cancer risk. This is because of the frequency of non-detects and because one-half of the PQL is greater than the maximum detected value; therefore, the arithmetic mean concentration used to calculate average risk exceeds the one-sided 95% UCL of the arithmetic mean used to calculate reasonable maximum case cancer risk.

Table 3.3-2
Total Human Receptor Hazard Index

Receptor	Total Hazard Index Range			Factors Contributing to an Hazard Index > 1		
	Average Case	Reasonable Maximum Case	Receptor Hazard Index > 1	Pathway Contributing to the Hazard Index >1	Pathway Reasonable Maximum Case Hazard Index	Chemical Contributing to Pathway Hazard Index >1
CURRENT LAND USE						
Recreational Users of Little Choconut Creek	8E-01	8E-01	No	NA	NA	NA
Recreational Users of Little Choconut Creek Background (i.e., upstream of AFP 59)	8E-02	1E-01	No	NA	NA	NA
On-site Industrial Workers Impacted by the Waste Oil Tank Area	1E-05	1E-05	No	NA	NA	NA
FUTURE LAND USE						
Off-site 30-Year Residents	3E+00	8E+01(1)	Yes	Ingestion of Chemicals in Drinking Water	7E+00	Thallium
				Inhalation of VOCs While Showering	7E+01	cis-1,2-Dichloroethene Trichloroethene
On-site Industrial Workers	3E+00	1E+01(1)	Yes	Plating Room - Dermal Absorption of Chemicals in Surface Soil	3E+00(3)	Molybdenum Manganese Total Chromium
				Ingestion of Chemicals in Drinking Water	6E+00	Thallium
On-site Construction Workers Impacted by the Plating Room	2E+00	1E+00	No	NA	NA	NA
On-site Construction Workers Impacted by the Reservoir	2E-01	2E-01	No	NA	NA	NA
On-site Construction Workers Impacted by the Waste Oil Tanks	2E-01	2E-01	No	NA	NA	NA
On-site Construction Workers (2) Impacted by All Source Areas	2E+00	1E+00	No	NA	NA	NA

Key: NA = Not Applicable

(1) In calculating the reasonable maximum case hazard index, the shallow and deep groundwater pathway hazard indexes were combined by selecting the highest shallow or deep zone hazard index for each analyte.

(2) The same on-site construction workers were assumed to work at each source area for the full two-month exposure duration. Consequently, the hazard index from exposure at each source area was summed to determine a total hazard index.

(3) As a screening approach, the hazard quotients for molybdenum, manganese, and total chromium were considered additive. Molybdenum, manganese, and chromium do not induce the same noncarcinogenic health effects. Consequently, their hazard quotients are not considered additive for determination of a final hazard index. The hazard quotient of 2 for molybdenum still exceeds one. Manganese, with a hazard quotient for 0.4, and chromium, with a hazard quotient of 0.1, no longer contributes to a pathway hazard index that is greater than one.

Note: For some of the receptors, the average case hazard index exceeds the reasonable maximum case hazard index. This is because of the frequency of non-detects and because one-half of the PQL is greater than the maximum detected value: therefore, the arithmetic mean concentration used to calculate the average case hazard index exceeds the one-sided 95% UCL of the arithmetic mean used to calculate reasonable maximum case hazard index.

the replicate sample displayed elevated concentrations of most inorganics compared to the normal sample; the one site detect that drove risk (4,060 mg/kg at the Plating Room Area) was greatly elevated compared to other site detects (22 mg/kg was the second highest detected concentration); the other site detects did not drive risk at either the Waste Oil Tank Area or the Reservoir Area; and the one site detect that drove risk was from a soil sample collected beneath an asphalt surface (therefore, exposure to the soil is unlikely). Despite this information, the *Final RI Report* (Earth Tech, 1996b) did not eliminate molybdenum as a chemical of potential concern in soil at AFP 59. Therefore, appropriate personnel protective equipment should be worn if exposure to site soils is possible.

3.3.1.2 Groundwater

Carcinogenic and noncarcinogenic risk related to chemicals of potential concern in groundwater at AFP 59 are discussed below.

CARCINOGENIC RISK. Carcinogenic risk due to chemicals in groundwater was identified for future off-site 30-year residents and future on-site industrial workers (see Table 3.3-1). For future off-site 30-year residents, the following exposure pathways and analytes contributed to unacceptable risk:

- Dermal absorption of beryllium, p,p'-DDE, TCE, and vinyl chloride in shower water;
- Ingestion of 1,1-dichloroethene, beryllium, TCE, and vinyl chloride in drinking water; and
- Inhalation of 1,1-dichloroethene, bromodichloromethane, carbon tetrachloride, chloroform, methylene chloride, TCE, and vinyl chloride while showering.

For future on-site industrial workers, the following exposure pathway and analytes contributed to unacceptable risk:

- Ingestion of 1,1-dichloroethene, beryllium, TCE, and vinyl chloride in drinking water.

Although beryllium contributed to unacceptable risk, it was detected in groundwater monitoring wells at AFP 59 at concentrations below the New York State guidance value (no drinking water or ambient water quality standards exist for beryllium) and below the laboratory PQL. Additionally, the presence of beryllium may be related to emissions from the NYSEG power plant rather than historical activities at AFP 59. As a result, the *Final RI Report* (Earth Tech, 1996b) eliminated beryllium as a chemical of potential concern in groundwater at AFP 59. The detection of the pesticide p,p'-DDE in the deep zone of the aquifer is probably unrelated to historical activities at AFP 59 because it was not detected in site soil samples or in the shallow zone of the aquifer. Therefore, no documented on-site source exists (the p,p'-DDE was interpreted to have migrated to AFP 59 from an off-site, hydraulically upgradient source) and the *Final RI Report* (Earth Tech, 1996b) eliminated it as a chemical of potential concern in groundwater at AFP 59.

The VOCs detected in groundwater samples collected from on-site monitoring wells at AFP 59, especially the chlorinated hydrocarbons, were detected in past studies. As a result, one of the objectives of the RI was to substantiate the earlier detections and delineate the extent of VOCs in groundwater. While the VOCs did contribute to unacceptable risk, their presence in groundwater at AFP 59 is not of immediate concern because of the air stripper currently operating at the Camden Street Well Field located downgradient of AFP 59. The air stripper, for which the USAF pays a portion of the operation and maintenance (O&M) costs, removes any VOCs from the drinking water supplied to local residents.

Although VOCs have been detected in the past at the Camden Street Well Field, it is not possible to document what portion of the VOCs have migrated from AFP 59. Groundwater that underlies AFP 59 only accounts for a small fraction of the total volume of groundwater that is pumped at the well field. As a result, any VOCs originating at AFP 59 would be greatly diluted by the time it reached the well field. Additionally, the USGS (1996) has identified potential source areas other than AFP 59 that exist within the zone of influence of the well field.

NONCARCINOGENIC RISK. Noncarcinogenic risk due to chemicals in groundwater was also identified for future off-site 30-year residents and future on-site industrial workers (see Table 3.3-2). For future off-site 30-year residents, the following exposure pathways and analytes contributed to unacceptable risk:

- Ingestion of thallium in drinking water; and
- Inhalation of cis-1,2-DCE and TCE while showering.

For future on-site industrial workers, the following exposure pathway and analyte contributed to unacceptable risk:

- Ingestion of thallium in drinking water.

No definable on-site source exists for thallium because it was not detected in site soil samples or in the shallow zone of the aquifer. Additionally, thallium was only detected in one of the nine groundwater samples collected from deep monitoring wells. Therefore, the thallium was interpreted to have migrated to AFP 59 from an off-site, hydraulically upgradient source, and the *Final RI Report* (Earth Tech, 1996b) eliminated it as a chemical of potential concern in groundwater at AFP 59. As discussed above, VOCs (in this case cis-1,2-DCE and TCE) are not of immediate concern at AFP 59 because of the air stripper operating at the well field.

3.3.1.3 Sediment

A human health risk assessment was not conducted for sediment in Little Choconut Creek because no complete exposure pathway was identified. However, because New York State sediment screening criteria are risk-based, they do allow for a preliminary assessment of risk. A comparison of site detections and New York State sediment screening criteria is presented in Section 3.4.4.

3.3.1.4 Surface Water

Carcinogenic risk related to chemicals of potential concern in surface water in Little Choconut Creek adjacent to AFP 59 is discussed below. No noncarcinogenic risk was identified.

CARCINOGENIC RISK. Current recreational users of Little Choconut Creek are potentially exposed to unacceptable risk due to ingestion of arsenic, BEHP, and p,p'-DDD in contaminated fish (see Table 3.3-1). Arsenic (possibly related to emissions from the NYSEG power plant) contributed to unacceptable risk for both site and background samples; therefore, exposure to BEHP and p,p'-DDD drove site risk. However, the two analytes were only detected in the surface water sample collected at CR04, which is located downstream of both the NYSEG and AFP 59 outfalls. They were not detected at the two surface water sampling locations immediately downstream of the AFP 59 outfalls (CR01 and CR02) or at the two background surface water sampling locations (CR05 and CR06). Consequently, they may have migrated from the NYSEG outfall and not AFP 59. Additionally, neither of the two analytes was detected in both the normal and duplicate samples collected at CR04, and neither was detected during previous surface water sampling conducted by Argonne National Laboratory (1994). Despite this information, the *Final RI Report* (Earth Tech, 1996b) did not eliminate arsenic, BEHP, or p,p'-DDD as chemicals of potential concern in surface water at AFP 59. As a result, additional sampling was conducted as part of the December 1995 investigation (see Section 3.3.2).

3.3.2 Conclusions from the Final RI Report Addendum Concerning Site Risk

Groundwater, sediment, and surface water sampling completed in December 1995 and documented in the *Final RI Report Addendum* (Earth Tech, 1996c) was conducted to accomplish the following objectives:

- To provide another round of groundwater samples from select locations to further characterize the extent of VOCs contamination in site groundwater;
- To verify or eliminate those chemicals of potential concern identified in the *Final RI Report* (Earth Tech, 1996b) that contributed to unacceptable risk; and
- To further evaluate the direction of groundwater flow beneath AFP 59 in the shallow and deep zones of the aquifer.

The analyses performed on samples collected during the December 1995 investigation were selected based on conclusions from the *Final RI Report* (Earth Tech, 1996b) and recommendations made by the NYSDEC. The conclusions from the *Final RI Report* (Earth Tech, 1996b) concerning site risk are presented in Section 3.3.1. Only those analytes that either contributed to unacceptable risk (i.e., carcinogenic risk exceeding 1×10^{-6} or noncarcinogenic risk with a HQ exceeding 1.0) or exceeded ARARs were considered during the December 1995 sampling event. This section presents the conclusions from the *Final RI Report Addendum* (Earth Tech, 1996c) as they relate to the risk to human health. The conclusions are presented by environmental medium. Section 3.4.5 presents the conclusions from the *Final RI Report Addendum* as they relate to the comparison of site chemicals of potential concern to ARARs.

3.3.2.1 Soil

None of the analytes that contributed to unacceptable risk in soil were sampled and analyzed for during the December 1995 investigation for reasons discussed in Section 3.3.1.1.

3.3.2.2 Groundwater

Beryllium, thallium, and p,p'-DDE were not sampled and analyzed for during the December 1995 investigation for reasons discussed in Section 3.3.1.2. However, groundwater samples were analyzed for VOCs to monitor VOC levels at select locations one year after the RI sampling to substantiate the earlier detections and to further delineate the extent of VOCs in groundwater. The VOCs and concentrations detected in groundwater samples collected during the December 1995 sampling event were very similar to VOCs and concentrations detected in groundwater samples collected during the December 1994 sampling event. Therefore, although no risk assessment was conducted during the

December 1995 investigation, the results substantiate the risks associated with exposure to groundwater identified in the *Final RI Report* (Earth Tech, 1996b).

3.3.2.3 Sediment

A human health risk assessment was not conducted for sediment in Little Choconut Creek because no complete exposure pathway was identified. However, because New York State sediment screening criteria are risk-based, they do allow for a preliminary assessment of risk. A comparison of December 1995 detections and New York State sediment screening criteria is presented in Section 3.4.5.

3.3.2.4 Surface Water

Surface water samples were collected to substantiate or eliminate arsenic, BEHP, and p,p'-DDD as chemicals of potential concern in Little Choconut Creek surface water. No chemicals, including arsenic, BEHP, and p,p'-DDD, were detected in site or background surface water samples collected during the December 1995 sampling event. Therefore, the *Final RI Report Addendum* (Earth Tech, 1996c) eliminated arsenic, BEHP, and p,p'-DDD as chemicals of potential concern in surface water at AFP 59.

3.4 Applicable or Relevant and Appropriate Requirements

Section 121 of CERCLA requires that site cleanups comply with Federal ARARs or State ARARs (whichever are more stringent). ARARs are derived from both Federal and State laws. A requirement may be either "applicable" or "relevant and appropriate." "Applicable" requirements are those promulgated Federal or State substantive cleanup standards, standards of control, or requirements under Federal or State environmental laws or facility siting laws that meet all jurisdictional prerequisites of a requirement and fully address the circumstances at the site or the proposed remedial activity. Applicable requirements are identified on a site-specific basis by determining whether the jurisdictional prerequisites of a requirement fully address the circumstances at the site or the proposed remedial activity.

If not applicable, a requirement may nevertheless be "relevant and appropriate" if circumstances at the site, based on best professional judgment, are sufficiently similar to the problems or situations regulated by the requirement. Relevant and appropriate requirements are also determined on a site-specific basis by determining their jurisdictional prerequisites and comparing them to circumstances at the site. If there is sufficient similarity between the requirement and circumstances at the site, then determination of the requirement as relevant and appropriate may be made.

In addition to ARARs, nonpromulgated advisories or guidances, referred to as to-be-considered (TBC) materials, may also apply to the conditions found at a site. TBCs are not legally binding. However, they may be used to determine cleanup levels when ARARs do not exist or when ARARs alone would not be sufficiently protective of human health and the environment.

There are three types of ARARs: chemical-specific, location-specific, and action-specific. They are reviewed below.

3.4.1 Chemical-Specific ARARs

Chemical-specific ARARs include those environmental laws and regulations that regulate the release to the environment of materials possessing certain chemical or physical characteristics or containing specified chemical compounds. These requirements generally set health- or risk-based concentration limits or discharge limits for specific hazardous substances. Chemical-specific ARARs are triggered by the specific chemicals found at a particular site.

This section presents a summary of Federal and State chemical-specific ARARs for groundwater and surface water and TBCs for soil and sediment. Chemical-specific ARARs and TBCs are listed, and comparisons are made between ARARs and maximum chemical concentrations for each chemical identified. Only TBCs are listed for soil and sediment because there are no chemical-specific ARARs for soil and sediment.

GROUND AND SURFACE WATER ARARS AND TBCS. Primary maximum contaminant levels (MCLs) are enforceable standards for chemicals in public drinking water supply systems. MCLs are relevant and appropriate as groundwater cleanup standards where groundwater is a potential drinking water source. Groundwater is a potential drinking water source at AFP 59. For groundwater, Federal primary MCLs were obtained from 40 CFR 141 (CFR, 1991b).

The New York State chemical-specific groundwater standards were obtained from the New York State Sanitary Code, Chapter I, Subpart 5-1, Public Water Systems (New York State Department of Health, 1993). For those analytes not listed in the New York Sanitary Code, groundwater standards and guidance values were obtained from *Water Quality Regulations: Surface Water and Groundwater Classifications and Standards,* New York State Codes of Rules and Regulations, Title 6, Chapter X, Parts 700-705 (NYSDEC, 1992). A memorandum, Division of Water Technical and Operational Guidance Series (1.1.1), *Ambient Water Quality Standards and Guidance Values* (NYSDEC, 1993a), outlines the regulations in Title 6, Chapter X, Parts 700-705. Surface water standards were also obtained from Title 6, Chapter X, Parts 700-705.

SOIL ARARS AND TBCS. Neither the Federal government nor the State of New York have developed a comprehensive list of general cleanup standards for soil; the Toxic Substances Control Act does establish PCB soil cleanup levels for residential, industrial, and transformer substation scenarios. There are, however, various methodologies and guidelines for determining soil cleanup levels. These are considered TBCs. The methodology for determination of soil cleanup objectives is presented in a NYSDEC Division Technical and Administrative Guidance Memorandum entitled *Determination of Soil Cleanup Objectives and Cleanup Levels* (NYSDEC, 1994). These generic soil cleanup objectives will "at a minimum, eliminate all significant threats to human health and/or the environment" (NYSDEC, 1994). The cleanup objectives are intended to be protective of: (1) human health from exposure to carcinogens and systemic toxicants; and (2) groundwater/drinking water quality. However, background values and/or MDLs may be used as the objectives if the calculated soil cleanup objectives are less than either of these values.

The cleanup objectives for protection of groundwater/drinking water are developed using the water/soil partitioning theory to predict the "maximum amount of contamination that may remain in soil so that leachate from the contaminated soil will not violate groundwater and/or drinking water standards" (NYSDEC, 1994). A correction factor of 100 is also used to account for mechanisms that would hinder the migration of contamination from soil to groundwater that are not considered as part of the partitioning theory. In calculating the allowable soil concentration, the fraction of organic carbon in the site soil is used to develop site-specific cleanup objectives. Soil cleanup objectives were calculated for all analytes detected at each of the three areas identified during the RI. For each area, an average TOC concentration was determined from data collected during the RI and used to calculate site-specific cleanup objectives. If an analyte was not detected at a particular area, no cleanup objective was calculated. In addition to these calculated objectives, the following maximum values for groups of chemicals may not be exceeded:

Total VOCs $\leq$ 10 parts per million (ppm),
Total SVOCs $\leq$ 500 ppm,
Individual SVOCs $\leq$ 50 ppm, and
Total pesticides $\leq$ 10 ppm.

Where the site-specific, calculated cleanup objective exceeded any of these criteria, the listed maximum value was considered the appropriate cleanup objective.

For cleanup values for metals, eastern United States or New York State soil background values may be used, although site-specific background data are preferable (NYSDEC, 1994). A statistical comparison of site inorganic concentrations in soil to AFP 59 background is presented in Section 3.1.4, and inorganics exceeding background are identified.

SEDIMENT ARARS AND TBCS. There are no Federal or State standards for cleanup of sediments. New York State criteria for screening sediments for human health and environmental risk do, however, exist. The sediment criteria were obtained from the *Technical Guidance for Screening Contaminated Sediments* (NYSDEC, 1993b). The sediment screening criteria were developed "to identify areas of sediment contamination and to make a preliminary assessment of the risk posed by the contamination to human health and the environment" (NYSDEC, 1993b). Different methods were used to develop screening criteria for two classes of chemicals (nonpolar organics and metals). The organic criteria are based on the USEPA equilibrium partitioning model and are tied to New York State surface water quality standards and guidance values and USEPA surface water criteria. The organic screening criteria are also based on the concentration of organic carbon in the sampled sediment; therefore, the screening criteria apply to specific sediment samples. Sediment criteria are developed for protection of human health from toxic effects of bioaccumulation; aquatic life from acute toxicity; aquatic life from chronic toxicity; and wildlife from toxic effects of bioaccumulation. If the criteria for any of these categories is exceeded, a sediment is considered to be contaminated.

The sediment screening criteria for metals are based on two levels of protection (lowest effect levels and severe effect levels). Background concentrations for metals are not used since naturally occurring concentrations could cause adverse ecological effects. Lowest effect levels indicate the "level of sediment contamination that can be tolerated by the majority of benthic organisms, but still causes toxicity to a few species" (NYSDEC, 1993b); severe effect levels indicate the "concentration at which pronounced disturbance of the sediment dwelling community can be expected" (NYSDEC, 1993b). The New York State lowest effect level is the lower of either the lowest effect level as described in the Ontario Ministry of the Environment guidelines for metals (Persaud, Jaagumagi, and Hayton, 1992), or the effect range-low as described by Long and Morgan (1990). The New York State severe effect level is the lower of either the severe effect level as described in the Ontario Ministry of the Environment guidelines for metals (Persaud, Jaagumagi, and Hayton, 1992), or the effect range-moderate as described by Long and Morgan (1990). A sediment is considered contaminated if either of these levels is exceeded. If only the lowest effect level is exceeded, the impact is considered moderate; if both criteria are exceeded, the sediment is considered to be severely impacted. The metals criteria are intended for screening only; if metals are identified exceeding these criteria, additional studies are needed to quantify risk and determine if remediation is necessary.

3.4.2 Potential Location-Specific ARARs

Location-specific ARARs govern activities in certain environmentally sensitive areas. Potential location-specific ARARs that may be pertinent to remedial activities at AFP 59 are described below:

- **Endangered Species Act (50 CFR 200 and 402).** Endangered species and the critical habitats upon which they depend are protected under this statute. Threatened species are also identified.

- **Executive Order on Flood Plain Management (Executive Order No. 11988).** In furtherance of the National Environmental Policy Act of 1969 (NEPA) (42 USC 4321 *et seq.*), the National Flood Insurance Act (42 USC 4001 *et seq.*), and the Flood Disaster Protection Act (PL93-234, 87 Stat. 975), long- and short-term adverse impacts associated with the occupancy and modification of flood plains are regulated. Mandatory identification of flood plains, alternatives to activities conducted or planned in flood plains, and potentially an Environmental Impact Statement for activities that cannot be moved, are stipulated.

- **National Historic Preservation Act (16 USC Section 470 et seq. 36 CFR Part 800).** This act requires Federal agencies to take into account the effect of any federally assisted undertaking or licensing on any district, site, building structure, or object that is included in or eligible for inclusion in the National Register for Historic Places.

- **Clean Water Act, Section 404(b)(1) and Executive Order 11990 "Protection of Wetlands" (40 CFR Section 230.10 and Executive Order 11990).** Section 404 of the Clean Water Act requires permits for the discharge of dredge or fill materials into wetlands. Executive Order 11990, in furtherance of the NEPA, requires action to minimize adverse impact, destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

- **New York State Freshwater Wetlands Act and implementing regulations (Article 24 ECL, 6 NYCRR Parts 663 and 664).** The Act and implementing regulations require that wetlands be preserved, protected, and conserved consistent with the general welfare and beneficial economic, social and agricultural development of the State. Unavoidable adverse impacts on wetlands are addressed through a mitigation program.

- **Laws and regulations regulating streams and navigable water bodies (Article 15 ECL, 6 NYCRR Part 608).** The laws and regulations prohibit change, modification or disturbance of any protected stream, its bed, or banks without a permit. Placement of dams or docks and excavation or placement of fill in navigable waters is also regulated.

3.4.3 Potential Action-Specific ARARs

Action-specific ARARs are restrictions that define acceptable treatment and disposal procedures for hazardous substances. These ARARs generally set performance, design or other similar action-specific controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants, such as Resource Conservation and Recovery Act (RCRA) regulations for waste treatment, storage, and disposal. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. These requirements may include:

- **National Pretreatment Standards (40 CFR Part 403)**. Standards are set to control pollutants that pass through or interfere with treatment processes in publicly owned treatment works or that may contaminant sewage sludge.

- **Clean Water Act (33 USC 1251-1376).** This act sets standards and requirements for pollutant discharge. **The National Pollutant Discharge Elimination System (NPDES) (40 CFR 122 and 125)** requires permits for the discharge of pollutants from any point source into waters of the United States.

- **New York Hazardous Waste Identification Rules (NYCRR, Title 6, Chapter 371).** These regulations establish criteria for identifying a hazardous waste.

- **New York Final Status and Interim Status Standards for Owners and Operators of Hazardous Waste Facilities (NYCRR, Title 6, Chapter IV, Subchapter B, Subpart 373-2 and 373-3).** Site remedies may include the operation of facilities for storage or treatment of groundwater and soils containing hazardous contaminant concentrations. Potential pertinent regulations include those regulating tank systems, waste piles, container storage, and generation of hazardous waste.

- **New York Land Disposal Restrictions (NYCRR, Title 6, Chapter IV, Subchapter B, Subpart 376)**. These regulations prohibit the land disposal of any waste listed in the regulations and containing constituents exceeding published criteria. These regulations may be applicable to the disposal of soils and treatment residuals, if soils are treated and disposed of on-site.

3.4.4 Conclusions from the Final RI Report Concerning ARARs

This section presents the conclusions from the NYSDEC-approved *Final RI Report* (Earth Tech, 1996b) as they relate to the comparison of site chemicals of potential concern to ARARs. The conclusions are presented below by environmental medium. Tables 3.4-1 through 3.4-4 present a comparison of site data to ARARs.

3.4.4.1 Soil

In addition to those analytes that contributed to unacceptable risk, the following analytes were detected in site soil samples above calculated soil cleanup objectives (see Table 3.4-1): acetone and benzo(a)anthracene in the Plating Room Area, heptachlor epoxide in the Reservoir Area, and benzo(b)fluoranthene and chrysene in all three areas. Acetone is a common laboratory contaminant and probably does not represent site contamination. The only heptachlor epoxide detected in the Reservoir Area was from a soil sample collected beneath the asphalt parking lot; therefore, no known

Table 3.4-1
Comparison of Site Organic Soil Data and Cleanup Objectives

Analyte	Plating Room		Waste Oil Tanks		Reservoir	
	Calculated New York Soil Cleanup Objective (mg/kg)	Maximum Site Concentration (mg/kg)	Calculated New York Soil Cleanup Objective (mg/kg)	Maximum Site Concentration (mg/kg)	Calculated New York Soil Cleanup Objective (mg/kg)	Maximum Site Concentration (mg/kg)
Acetone	0.03	**1.54**	NC	NA	NC	NA
Acenaphthene	21.5	0.15	43.7	0.29	NC	ND
Anthracene	50*	0.59	50*	0.42	50*	0.14
Benzo(a)anthracene	0.65	**2.7**	1.3	1.0	1.4	0.5
Benzo(a)pyrene	2.6	1.6	5.2	0.97	5.5	0.42
Benzo(b)fluoranthene	0.26	**2.9**	0.52	**1.3**	0.55	**0.78**
Benzo(g,h,i)perylene	NC	ND	50*	0.49	50*	0.15
Beta BHC	NC	ND	0.09	0.0043	NC	ND
Delta BHC	NC	ND	0.16	0.0021	0.17	0.0009
Gamma BHC	NC	ND	0.03	0.0006	0.028	0.0006
Bromomethane	--	0.016	--	ND	--	ND
n-Butylbenzene	--	ND	--	0.047	--	ND
sec-Butylbenzene	--	ND	--	0.011	--	ND
Bis(2-ethylhexyl)phthalate	50*	0.471	50*	0.97	50*	0.2
Chloroethane	NC	ND	0.88	0.0045	NC	ND
Chrysene	0.09	**2.6**	0.19	**1.0**	0.2	**0.5**
s-1,2-Dichloroethene	--	ND	--	0.11	--	ND
Cymene	--	ND	--	0.053	--	ND
4,4'-DDD	1.8	0.0022	3.7	0.0056	4.1	0.0061
4,4'-DDT	NC	ND	1.2	0.008	1.3	0.0049
Dibenzofuran	NC	ND	2.9	0.36	NC	ND
Dibenz(a,h)anthracene	NC	ND	50*	0.11	NC	ND
1,1-Dichloroethane	NC	ND	0.07	0.011	NC	ND
Dieldrin	NC	ND	0.05	0.0039	0.06	0.0036
2,4-Dinitrotoluene	--	ND	--	0.41	--	ND
Endosulfan I	0.19	0.0026	0.39	0.0028	NC	ND
Endosulfan II	NC	ND	NC	ND	0.42	0.0053
Endosulfan Sulfate	NC	ND	0.48	0.013	NC	ND
Endrin	NC	ND	0.04	0.0088	0.05	0.0024
Endrin Aldehyde	--	ND	--	0.043	--	0.014
Ethylbenzene	NC	ND	2.6	0.0013	NC	ND
Fluoranthene	50*	5.3	50*	2.7	50*	0.94
Fluorene	50*	0.11	50*	0.45	NC	ND
Heptachlor	NC	ND	NC	ND	0.06	0.0021
Heptachlor Epoxide	NC	ND	NC	ND	0.001	**0.0049**
Indeno(1,2,3-cd)pyrene	NC	ND	1.5	0.45	1.6	0.16
Isopropylbenzene	--	ND	--	0.0028	--	ND
Methoxychlor	10*	0.013	10*	0.025	10*	0.024
Methylene chloride	0.03	0.089	0.05	0.076	0.05	0.037
ethyl Ethyl Ketone	--	0.00454	--	ND	--	ND
Methylnaphthalene	NC	ND	17.3	0.6	NC	ND

Table 3.4-1
Comparison of Site Organic Soil Data and Cleanup Objectives (Continued)

Analyte	Plating Room		Waste Oil Tanks		Reservoir	
	Calculated New York Soil Cleanup Objective (mg/kg)	Maximum Site Concentration (mg/kg)	Calculated New York Soil Cleanup Objective (mg/kg)	Maximum Site Concentration (mg/kg)	Calculated New York Soil Cleanup Objective (mg/kg)	Maximum Site Concentration (mg/kg)
Naphthalene	NC	ND	6.2	2.5	NC	ND
PCB-1254	0.41	0.17	0.83	0.17	NC	ND
PCB-1260	NC	ND	0.83	0.15	0.92	0.079
Phenanthrene	50*	2.7	50*	2.9	50*	0.61
n-Propylbenzene	--	ND	--	0.0078	--	ND
Pyrene	50*	4.2	50*	2.3	50*	0.8
Styrene	--	0.00124	--	ND	--	ND
1,2,3-Trichlorobenzene	--	ND	--	ND	--	0.0031
1,1,1-Trichloroethane	0.18	0.0087	NC	ND	0.38	ND
Trichloroethene	0.15	0.071	0.30	0.015	0.32	0.07
1,2,4-Trimethylbenzene	--	ND	--	0.07	--	ND
1,3,5-Trimethylbenzene	--	ND	--	0.19	--	ND
Vinyl Chloride	NC	ND	0.05	0.015	NC	ND
m,p-Xylenes	0.281	0.00273(1)	0.57	0.0066	NC	ND
o-Xylenes	NC	ND	0.57	0.0062	NC	ND

Key:

ND	=	Not detected
NC	=	Not calculated
NA	=	Not analyzed
*	=	Calculated site-specific cleanup objective exceeds maximum value for group of contaminants; group maximum value is used.
--	=	No cleanup objective available
(1)	=	Total Xylenes

Note: Concentrations exceeding cleanup objectives are in bold font and shaded.

Table 3.4-2
Comparison of Site Data and Federal and New York State Chemical-Specific ARARs for Groundwater and Surface Water

Analyte	**Federal Primary MCL**	**New York Drinking Water Standard**	**New York Surface Water Standard**	**Max. Site Shallow Ground-water Conc.**	**Max. Site Deep Ground-water Conc.**	**Max. Site Surface Water Conc.**
ORGANIC COMPOUNDS (µg/L)						
BHC (total)	---	5 (1)	0.01 (1)	0.01	0.011	**0.0155**
Bis(2-ethylhexyl) phthalate	6	50	0.6	ND	5.9	**3.0**
Bromodichloromethane	100 (2)	100	---	0.38	ND	0.60
Bromoform	100 (2)	100	---	ND	ND	1.1
Carbon Tetrachloride	5	5	---	0.6	ND	ND
Chlorodibromomethane	100 (2)	100	---	ND	ND	0.96
Chloroethane	---	5	---	4.2	ND	ND
Chloroform (Trichloromethane)	100 (2)	100	---	0.46	ND	0.33
Chloromethane	---	5	---	ND	0.38	ND
4,4'-DDE, 4,4'-DDD, 4,4'-DDT (total)	---	ND	0.001	ND	**0.166**	**0.018**
Dichlorodifluoromethane	---	5	---	ND	ND	0.38
1,1-Dichloroethane	---	5	---	**33**	2.4	ND
1,1-Dichloroethene	7	5	---	2.1	ND	ND
cis-1,2-Dichloroethene	70	5	---	**150**	**36**	ND
trans-1,2-Dichloroethene	100	5	---	0.30	ND	ND
Alpha Endosulfan (Endosulfan I)	---	---	0.009 (3)	ND	ND	**0.014**
Beta Endosulfan (Endosulfan II)	---	---	0.009 (3)	0.010	N	0.0068
Ethylbenzene	700	5	---	0.68	0.40	ND
Heptachlor	0.4	0.4	0.001 (4)	**0.0095**	ND	ND
Isopropylbenzene	---	5	---	1.0	ND	ND
Methoxychlor	40	40	0.03	ND	0.090	ND
Methylene Chloride	5	5	---	**6.0**	ND	ND
Naphthalene	---	50	---	2.8	ND	ND
n-Propylbenzene	---	5	---	0.90	ND	ND
Toluene	1,000	5	---	1.3	ND	ND
1,2,4-Trichlorobenzene	70	5	5	2.7	ND	ND
1,1,1-Trichloroethane	200	5	---	**20**	1.2	ND
Trichloroethene	5	5	11 (5)	**370**	4.0	ND
Trichlorofluoromethane	---	5	---	2.8	ND	ND
1,2,4-Trimethylbenzene	---	5	---	**15**	ND	ND
1,3,5-Trimethylbenzene	---	5	---	**36**	0.78	ND
Vinyl chloride	2	2	---	**6.2**	0.28	ND
Xylenes (total)	10,000	5	---	6.9	0.54	ND
INORGANIC COMPOUNDS (µg/L)						
Aluminum	---	---	0.1 ionic	3.48	1.0	---
Arsenic	0.05	0.05	0.190 (6)	0.0063	0.0119	0.0029
Barium	2.0	2.0	---	0.344	0.222	0.064
Beryllium	0.004	0.003 (5)	1.1 (7)	0.0011	ND	ND
Calcium	---	---	---	260	157	93.9
Chromium (total)	0.1	0.1	0.35 (8)	0.0272	ND	0.0065
Copper	1.3 (9)	1.3 (10)	0.02 (11)	0.0455	ND	0.0133
Iron	---	0.3/0.5 (12)	0.3	**10.4**	**4.46**	**0.665**
Lead	0.015 (9)	0.015 (10)	0.007 (13)	**0.0796**	0.006	0.0032
Magnesium	---	35 (5)	---	**58.3**	**38.3**	16.7
Manganese	---	0.3/0.5 (12)	---	**3.1**	**1.44**	0.0345
Nickel	0.1	---	0.16 (14)	0.0475	ND	ND

Table 3.4-2
Comparison of Site Data and Federal and New York State Chemical-Specific ARARs for Groundwater and Surface Water (Continued)

Analyte	Federal Primary MCL	New York Drinking Water Standard	New York Surface Water Standard	Max. Site Shallow Ground-water Conc.	Max. Site Deep Ground-water Conc.	Max. Site Surface Water Conc.
INORGANIC COMPOUNDS (CONTINUED)						
Potassium	---	---	---	4.0	6.04	2.13
Silver	---	0.05	0.0001 ionic	0.010	ND	ND
Sodium	---	NDL (15)	---	**60**	**94.3**	38.3
Thallium	0.0005 (16)	0.004 (5)	0.008	ND	**0.0468**	ND
Vanadium	---	---	0.014	0.0124	0.006	ND
Zinc	---	0.3	0.14 (17)	ND	ND	0.0299

Key:
MCL = Maximum Contaminant Level
ND = Not Detected
NDL = No Designated Limit
--- = No ARAR

Note: Concentrations exceeding ARARs are in bold font and shaded.

(1) Sum of alpha, beta, delta, and gamma BHC.

(2) Sum of trihalomethanes, including bromodichloromethane, dibromochloromethane, bromoform, and chloroform.

(3) Standard applies to Endosulfan (not distinguished I or II).

(4) Sum of Heptachlor and Heptachlor Epoxide.

(5) NY State groundwater guidance value (guidance values may be used where a standard has not been established) from the NY State Ambient Water Quality Standards and Guidance Values.

(6) Dissolved arsenic form.

(7) Standard = 1.1 mg/L when hardness is >75 ppm; acid-soluble form.

(8) Standard = exp(0.819[ln(ppm hardness)]+1.561)/1,000 mg/L, where average site surface water hardness = 191 ppm; acid-soluble form.

(9) Action level; applies to community water systems and non-transient, non-community water systems (i.e., at consumers' tap).

(10) The copper action level is exceeded if the concentration of copper in more than ten percent of one liter first draw tap water samples during any monitoring period exceeds 1.3 mg/l. The lead action level is exceeded if the concentration of lead in more than ten percent of one liter first draw top water samples collected during any monitoring period exceeds 0.015 mg/l.

(11) Standard = exp(0.8545[ln(ppm hardness)]-1.465)/1,000 mg/L, where average site surface water hardness = 191 ppm; dissolved form.

(12) The second standard applies to the sum of Iron and Manganese

(13) Standard = exp(1.266[ln(ppm hardness)]-4.661)/1,000 mg/L, where average site surface water hardness = 191 ppm; acid-soluble form.

(14) Standard = exp(0.76[ln(ppm hardness)]+1.06)/1,000 mg/L, where average site surface water hardness = 191 ppm; acid-soluble form.

(15) Water containing more than 20 mg/l of sodium should not be used for drinking by people on severely restricted sodium diets. Water containing more than 270 mg/l of sodium should not be used for drinking by people on moderately restricted sodium diets.

(16) Value provided is the Federal maximum contaminant level goal (MCLG). MCLGs are ARARs when greater than 0 and less than MCL.

(17) Standard = exp(0.85[ln(ppm hardness)]+0.50)/1,000 mg/L, where average site surface water hardness = 191 ppm; dissolved form.

Table 3.4-3
Comparison of Organic Data and New York State Screening Criteria for Sediment

Analyte	CK01		CK02		CK04		CK05		CK06	
	Sediment Conc. (mg/kg)	NY Sample-Specific Sediment Criterion (mg/kg)	Sediment Conc. (mg/kg)	NY Sample-Specific Sediment Criterion (mg/kg)	Sediment Conc. (mg/kg)	NY Sample-Specific Sediment Criterion (mg/kg)	Sediment Conc. (mg/kg)	NY Sample-Specific Sediment Criterion (mg/kg)	Sediment Conc. (mg/kg)	NY Sample-Specific Sediment Criterion (mg/kg)
Anthracene	ND	--	0.34	--	ND	--	ND	--	ND	--
Benzo(a)anthracene	ND	NA	**0.97**	0.0039	**0.21**	0.011	ND	NA	**0.12**	0.0057
Benzo(a)pyrene	ND	NA	**0.89**	0.0039	**0.17**	0.011	ND	NA	**0.097**	0.0057
Benzo(b)fluoranthene	ND	NA	**1.5**	0.0039	**0.29**	0.011	ND	NA	**0.17**	0.0057
Benzo(g,h,i)perylene	ND	--	0.41	--	ND	--	ND	--	ND	--
BHCs (total)	ND	NA	**0.016**	0.0002	0.0003	0.0005	ND	NA	**0.013**	0.0003
Bis(2-ethylhexyl)phthalate	ND	NA	0.23	0.60	0.15	2.7	ND	NA	ND	NA
Chrysene	ND	NA	**1**	0.0039	**0.22**	0.011	ND	NA	ND	NA
Dibenzofuran	ND	--	0.12	--	ND	--	ND	--	ND	--
Endosulfan (I & II)	ND	NA	**0.0028**	9.0e-05	**0.002**	0.0004	**0.0014**	4.2e-05	**0.0013**	0.0001
Endrin	ND	NA	ND	NA	0.0025	0.01	**0.0045**	0.0011	ND	NA
Fluoranthene	ND	NA	1.9	3.0	0.28	13.7	0.11	1.4	0.2	4.5
Fluorene	ND	--	0.20	--	ND	--	ND	--	ND	--
Methoxychlor	ND	NA	ND	NA	**0.019**	0.008	ND	NA	ND	NA
Methylene Chloride	ND	--	0.022	--	0.019	--	ND	--	0.015	--
Naphthalene	ND	--	0.21	--	ND	--	ND	--	ND	--
PCBs (total)	ND	NA	ND	NA	ND	NA	**0.16**	1.1e-06	ND	NA
Phenanthrene	ND	NA	**1.7**	0.36	0.13	1.6	ND	NA	0.16	0.52
Pyrene	ND	--	1.4	--	0.33	--	0.11	--	0.16	--

Key:

NA = Not Applicable

ND = Not Detected

-- = No screening criteria

Note: Concentrations exceeding screening criteria are in bold font and shaded.

Table 3.4-4
Comparison of Inorganic Data and New York State Screening Criteria for Sediment

Analyte	New York Sediment Criterion		Maximum Site Sediment Concentration (mg/kg)	Impact	Maximum Background Sediment Concentration (mg/kg)	Impact
	Lowest Effect Level (mg/kg)	Severe Effect Level (mg/kg)				
Aluminum	--	--	9,450	Unknown	6,840	Unknown
Arsenic	6.0	33.0	6.1	Moderate	5.2	None
Barium	--	--	71.3	Unknown	42.5	Unknown
Beryllium	--	--	0.47	Unknown	0.24	Unknown
Calcium	--	--	7,750	Unknown	32,100	Unknown
Chromium	26.0	110.0	16.2	None	9.9	None
Cobalt	--	--	9.4	Unknown	7.7	Unknown
Copper	16.0	110.0	28.8	Moderate	26.8	Moderate
Iron	20,000	40,000	20,100	Moderate	17,600	None
Lead	31.0	110.0	55.5	Moderate	19.5	None
Magnesium	--	--	5,100	Unknown	3,400	Unknown
Manganese	460.0	1,100.0	410	None	584	Moderate
Mercury	0.15	1.3	0.22	Moderate	ND	None
Molybdenum	--	--	16.8	Unknown	15.0	Unknown
Nickel	16.0	50.0	21.1	Moderate	19.3	Moderate
Potassium	--	--	843	Unknown	NA	Unknown
Silver	1.0	2.2	0.59	None	ND	None
Vanadium	--	--	15.9	Unknown	11.5	Unknown
Zinc	120.0	270.0	383	Severe	138	Moderate

Key:
ND = Not Detected
NA = Not Applicable
-- = No Screening Criteria
mg/kg = Milligrams per kilogram

source of heptachlor epoxide exists. Benzo(a)anthracene, benzo(b)fluoranthene, and chrysene are PAHs that represent possible area-wide contamination related to emissions from the adjacent NYSEG power plant. Despite this information, the *Final RI Report* (Earth Tech, 1996b) did not eliminate the above analytes as chemicals of potential concern in soil at AFP 59. Therefore, appropriate personal protective equipment should be worn if exposure to site soils is possible.

Background data were used for soil cleanup objectives for inorganic analytes. The following inorganic analytes exceeded background conditions objectives: aluminum, barium, calcium, cadmium, copper, cyanide, selenium, and zinc. None of these inorganic analytes contributed to unacceptable risk. Additionally, the majority of the site is covered by buildings and asphalt parking lots, thereby limiting the potential for exposure to soil contamination. Despite this information, the *Final RI Report* (Earth Tech, 1996b) did not eliminate the above analytes as chemicals of potential concern in soil at AFP 59. Therefore, appropriate personal protective equipment should be worn if exposure to site soils is possible.

3.4.4.2 Groundwater

In addition to those analytes that contributed to unacceptable risk, the following analytes (excluding VOCs) were detected in site groundwater samples above New York State drinking water standards (see Table 3.4-2): heptachlor, iron, lead, magnesium, manganese, and sodium. No apparent source exists for the pesticide because the majority of the plant property has been covered by impervious material (i.e., the plant and parking lots) since it was paved in 1959. Iron, magnesium, and sodium are common groundwater constituents, and lead and manganese did not contribute to unacceptable risk using a conservative risk assessment model. For these reasons, the *Final RI Report* (Earth Tech, 1996b) eliminated the above analytes as chemicals of potential concern in groundwater at AFP 59.

3.4.4.3 Sediment

The organic analytes chrysene, methoxychlor, and phenanthrene exceeded their respective screening criteria thresholds in site samples but not in background samples (see Table 3.4-3). Chrysene and phenanthrene are PAHs that represent possible area-wide contamination related to emissions from the adjacent NYSEG power plant. Methoxychlor was only detected in the replicate sediment sample (not the normal sample) collected at CR04, which is located downstream of both the NYSEG and AFP 59 outfalls. It was not detected at the two sediment sampling locations immediately downstream of the AFP 59 outfalls or at the background sediment sampling locations. Consequently, methoxychlor may have migrated from the NYSEG outfall and not AFP 59. Additionally, none of the above three analytes were detected during the sediment sampling conducted by Argonne National Laboratory (1994) during their investigation of AFP 59. Despite this information, the *Final RI Report* (Earth Tech, 1996b) did not eliminate the above analytes as chemicals of potential concern in sediment at AFP 59. As a result, additional sampling was conducted as part of the December 1995 investigation (see Section 3.4.5).

The inorganic analytes arsenic, iron, lead, and mercury exceeded screening criteria in site samples but not in background samples (see Table 3.4-4). However, each of the four analytes was detected at a concentration only slightly above the "lowest effect level" established by the New York State screening criteria. Additionally, the presence of arsenic may be related to emissions from the adjacent NYSEG power plant, and the presence of mercury may be related to discharge from the NYSEG outfall (mercury was only detected at the sediment sampling location that is downstream of both the NYSEG and AFP 59 outfalls). Despite this information, the *Final RI Report* (Earth Tech, 1996b) did not eliminate the above analytes as chemicals of potential concern in sediment at AFP 59. As a result, additional sampling was conducted as part of the December 1995 investigation (see Section 3.4.5).

3.4.4.4 Surface Water

In addition to those analytes that contributed to unacceptable risk, the following analytes were detected in site surface water samples above surface water standards (see Table 3.4-2): BHC (total), alpha endosulfan (endosulfan I), and iron. However, no apparent source exists for any of the three analytes detected above surface water standards. No apparent source exists for the two pesticides (BHC and alpha endosulfan) because the majority of the plant property has been covered by impervious material (i.e., the plant and parking lots) since it was paved in 1959. For this reason, the *Final RI Report* (Earth tech, 1996b) eliminated the above analytes as chemicals of potential concern in surface water at AFP 59.

3.4.5 Conclusions from the Final RI Report Addendum Concerning ARARs

This section presents the conclusions from the *Final RI Report Addendum* (Earth Tech, 1996c) as they relate to the comparison of site chemicals of potential concern to ARARs. The conclusions are presented below by environmental medium.

3.4.5.1 Soil

The NYSDEC did not request that any of the analytes that exceeded ARARs in soil be sampled and analyzed for during the December 1995 investigation for reasons discussed in Section 3.4.4.1.

3.4.5.2 Groundwater

The NYSDEC did not request that any of the analytes that exceeded ARARs (other than VOCs) in groundwater be sampled and analyzed for during the December 1995 investigation for reasons discussed in Section 3.4.4.2.

3.4.5.3 Sediment

Sediment samples were collected to substantiate or eliminate chrysene, methoxychlor, phenanthrene, arsenic, iron, lead, and mercury as chemicals of potential concern in Little Choconut Creek sediment. The *Final RI Report Addendum* (Earth Tech, 1996c) eliminated chrysene, phenanthrene, methoxychlor, lead, and mercury as chemicals of potential concern in site sediment for the following reasons: methoxychlor and mercury were not detected in site or background samples; chrysene and phenanthrene were detected in the background sample but not in site samples; and lead was detected at a higher concentration in the background sample than in the site samples.

The maximum detections of arsenic (7.5 mg/kg) and iron (21,700 mg/kg) in site sediment samples exceeded detections of arsenic (6.9 mg/kg) and iron (20,700 mg/kg) in the background sediment sample. Therefore, these analytes could not be immediately eliminated as chemicals of potential concern. However, because site and background concentrations were very similar, the site detections were likely the result of background contamination. Therefore, the *Final RI Report Addendum*

(Earth Tech, 1996c) eliminated these analytes as chemicals of potential concern in sediment at AFP 59.

3.4.5.4 Surface Water

The NYSDEC did not request that any of the analytes that exceeded ARARs in surface water be sampled and analyzed for during the December 1995 investigation for reasons discussed in Section 3.4.4.4.

3.5 Threat to Public Health

With the exception of VOCs in groundwater, all chemicals identified in groundwater, sediment, and surface water samples collected during the RI were eliminated as chemicals of potential concern through the baseline risk assessment and sampling conducted as part of the December 1995 investigation. Although not all chemicals identified in soil samples collected during the RI were eliminated as chemicals of potential concern, exposure to these chemicals can be prevented through the use of appropriate personal protective equipment.

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Section 4

4.0 Goals for the Remedial Actions

The goal of remedial actions at AFP 59 is to protect human health from VOCs in groundwater related to historical activities at AFP 59. Therefore, remedial action objectives are dictated by Federal and New York State groundwater standards.

As discussed in Section 3.4.1, Federal primary MCLs were obtained from 40 CFR 141, and New York State groundwater standards were obtained from the New York State Sanitary Code, Chapter I, Subpart 5-1, Public Water Systems. For those analytes not listed in the New York Sanitary Code, groundwater standards and guidance values were obtained from *Water Quality Regulations: Surface Water and Groundwater Classifications and Standards,* New York State Codes of Rules and Regulations, Title 6, Chapter X, Parts 700-705. All VOCs detected in site groundwater samples from the shallow and deep zones of the aquifer are included in Table 4-1.

Table 4-1
Comparison of Site Data and Federal and New York State Chemical-Specific ARARs for VOCs in Groundwater

Analyte	Federal Primary MCL	New York Groundwater Standard	Maximum Site Shallow Groundwater Concentration	Maximum Site Deep Groundwater Concentration
ORGANIC COMPOUNDS (µg/L)				
Bromodichloromethane	100 (1)	100	0.38	ND
Carbon Tetrachloride	5	5	0.6	ND
Chloroethane	---	5	4.2	ND
Chloroform (Trichloromethane)	100 (1)	100	0.46	ND
Chloromethane	---	5	ND	0.38
1,1-Dichloroethane	---	5	**33**	2.4
1,1-Dichloroethene	7	5	2.1	ND
cis-1,2-Dichloroethene	70	5	**150**	**36**
trans-1,2-Dichloroethene	100	5	0.30	ND
Ethylbenzene	700	5	0.68	0.40
Isopropylbenzene	---	5	1.0	ND
Methylene Chloride	5	5	**6.0**	ND
Naphthalene	---	50	2.8	ND
n-Propylbenzene	---	5	0.90	ND
Toluene	1,000	5	1.3	ND
1,2,4-Trichlorobenzene	70	5	2.7	ND
1,1,1-Trichloroethane	200	5	**20**	1.2
Trichloroethene	5	5	**370**	4.0
Trichlorofluoromethane	---	5	2.8	ND
1,2,4-Trimethylbenzene	---	5	**15**	ND
1,3,5-Trimethylbenzene	---	5	**36**	0.78
Vinyl chloride	2	2	**6.2**	0.28
Xylenes (total)	10,000	5	6.9	0.54

Key: MCL = Maximum contaminant level
ND = Not detected
NDL = No designated limits
--- = No ARAR

Note: Concentrations exceeding ARARs are in bold font and shaded.

(1) Sum of trihalomethanes, including bromodichloromethane, chlorodibromomethane, bromoform, and chloroform.

Section 5

5.0 Description and Evaluation of the Alternatives

In order to identify and select cleanup methods to address VOCs in groundwater at AFP 59, a wide range of general response actions (herein referred to as response actions) that could satisfy the remedial action objectives (i.e., ARARs for VOCs in groundwater) were identified and evaluated in the *Remedial Alternatives ITIR* (Earth Tech, 1996a). Each identified response action is defined and screened for implementability, project duration, and effectiveness in Section 5.1. Response actions that are retained after completion of the screening are subjected to a detailed analysis in Sections 5.2 and 5.3.

5.1 Identification and Screening of General Response Actions

This section identifies and screens the response actions considered for the development of remedial alternatives.

5.1.1 Identification of General Response Actions

Response actions describe those actions that will satisfy the remedial action objectives developed in Section 4. The selected response actions were chosen to determine whether VOCs in groundwater should be remediated at AFP 59 or at the Camden Street Well Field (as is currently the case). The response actions include:

- No action (shutting down the Camden Street Well Field Treatment System);
- No additional action (status quo);
- Upgrading the current treatment system at the Camden Street Well Field;
- Treatment at AFP 59; and
- Containment at AFP 59.

5.1.2 Evaluation of General Response Actions

The response actions can be broadly evaluated in terms of implementability, project duration, and effectiveness. The implementability of a response action includes both technical and institutional feasibility considerations. Technical feasibility of response actions is affected by the media volumes that have to be considered, the location and depth of the contaminated media, and site geology and conditions. Institutional aspects may include: the potential for obtaining the necessary permits, the availability of the necessary equipment and skilled workers to implement the action, and the availability of treatment, storage, and disposal services.

Project duration of a response action refers to the time required to fully implement the response action.

The effectiveness of a response action focuses on the following elements: the potential effectiveness of an action to remediate the estimated area or volume of contaminated media and achieve the remedial action objectives, the potential impacts to human health and the environment during the construction and implementation phase, and the reliability and proven effectiveness of the action with respect to the chemicals of concern and conditions at the site.

The response actions were evaluated on the basis of Earth Tech's experience on other hazardous waste projects and knowledge of technologies available under a response action. Detailed descriptions and evaluations of each response action are provided below.

5.1.2.1 No Action

This response action implies no action at both AFP 59 and the Camden Street Well Field. In the case of the Camden Street Well Field, where a groundwater treatment system is currently in operation, the no action response involves shutting down the treatment system. Although this action will require an initial cost associated with the system shutdown, conditions after shutdown will represent a no action response.

The technical implementability of the no action response is very high because requirements for achievement are minimal. Project duration is very short for a no action response. The no action response will not remediate a site unless the chemicals of concern naturally attenuate to acceptable levels. Therefore, the effectiveness in attaining the remedial action objectives is questionable. Additionally, a no action response at the Camden Street Well Field (i.e., shutdown of the current groundwater treatment system) will subject residents to potential risk associated with contacting the untreated groundwater. Because of the questionable effectiveness of the response in attaining the remedial action objectives and the exposure of residents to potential risk, the no action response was eliminated from further consideration in the *Remedial Alternatives ITIR* (Earth Tech, 1996a).

5.1.2.2 No Additional Action

The no additional action response represents maintaining status quo conditions (i.e., continued operation of the current groundwater treatment system at the Camden Street Well Field; no treatment at AFP 59). This response action will not prevent the potential off-site migration of VOCs in groundwater originating at AFP 59.

The technical implementability of the no additional action response is very high because the response action represents status quo conditions. Project duration is very short for a no additional action response. The no additional action response allows for treatment of groundwater through the use of the current groundwater treatment system at the Camden Street Well Field. Because all groundwater is treated before being pumped into distribution, the effectiveness of the system in attaining the remedial action objectives is currently acceptable. However, the treatment system is currently only capable of treating groundwater from one of the three production wells at the Camden Street Well Field. If the one production well (Production Well 2) were to become inoperable, untreated groundwater from one of the other two production wells would be pumped into distribution. Therefore, because residents could possibly be exposed to untreated groundwater and the potential risk associated with such an exposure, the no additional action response was eliminated from further consideration in the *Remedial Alternatives ITIR* (Earth Tech, 1996a).

5.1.2.3 Upgrading the Current Treatment System at the Camden Street Well Field

This response action includes upgrading the current groundwater treatment system at the Camden Street Well Field. The upgrade of the treatment system at the well field is described in detail in Section 5.2 (as is the current treatment system). The upgrade generally allows groundwater from all three production wells at the well field to be treated before being pumped into the distribution system. This response action will not prevent the potential off-site migration of VOCs in groundwater originating at AFP 59. A long-term groundwater monitoring program would accompany this response action.

The technical implementability of the system upgrade is high because of the chemical types and concentrations and because regional contractors are technically capable of providing the necessary services. Project duration for the system upgrade is short to moderate, except for the long-term groundwater monitoring at AFP 59. Although implementing this response action would not prevent the potential off-site migration of VOCs originating at AFP 59, the upgraded system would virtually eliminate the possibility of pumping untreated groundwater into distribution; therefore, the effectiveness in attaining the remedial action objectives is very high. For this reason, upgrading the well field treatment system was retained for further evaluation in the *Remedial Alternatives ITIR* (Earth Tech, 1996a).

5.1.2.4 Treatment at AFP 59

This response action involves installing a groundwater treatment system at AFP 59. The identification and screening of the five different technology types that fall under this response action (i.e., physical, chemical, thermal, biological, and volatilization) are presented in Section 5.3. In general, this response action calls for installing a groundwater treatment system that remediates the groundwater at the source (AFP 59) rather than at the well field. A long-term groundwater monitoring program would accompany this response action.

The technical implementability of installing a treatment system at AFP 59 is high because of the chemical types and concentrations and because regional contractors are technically capable of providing the necessary services. Project duration is long-term because of the groundwater monitoring program; however, it is anticipated that operation of an on-site system would be relatively short-term (approximately 15 years). The groundwater treatment system would be installed to prevent the off-site migration of VOCs for the purpose of protecting the Camden Street Well Field. However, this response action would not protect the well field from other sources of VOCs. Because the response action is readily implementable and would protect the well field from VOCs originating at AFP 59, it was retained for further evaluation in the *Remedial Alternatives ITIR* (Earth Tech, 1996a).

5.1.2.5 Containment at AFP 59

The containment response action does not reduce the chemical concentrations, but it does isolate the chemicals to prevent their migration (both laterally and vertically) and to limit exposure pathways.

Potential technology types that fall under the containment response action include capping, horizontal barriers, vertical barriers, surface controls, and encapsulation. The containment response action is limited to the containment of chemicals present on AFP 59 property. A long-term groundwater monitoring program would accompany this response action.

The technical implementability and effectiveness of the containment response action varies depending on the technology type and environmental medium. However, both the implementability and the effectiveness are low for the containment of groundwater flow at AFP 59 because of the hydrogeologic conditions at the site. For these reasons, this response action was eliminated from further consideration in the *Remedial Alternatives ITIR* (Earth Tech, 1996a).

5.1.2.6 Summary of the Evaluation

Table 5.1-1 summarizes the initial evaluation of the response actions. Sections 5.2 and 5.3 present a detailed evaluation of the response actions that were retained after the initial evaluation, including the upgrade of the current treatment system at the Camden Street Well Field and treatment at AFP 59. The no action, no additional action, and containment at AFP 59 response actions were eliminated from further consideration.

Table 5.1-1
Summary of General Response Actions

General Response Action	Retained or Rejected	Rationale
No Action	Rejected	Effectiveness in attaining remediation goals is questionable.
No Additional Action	Rejected	Potential exposure to chemicals of concern if Production Well 2 becomes inoperable.
Upgrading the Well Field Treatment System	Retained	Remediates chemicals of concern at the well field.
Treatment at AFP 59	Retained	Remediates chemicals of concern at AFP 59.
Containment at AFP 59	Rejected	Low implementability and effectiveness.

5.2 Detailed Analysis of the Camden Street Well Field Treatment System Upgrade

This section describes the groundwater treatment system currently in operation at the Camden Street Well Field and the upgrade of the system. A detailed evaluation of this response action will be conducted on the basis of the seven USEPA assessment criteria outlined in Section 5.2.1. Two additional USEPA criteria, state acceptance and community acceptance, are considered following the ROD.

5.2.1 USEPA Assessment Criteria

The USEPA criteria used to evaluate response actions are given in *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988) and are listed below.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. This criterion describes how the remedial alternative achieves and maintains protection of human health and the environment. This evaluation focuses on whether a specific remedial alternative achieves adequate protection and describes how site risks posed by each migration pathway are eliminated, reduced, or controlled.

COMPLIANCE WITH ARARS. This criterion is used to determine whether the remedial alternative meets all remedial action objectives (i.e., the ARARs presented in Section 3.5).

LONG-TERM EFFECTIVENESS AND PERMANENCE. This criterion is used to measure residual risk at a site after remedial action objectives have been met. In addition to the magnitude of residual risk, this criterion also focuses on the adequacy and long-term reliability of controls (i.e., engineering or institutional). Residual risk is the risk remaining from untreated waste or treatment residuals upon completion of the remedial activities.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT. This criterion pertains to the statutory preference for remedial alternatives capable of permanently and significantly reducing toxicity, mobility, or volume of the hazardous substances through treatment. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of contaminants, reduction of the total mass or volume of contaminants, or irreversible reduction in contaminant mobility. The type and quantity of residuals expected to remain after treatment will be specified for evaluation.

SHORT-TERM EFFECTIVENESS. This criterion pertains to the effects of the remedial alternative during the construction and implementation phase until remedial action objectives (i.e., ARARs) have been met. Under this criterion, alternatives will be evaluated with respect to their effects on human health and the environment during implementation of the remedial action.

IMPLEMENTABILITY. The implementability criterion pertains to the technical and administrative feasibility of implementing a remedial alternative and the availability of various services and materials required during implementation. This criterion includes technical feasibility (i.e., technical difficulties, reliability, monitoring requirements, and safety), administrative feasibility (i.e., permitting and coordination with regulatory agencies), and availability of services and materials (i.e., equipment, personnel, and materials).

COST. This criterion evaluates the estimated capital and O&M costs of a remedial alternative.

5.2.2 Current Well Field Treatment System

The layout of the Camden Street Well Field is illustrated in Figure 5.2-1. Groundwater is currently pumped from Production Well 2 through an air stripper treatment system at approximately 3 mgd, which represents the maximum capacity of both the production well and the groundwater treatment system. Following chlorination, the treated groundwater flows into the drinking water distribution system of Johnson City. The treatment system is designed to remove VOCs from the groundwater prior to distribution. Groundwater discharge from Production Wells 1 and 3 is not currently routed to the air stripper; therefore, these wells cannot operate without pumping untreated groundwater into the distribution system.

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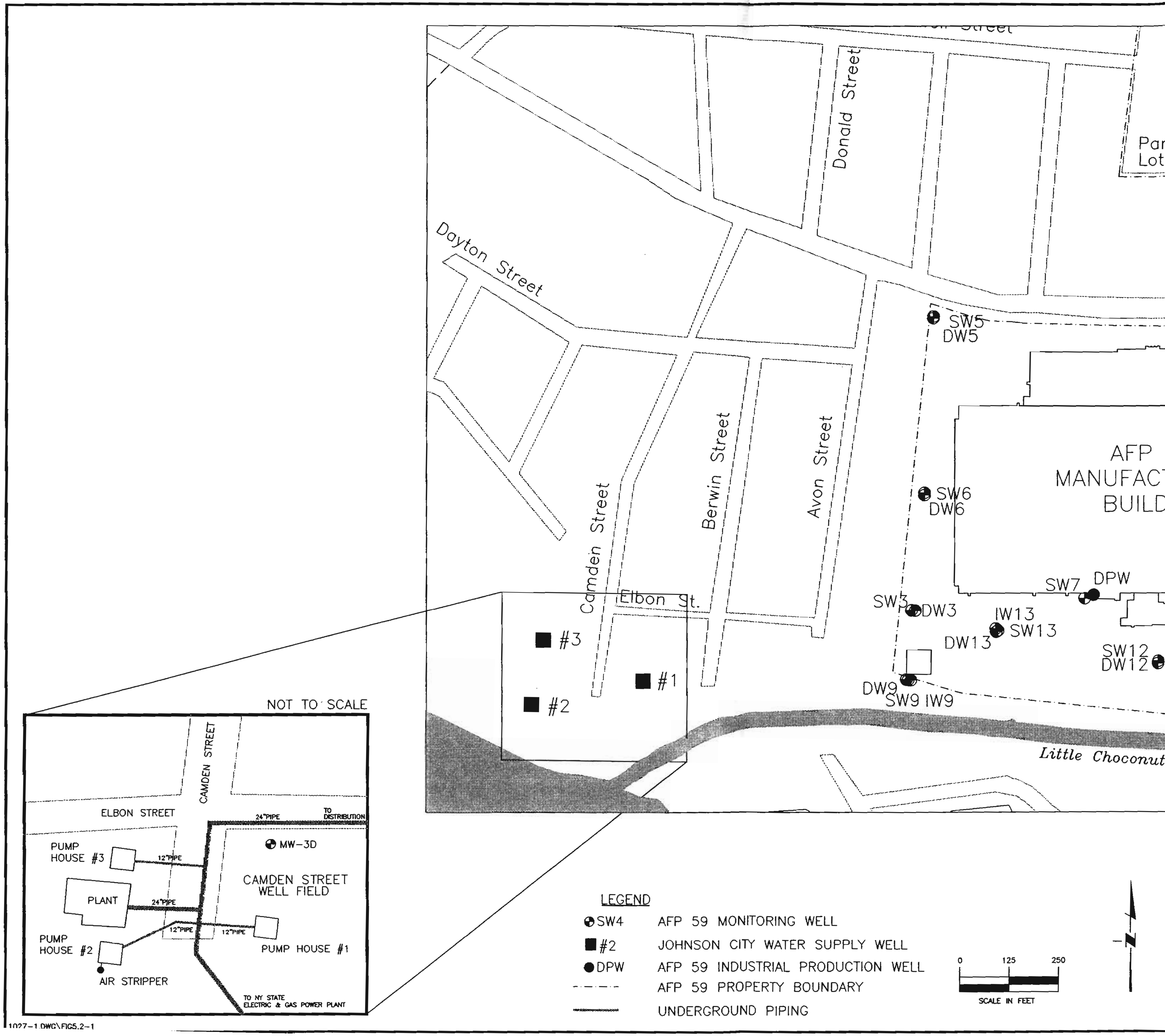

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FIGURE 5.2-1

SCHEMATIC OF
CAMDEN STREET WELL FIELD AND
GROUNDWATER DISTRIBUTION SYSTEM

5.2.3 Design of the System Upgrade

In August 1998, through funding provided by the USAF, the Village of Johnson City requested cost proposals during an open bid process involving Architecture and Engineering (A&E) firms for the design and construction of an upgraded groundwater treatment system capable of removing VOCs. The following description of the system upgrade is based on the preliminary design of the A&E firm selected by the Village of Johnson City during the cost proposal effort.

The primary function of the system upgrade is to intercept the discharge lines from all three production wells at the Camden Street Well Field and route them to the treatment system. Such routing would provide a measure of safety in the event that one of the production wells becomes inoperable. Therefore, the system upgrade is designed to prevent untreated groundwater from reaching the distribution system.

The upgrade also includes the following:

- The addition of a second packed column air stripper to expand the current treatment system capacity of approximately 3 mgd to approximately 6 mgd;
- The construction of a concrete pad adjacent to the two air strippers to allow for the future addition of a third air stripper (not included in the upgrade), which would further expand the capacity of the treatment system; and
- The construction of a new building to house the entire system, which includes the necessary blowers, controls, and the disinfection system.

In addition to the system upgrade, a groundwater monitoring program would be established at AFP 59 to continue to monitor groundwater quality in the shallow and deep zones of the aquifer at the site. The monitoring program would be established in coordination with the NYSDEC on the basis of groundwater quality data generated at the site.

5.2.4 Detailed Analysis of the Upgraded System

This section provides a detailed analysis of the upgraded treatment system at the Camden Street Well Field. The analysis focuses on the treatment system's ability to remediate VOCs in the groundwater on the basis of the seven USEPA assessment criteria discussed in Section 5.2.1. A detailed evaluation comparing the results of this analysis and the results of the analysis conducted on the potential groundwater treatment system at AFP 59 (see Section 5.3) is presented in Section 6.

5.2.4.1 Overall Protection of Human Health and the Environment

Implementation of this action would effectively remove VOCs in groundwater and the associated risk at the exposure point (i.e., the well field), thereby protecting human health and the environment. This response action, however, would not prevent potential off-site migration of VOCs in groundwater originating at AFP 59.

5.2.4.2 Compliance with ARARs

Implementation of this action would effectively remove VOCs in groundwater at the exposure point, thereby complying with the groundwater ARARs presented in Section 3.4.

5.2.4.3 Long-Term Effectiveness and Permanence

The current treatment system was installed as an interim corrective action. The upgraded treatment system would provide long-term effectiveness and permanence at the well field by removing VOCs in groundwater before it is pumped into the distribution system. The upgraded system would require long-term O&M and monitoring.

5.2.4.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The upgraded treatment system would effectively remove VOCs in groundwater at the exposure point. The volume of VOCs would be reduced through the transferal of VOCs from the groundwater to the atmosphere (by volatilizing the VOCs) during the air stripping process. The system would not reduce the toxicity, mobility, or volume of VOCs at AFP 59. Therefore, the only portion of the VOCs that would be remediated through treatment is that which migrates to the Camden Street Well Field.

5.2.4.5 Short-Term Effectiveness

Implementation of this alternative would not cause any negative, short-term impact on the environment or well field employees. The current groundwater treatment system will remain in operation until the new system is implemented. During implementation, worker and public exposure would be limited through standard health and safety practices.

5.2.4.6 Implementability

Based on the chemicals of concern at AFP 59 and the availability of the required services and materials, the implementability of the upgraded system is high. Construction difficulties are unlikely because this response action represents the upgrade of an existing system.

5.2.4.7 Cost

On September 10, 1998, the Village of Johnson City and the USAF signed a Memorandum of Agreement (MOA) addressing the design, construction, and startup of the upgraded treatment system. The MOA is a joint agreement that defines the financial responsibility of both parties concerning costs associated with the upgrade. The total cost of the upgrade, based on cost estimates received during the open bid process conducted by the Village of Johnson City, is $1,104,000.

Additional long-term costs include O&M expenses and sampling expenses associated with monitoring the system to assure that it continues to meet the remedial action objectives (i.e., effluent complies with ARARs). These costs are not included in the evaluation of this response action. Only the expenses associated with the design, construction, and startup of the upgraded treatment system are included in evaluating the upgrade of the treatment system versus the installation of a treatment system at AFP 59.

5.3 Detailed Analysis of Potential Remedial Alternatives at AFP 59

In this section, technology types for the treatment of groundwater at AFP 59 are identified. The technology types within this specific response action are then evaluated on the basis of their general effectiveness, implementability, and cost. Technology types that cannot be effectively implemented are not considered further. The treatment technologies within each retained technology type are then evaluated on the basis of the same criteria. The goal of this process is to select one representative technology, if possible, for each technology type to simplify the subsequent development and detailed evaluation of remedial alternatives.

5.3.1 Evaluation of Technology Types

The term "technology type" refers to broad categories of technologies under a general response action. The technology types associated with the treatment response action include physical, chemical, thermal, biological, and volatilization. These technology types are typically considered for cleanup of hazardous waste sites and are presented in *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988). The technology types for treatment of groundwater at AFP 59 are evaluated below.

Technology types are assessed with respect to implementability by using information from the RI site characterization on chemical types and concentrations. General site conditions are also used to determine whether the technology type can be effectively implemented.

5.3.1.1 Physical Treatment

Physical treatment consists of removal or transfer technologies such as ultrafiltration, carbon adsorption, or regenerative resin adsorption.

Because the chemicals of concern are dissolved VOCs, ultrafiltration would be an ineffective technology. The dissolved VOCs would pass through the ultrafiltration system without being captured.

Activated carbon adsorption can be used to remove a wide variety of chemicals from liquid or gaseous streams, although it is most frequently used for the removal of VOCs. Most carbon adsorption systems use granular-activated carbon (GAC) in flow-through column reactors. GAC adsorption can be applied as a primary and/or secondary treatment method.

A variation of carbon adsorption is regenerative bed adsorption. Regenerative resin adsorption beds may be applied as a secondary treatment method to remove volatile components resulting from various primary treatments, including air stripping (discussed below). Resin beds remove chemicals by adsorption onto a specially designed resin.

Physical treatment was retained for further consideration in the *Remedial Alternatives ITIR* (Earth Tech, 1996a) because it is relatively implementable, applicable to the chemicals in groundwater at AFP 59, and economically feasible.

5.3.1.2 Chemical Treatment

Chemical treatment consists of technologies that use chemical reactions such as oxidation/reduction, dehalogenation, or neutralization to alter the chemical make-up of the chemicals. Dehalogenation is the most applicable of these techniques for treating the groundwater at AFP 59 because the chemicals of concern are halogenated hydrocarbons, and because the other technologies do not chemically address the hazardous aspect of the chemicals.

Dehalogenation is the chemical destruction of halogenated organic compounds in dilute, complex materials such as soils, sediments, sludges, or various aqueous and mixed waste streams through the application of chemical dehalogenation reactions. Chemical methods for dehalogenation of organic compounds include molten-salt chemistry, ultraviolet and other radiation sources, wet oxidation, elevated temperature catalytic reduction, and incineration. The process involves no water discharges, but there are solid by-products which are contained, consisting primarily of polyphenyl polymers, sodium salts, some entrapped oil, and other nontoxic material. In addition, volatile by-products generally consist of nitrogen, hydrogen, water vapor, and some hydrocarbons. Additional scrubbing can manage these off-gases. Further solid disposable materials generated by these processes are absorbent and filter cakes, gloves, and other processor safety equipment.

Chemical treatment was not retained for further consideration in the *Remedial Alternatives ITIR* (Earth Tech, 1996a) because of the creation of by-products that require additional management and because of the high cost to implement.

5.3.1.3 Thermal Treatment

Thermal treatment consists of technologies that destroy the VOCs through the use of elevated temperatures. Incineration is usually applied only to soils or vapors because it is not economically feasible for groundwater. Therefore, incineration is only applicable as a secondary treatment method for organic vapors removed from the groundwater.

Thermal treatment was not retained for further consideration in the *Remedial Alternatives ITIR* (Earth Tech, 1996a) for the following reasons: it is only implementable as a secondary treatment method; the cost is comparatively high; the monitoring requirements are high; and the permitting requirements are strict.

5.3.1.4 Biological Treatment

Biological treatment consists of the use of microbes to biodegrade or destroy chemicals. Bioventing is an *in-situ* type of biodegradation where oxygen is injected into the groundwater to optimize the growth of the naturally occurring microbes. This accelerates the natural biodegradation process. *Ex-situ* biodegradation is the same process, except the groundwater is extracted and treated in above-ground tanks. Biological treatment is highly dependent on the amenability of the microbes with the chemicals to be degraded. Biodegradation is used extensively at sites with petroleum hydrocarbons. However, the chlorine present in the chlorinated hydrocarbons at AFP 59 is toxic to most microorganisms. Therefore, biological treatment is not an effective treatment technology and was not retained for further consideration in the *Remedial Alternatives ITIR* (Earth Tech, 1996a).

5.3.1.5 Volatilization

Volatilization consists of the physical mass transfer of dissolved volatile compounds from one medium, such as a liquid, to another, such as a flowing gas or vapor stream. One of the common forms of volatilization is air stripping. Air stripping is a proven technology for the removal of VOCs from groundwater. The technology has proven particularly economical for treatment of groundwater containing low levels of VOCs.

The removal efficiency for VOCs is governed by several factors, including VOC concentrations, temperature, air to water ratio, and matrix effects. The vapor stream exits the system, where it may then require secondary treatment. One possible secondary treatment method is GAC adsorption polishing.

A wide variety of devices are used to facilitate the air/water contact, including diffused aeration tanks, aeration lagoons, countercurrent packed air stripper towers, and shallow tray aeration systems. A shallow tray aeration system (STAS) will be considered as a possible option for this site because of the estimated low groundwater flow rate and the low profile of the equipment. An STAS is constructed to create a counter-current flow of water down through the stacks of aeration trays at the same time that an air blower forces air up through the holes in the aeration trays. The air causes the water to froth as it moves across the surface of each tray. The frothing of the water increases the groundwater surface area, thereby increasing the volatilization rate of the VOCs in the collected water.

Another form of volatilization is air sparging. This is an *in-situ* technology that does not require the extraction of the groundwater. Air sparging removes the VOCs from the groundwater within the saturated aquifer zone and the vadose zone by bubbling air through the groundwater and out into the vadose zone. Significant design factors that must be considered are the stratigraphy and permeability of the subsurface geology. These parameters can affect the dispersion of the air bubbles and the efficiency of the volatilization. This makes it very difficult to control the amount of groundwater that is treated and to capture the VOCs. The collection of the volatilized vapors requires the installation of soil vapor extraction wells.

Volatilization was retained for further consideration in the *Remedial Alternatives ITIR* (Earth Tech, 1996a) because it is relatively implementable, applicable to the chemicals in groundwater at AFP 59, and economically feasible.

5.3.1.6 Summary of the Evaluation

On the basis of the results of this initial evaluation of the technology types associated with the treatment response action, the physical treatment and volatilization technology types were retained for further evaluation in the *Remedial Alternatives ITIR* (Earth Tech, 1996a). The chemical, thermal, and biological treatment technology types were eliminated from further consideration. Table 5.3-1 summarizes the initial evaluation of the technology types.

Table 5.3-1
Summary of Preliminary Screening of Technology Types for Remediation of Groundwater at AFP 59

Technology Type	Retained or Rejected	Rationale
Physical Treatment	Retained	Applicable to site conditions and chemicals of concern at AFP 59.
Chemical Treatment	Rejected	Hazardous by-products and high cost.
Thermal Treatment	Rejected	Not technically feasible for groundwater remediation.
Biological Treatment	Rejected	Not technically feasible for chemicals of concern at AFP 59.
Volatilization	Retained	Applicable to site conditions and chemicals of concern at AFP 59.

5.3.2 Preliminary Screening of Technologies

This section presents the preliminary screening of the technologies identified for the two technology types that were retained in the *Remedial Alternatives ITIR* (Earth Tech, 1996a). In many cases, one technology may not be sufficient to remediate all of the chemicals of concern, and combinations of technologies are developed. For the remainder of this document, these combined technologies will be referred to as remedial alternatives. The preliminary screening criteria consist of implementability with respect to technical feasibility and regulatory compliance, general effectiveness at reducing chemical and risk levels, and cost comparison by order of magnitude. The specific remedial alternatives that have been retained after the preliminary screening are analyzed in detail in Section 5.3.3.

5.3.2.1 Identification of Technologies for Further Evaluation

The technology types that were retained for further consideration are physical treatment and volatilization. Physical treatment technologies include ultrafiltration, carbon adsorption, and regenerative resin adsorption. Ultrafiltration was eliminated in the *Remedial Alternatives ITIR* (Earth Tech, 1996a) because the chemicals of concern are dissolved VOCs. Both carbon adsorption and regenerative resin adsorption are *ex-situ* technologies that require the pumping of groundwater prior to remediation. Carbon adsorption requires the spent carbon to be changed out and reactivated in an off-site incinerator.

Regenerative resin adsorption is regenerated in-place and on-site, but it is not as economical as carbon adsorption for the concentrations of chemicals that exist at AFP 59. Therefore, carbon adsorption was retained for further evaluation in the *Remedial Alternatives ITIR* (Earth Tech, 1996a), and regenerative resin adsorption was screened out.

The technologies identified for volatilization include air stripping and *in-situ* air sparging. Air stripping is an *ex-situ* treatment of the extracted groundwater that can be combined with different secondary treatment methods, including liquid phase carbon adsorption and dual phase (liquid and vapor) carbon adsorption. Air sparging is an *in-situ* process that volatilizes the chemicals in the groundwater through the injection of air, thus transferring chemicals from the groundwater to the overlying soils. Controlling the dispersion of the volatilized vapors into the surrounding soils is difficult. Because air stripping maintains better control of the chemicals and is generally more effective than air sparging, it was retained for further evaluation in the *Remedial Alternatives ITIR* (Earth Tech, 1996a) and air sparging was rejected.

Table 5.3-2 summarizes the preliminary screening of the technologies and presents the rationale for the screening result.

5.3.2.2 Development and Evaluation of Remedial Alternatives

The remedial alternatives evaluated in this section are combinations of the technologies identified in Section 5.3.2.1. They were evaluated using the same criteria as the individual technologies: implementability, general effectiveness, and cost. The following three remedial alternatives were evaluated:

Table 5.3-2
Summary of Preliminary Screening of Technologies for Remediation of Groundwater at AFP 59

Technology Type	Technology	Retained or Rejected	Rationale
Physical Treatment	Ultrafiltration	Rejected	Not applicable to dissolved volatile organic compounds.
	Carbon Adsorption	Retained	Practical for site conditions and chemicals of concern at AFP 59.
	Resin Adsorption	Rejected	Practical for site conditions and chemicals of concern, but not as economical as carbon adsorption.
Volatilization	Air Stripping	Retained	Practical for site conditions and chemicals of concern at AFP 59; may require secondary treatment.
	Air Sparging	Rejected	Difficult to control and requires a secondary recovery method.

		Primary Treatment	Secondary Treatment
1.	Extract the groundwater	Air stripping	None (direct emission)
2.	Extract the groundwater	Liquid phase carbon adsorption	None
3.	Extract the groundwater	Air stripping	Dual phase carbon adsorption

These on-site remedial alternatives involve the extraction and treatment of groundwater at AFP 59. The design of the groundwater extraction system was the same for each of the alternatives. As proposed (for the purpose of costing), the groundwater extraction system would include six groundwater extraction wells. The total pumping rate from the six wells would be 100 gpm.

If an on-site treatment system were to be installed, further studies (e.g., a pumping test in the shallow zone of the aquifer) would be required to determine the proper number and spacing of extraction wells.

Extraction wells would be completed at the base of the shallow zone of the aquifer, with the wells installed approximately 2 feet into the fine-grained glacial deposits that separate the shallow and deep zones of the aquifer. The wells would be completed in the shallow zone of the aquifer because most of the VOCs detected at AFP 59 are in the shallow zone of the aquifer. The wells would be completed at the base of the aquifer in order to capture the chemicals of concern, which are denser than water and will consequently sink to the base of the aquifer.

In addition to the installation of an on-site treatment system, a groundwater monitoring program would be established at AFP 59 to continue to monitor groundwater quality in the shallow and deep zones of the aquifer at the site. The monitoring program would be established in coordination with the NYSDEC on the basis of groundwater quality data generated at the site.

EVALUATION OF THE EXTRACT/AIR STRIP/DIRECT EMISSION REMEDIAL ALTERNATIVE. Figure 5.3-1 provides a schematic diagram of the extract/air strip/direct emission remedial alternative. This alternative would be technically feasible because the chemicals of concern could be effectively stripped from the groundwater. Authorization would have to be obtained from the NYSDEC to emit the VOCs directly to the air. However, based on current VOC concentrations in the groundwater at AFP 59, emission rates would remain below NYSDEC standards. This alternative would reduce the potential risk associated with contacting the groundwater by transferring the VOCs from the groundwater to the atmosphere. The cost of this alternative would be relatively low.

Based on implementability, the reduction in potential risk, and the relatively low cost, the extract/air strip/direct emission remedial alternative was retained for detailed evaluation in the *Remedial Alternatives ITIR* (Earth Tech, 1996a).

EVALUATION OF THE EXTRACT/LIQUID PHASE CARBON ADSORPTION REMEDIAL ALTERNATIVE. Figure 5.3-2 provides a schematic diagram of the extract/liquid phase carbon adsorption remedial alternative. This alternative would be technically feasible because the chemicals of concern could be effectively adsorbed to carbon. Factors that could affect the level of efficiency of adsorption include the water temperature, the existence of other clogging chemicals, and the concentrations of the chemicals to be adsorbed. Tests would have to be performed on the groundwater to determine the existence and concentrations of other chemicals that could clog the carbon.

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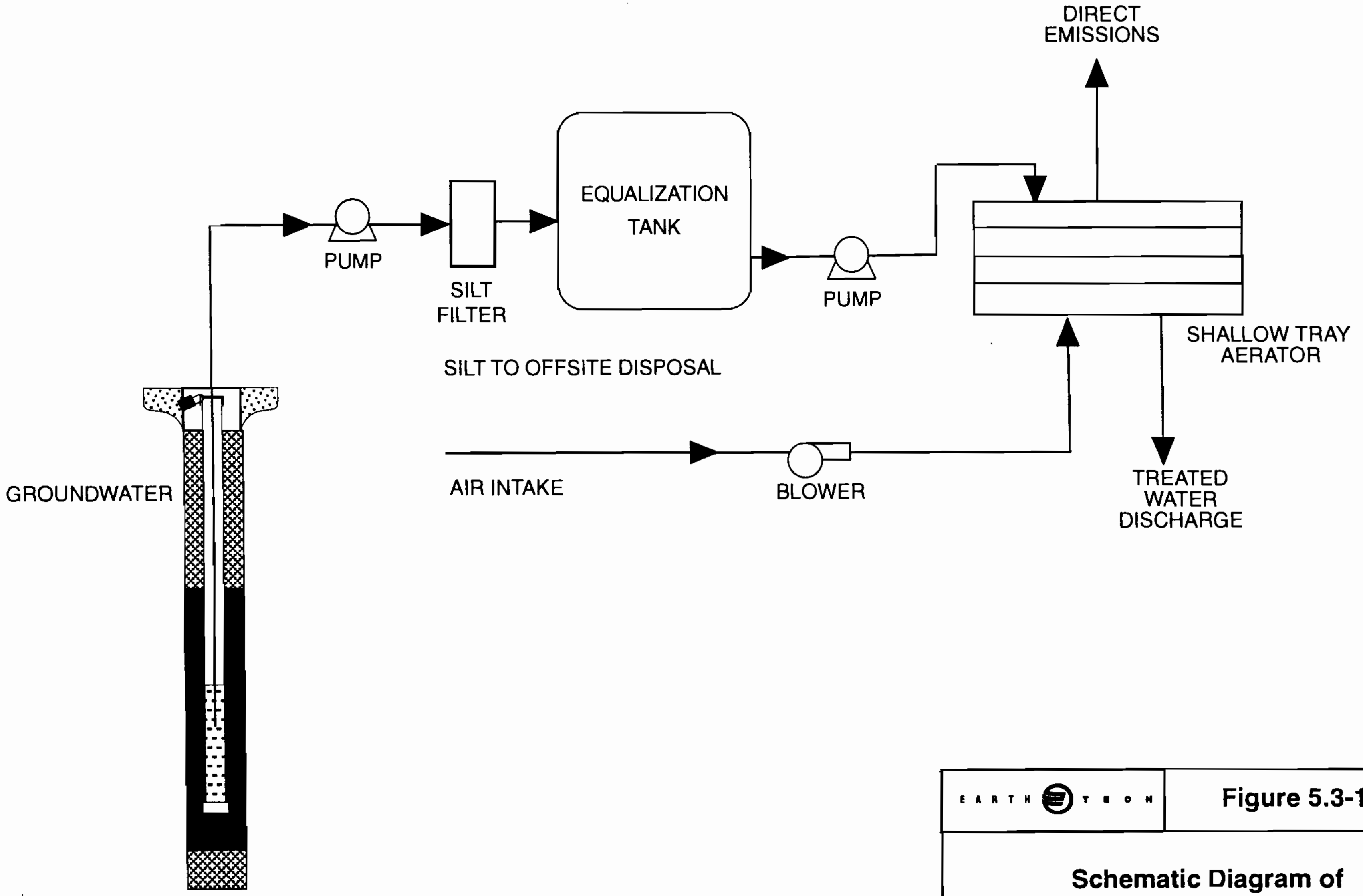

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Figure 5.3-1

Schematic Diagram of Extract/Air Strip/Direct Emission Remedial Alternative

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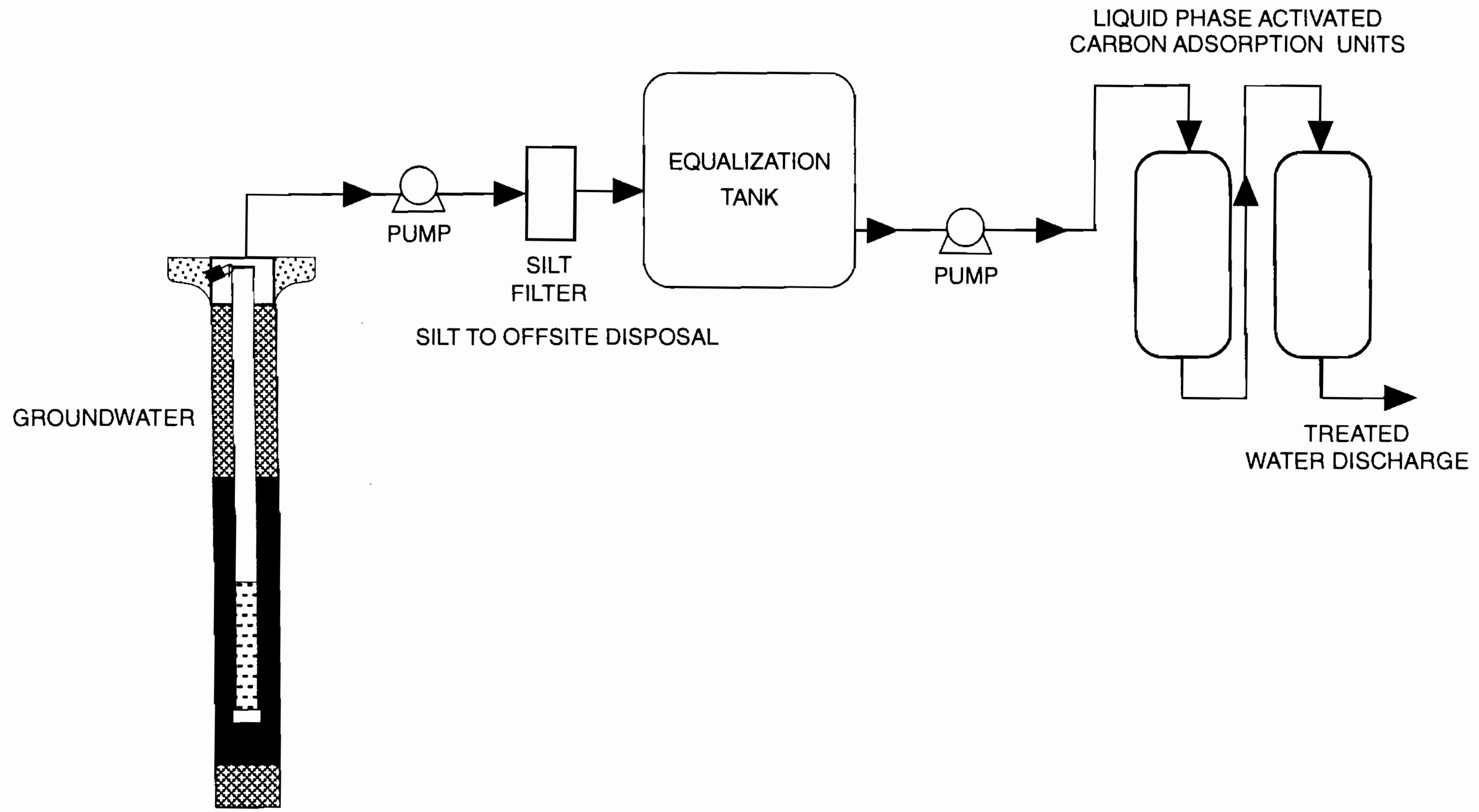

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Figure 5.3-2

Schematic Diagram of Extract/Liquid Phase Carbon Adsorption Remedial Alternative

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The extract/liquid phase carbon adsorption alternative would reduce the potential risk associated with contacting groundwater by adsorbing the chemicals to carbon. The adsorbed chemicals would be subsequently destroyed when the spent carbon was reactivated through an incineration process.

The detected concentrations of the chemicals of concern at AFP 59 are low enough so that carbon units would not have to be replaced frequently. Additionally, because no chemicals would be emitted to the atmosphere during the adsorption process, emissions permitting would not be required. Therefore, the cost of this alternative would be relatively low.

On the basis of implementability, the reduction in potential risk, and the relatively low cost, the extract/liquid phase carbon adsorption remedial alternative was retained for detailed evaluation in the *Remedial Alternatives ITIR* (Earth Tech, 1996a).

EVALUATION OF THE EXTRACT/AIR STRIP/DUAL PHASE CARBON ADSORPTION REMEDIAL ALTERNATIVE. Figure 5.3-3 provides a schematic diagram of the extract/air strip/dual phase carbon adsorption remedial alternative. This alternative would be technically feasible because the chemicals of concern could be effectively stripped from the groundwater. The dual phase carbon adsorption is a secondary treatment method that would provide the following treatment: chemicals in the vapor emissions from the air stripping process would be adsorbed onto vapor phase carbon, and groundwater effluent from the air stripping process would be polished using liquid phase carbon adsorption. The vapor phase secondary treatment would eliminate the need for emissions permitting for this alternative. The factors influencing the efficiency of this alternative would be the same as those that affect the extract/liquid phase carbon adsorption alternative.

The spent carbon units from both phases would require replacement and reactivation. The frequency of carbon unit replacements would likely be limited due to the low detected concentrations of VOCs at AFP 59. The cost of this alternative would be comparable to both the extract/air strip/direct emission and the extract/liquid phase carbon adsorption remedial alternatives.

On the basis of implementability, the reduction in potential risk, and the relatively low cost, the extract/air strip/dual phase carbon adsorption remedial alternative was retained for detailed evaluation in the *Remedial Alternatives ITIR* (Earth Tech, 1996a).

SUMMARY OF THE EVALUATION. On the basis of the results of this initial evaluation of the remedial alternatives, all three remedial alternatives were retained for further evaluation. Table 5.3-3 summarizes the initial evaluation of the remediation alternatives.

5.3.3 Detailed Analysis of Remedial Alternatives

The retained remedial alternatives for the treatment of groundwater at AFP 59 are analyzed in detail in this section on the basis of the seven USEPA criteria presented in Section 5.2.1. Two additional USEPA criteria, state acceptance and community acceptance, are not relevant to this analysis, but are considered for the ROD. A detailed evaluation comparing the results of this analysis and the results of the analysis conducted on the potential upgrade of the groundwater treatment system at the Camden Street Well Field (see Section 5.2) is presented in Section 6.

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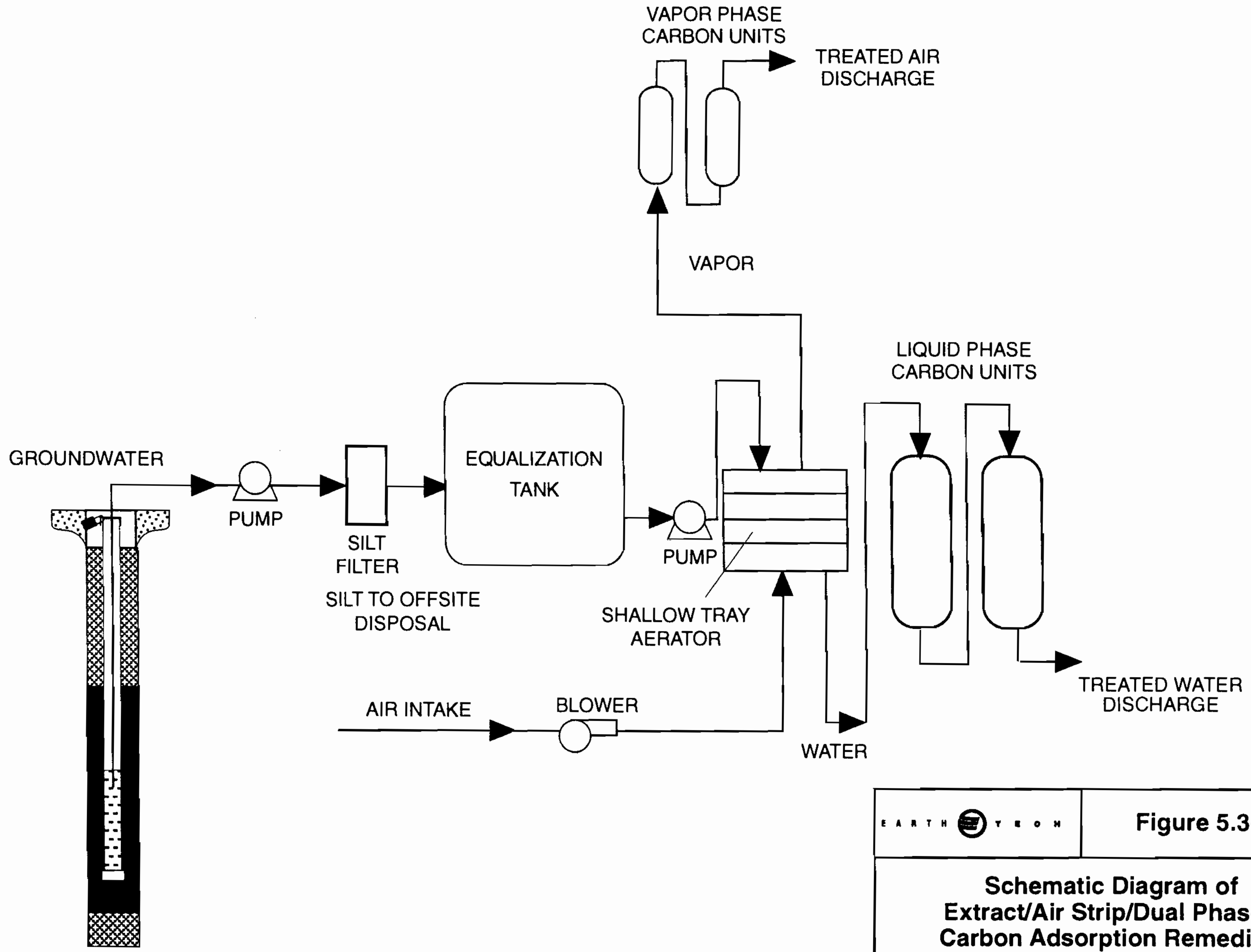

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Figure 5.3-3

Schematic Diagram of Extract/Air Strip/Dual Phase Carbon Adsorption Remedial Alternative

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Table 5.3-3
Summary of Preliminary Screening of Remedial Alternatives for Remediation of Groundwater at AFP 59

Remedial Alternatives	Retained or Rejected	Rationale
Extract/Air Strip/Direct Emission	Retained	Implementable, effective for site conditions and chemicals of concern, and relatively low cost.
Extract/Liquid Phase Carbon Adsorption	Retained	Implementable, effective for site conditions and chemicals of concern, and relatively low cost.
Extract/Air Strip/Dual Phase Carbon Adsorption	Retained	Implementable, effective for site conditions and chemicals of concern, and relatively low cost.

5.3.3.1 Detailed Analysis of the Extract/Air Strip/Direct Emission Remedial Alternative

This section provides a detailed analysis of the extract/air strip/direct emission alternative. The analysis evaluates the alternative's ability to remediate the groundwater at AFP 59 on the basis of the seven criteria described in Section 5.2.1.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. Implementation of this alternative would remove chemicals from the groundwater at the source area (AFP 59). Therefore, potential risk associated with exposure to chemicals originating at AFP 59 would be eliminated, thereby protecting human health. However, this alternative would not eliminate potential risk associated with chemicals that have already migrated off-site.

COMPLIANCE WITH ARARS. This remedial alternative would effectively reduce the chemicals in groundwater at AFP 59 to a level that complies with the ARARs presented in Section 4.

LONG-TERM EFFECTIVENESS AND PERMANENCE. Removal of the chemicals from the groundwater would be permanent. No additional chemicals would be expected after effective remediation of the site.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT. Implementation of this alternative would reduce chemical volume at AFP 59 through the transferal of chemicals from the groundwater to the atmosphere (by volatilizing the VOCs) during the air stripping process.

SHORT-TERM EFFECTIVENESS. Implementation of this alternative would immediately reduce chemicals in groundwater at AFP 59. Implementation would not cause any negative, short-term impact on the environment or site workers. VOC emissions from the air stripper would be monitored through regular sampling. During implementation, worker and public exposure would be limited through standard health and safety practices.

IMPLEMENTABILITY. Based on the chemicals of concern at AFP 59 and the availability of the required services and materials, the technical implementability of this remedial alternative would be high. A potential difficulty with the administrative implementability could be the State permitting process for emissions to the atmosphere. Monitoring of emissions from the air stripper would be required.

COST. The present worth cost to install, operate, and maintain this remedial alternative over a 15-year period was estimated at $717,363.

5.3.3.2 Detailed Analysis of the Extract/Liquid Phase Carbon Adsorption Remedial Alternative

This section provides a detailed analysis of the extract/liquid phase carbon adsorption alternative. The analysis evaluates the alternative's ability to remediate the chemicals in groundwater at AFP 59 on the basis of the seven criteria described in Section 5.2.1.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. Implementation of this alternative would remove chemicals from the groundwater at the source area (AFP 59). Therefore, potential risk associated with exposure to chemicals originating at AFP 59 would be eliminated, thereby protecting human health. However, this alternative would not eliminate potential risk associated with chemicals that have already migrated off-site.

COMPLIANCE WITH ARARs. This remedial alternative would effectively reduce the chemicals in groundwater at AFP 59 to a level that complies with the ARARs presented in Section 4.

LONG-TERM EFFECTIVENESS AND PERMANENCE. Removal of the chemicals from the groundwater would be permanent. No additional chemicals would be expected after effective remediation of the site.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME. Implementation of this alternative would eliminate the toxicity, mobility, and volume of the chemicals after the carbon unit was reactivated through an incineration process.

SHORT-TERM EFFECTIVENESS. Implementation of this alternative would immediately reduce chemicals in groundwater at AFP 59. Implementation would not cause any negative, short-term impact on the environment or site workers. During implementation, worker and public exposure would be limited through standard health and safety practices.

IMPLEMENTABILITY. Implementation of this remedial alternative would be high for the following reasons: it would be practical for the chemicals of concern at AFP 59; the required services and materials would be readily available; no air permitting would be required; the reactivation of the spent carbon would typically be included in the contract with the carbon supplier; and the treatment system would be passive, requiring very little maintenance.

COST. The present worth cost to install, operate, and maintain this remedial alternative over a 15-year period was estimated at $646,704.

5.3.3.3 Detailed Analysis of the Extract/Air Strip/Dual Phase Carbon Adsorption Remedial Alternative

This section provides a detailed analysis of the extract/air strip/dual phase carbon adsorption alternative. The analysis evaluates the alternative's ability to remediate the chemicals in groundwater at AFP 59 on the basis of the seven criteria described in Section 5.2.1.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. Implementation of this alternative would remove chemicals from the groundwater at the source area (AFP 59). Therefore, potential risk associated with exposure to chemicals originating at AFP 59 would be eliminated, thereby protecting human health. However, this alternative would not eliminate potential risk associated with chemicals that have already migrated off-site.

COMPLIANCE WITH ARARs. This remedial alternative would effectively reduce the chemicals in groundwater AFP 59 to a level that complies with the ARARs presented in Section 4.

LONG-TERM EFFECTIVENESS AND PERMANENCE. Removal of the chemicals from the groundwater would be permanent. No additional chemicals would be expected after effective remediation of the site.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME. Implementation of the alternative would eliminate the toxicity, mobility, and volume of the chemicals after the carbon units were reactivated through an incineration process.

SHORT-TERM EFFECTIVENESS. Implementation of this alternative would immediately reduce chemicals in groundwater at AFP 59. Implementation would not cause any negative, short-term impact on the environment or site workers. During implementation, worker and public exposure would be limited through standard health and safety practices.

IMPLEMENTABILITY. Implementation of this remedial alternative would be high for the following reasons: it would be practical for chemicals of concern at AFP 59; the required services and materials would be readily available; no air permitting would be required; and the reactivation of the spent carbon would typically be included in the contract with the carbon supplier.

COST. The present worth cost to install, operate, and maintain this remedial alternative over a 15-year period was estimated at $756,846.

5.3.4 Conclusions from the Detailed Analysis

Table 5.3-4 summarizes the results of the detailed analysis of the remedial alternatives. The table rates each remedial alternative against the seven USEPA criteria.

All three on-site remedial alternatives would provide adequate protection of human health and the environment. However, the extract/air strip/direct emission system would offer the best combination of effectiveness, implementability, and cost-efficiency. The long-term effectiveness of extract/liquid phase carbon adsorption systems would be questionable because of potential problems related to the efficiency of the carbon units. The extract/air strip/dual phase carbon adsorption system would be less implementable and would require more O&M than either the extract/air strip/direct emission system or the extract/liquid phase carbon system because of the need for secondary treatment technologies.

On the basis of the detailed analysis in the *Remedial Alternatives ITIR* (Earth Tech, 1996a), the extract/air strip/direct emission system was the recommended remedial alternative if an on-site treatment system was to be installed at AFP 59.

Table 5.3-4 Summary of Detailed Analysis of Remedial Alternatives at AFP 59			
USEPA Criteria	**Extract/Air Strip/Direct Emission**	**Extract/Liquid Phase Carbon Adsorption**	**Extract/Air Strip/Dual Phase Carbon Adsorption**
Overall protection of human health and the environment (1)	Excellent (assuming emissions remain below NYSDEC standards)	Excellent	Excellent
Compliance with ARARs	Yes, at AFP 59	Yes, at AFP 59	Yes, at AFP 59
Long-term effectiveness and permanence(1)	Excellent	Excellent	Excellent
Reduction of toxicity, mobility, or volume through treatment (1)	Excellent, chemicals are transferred from the groundwater to the atmosphere	Excellent, after reactivation of the carbon units	Excellent, after reactivation of the carbon units
Short-term effectiveness (1)	Excellent	Excellent	Excellent
Implementability	Excellent	Excellent	Good
Cost	$717,363	$646,704	$756,846

(1) Ratings were excellent, good, fair, poor, and none.

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Section 6

6.0 Comparison of Identified Response Actions

This section provides a comparative evaluation of the two response actions that were identified in the *Remedial Alternatives ITIR* (Earth Tech, 1996a) as being capable of satisfying the remedial action objectives outlined in Section 4. As discussed in Section 3, with the exception of a few chemicals in soil (exposure to these chemicals can be prevented through the use of appropriate personal protective equipment) and VOCs in groundwater, all chemicals in soil, groundwater, sediment, and surface water were eliminated as chemicals of potential concern through the baseline risk assessment and sampling conducted as part of the December 1995 investigation. As a result, the purpose of this evaluation was to provide sufficient information to choose the most appropriate response action for addressing the VOCs in groundwater at AFP 59.

6.1 Summary of Detailed Analyses

Four remedial alternatives were identified under the two response actions:

- Upgrading the current groundwater treatment system at the Camden Street Well Field;
- Installation of an extraction/air strip/direct emission system at AFP 59;
- Installation of an extraction/liquid phase carbon adsorption system at AFP 59; and
- Installation of an extraction/air strip/dual phase carbon adsorption system at AFP 59.

Generally, overall protection of human health and the environment and compliance with ARARs served as the determining factors in selecting a remedial alternative. These factors plus cost are compared in Table 6.1-1 for the four remedial alternatives identified under the two general response actions. Table 6.1-2 provides a detailed analysis of the remaining criteria (long-term effectiveness; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; and implementability). These tables present a summary of the detailed analyses conducted in Sections 5.2 and 5.3 and evaluate an alternative's ability to satisfy the remedial action objectives. For the treatment alternatives at AFP 59, the remedial action objective is to prevent contaminated groundwater (i.e., chemicals in groundwater exceeding ARARs) from migrating off-site. Therefore, although a treatment alternative at AFP 59 may be evaluated positively in Tables 6.1-1 and 6.1-2 as meeting this remedial action objective, it does not indicate that the Camden Street Well Field would be protected from other sources of chemicals.

The detailed analyses of the potential treatment systems at AFP 59 indicated that the extract/air strip/direct emission system represents the most effective, implementable, and cost-efficient alternative for on-site treatment. A comparative evaluation of upgrading the current treatment system at the Camden Street Well Field versus installing an extract/air strip/direct emission system at AFP 59 is provided in Section 6.2.

Table 6.1-1
Comparative Analysis of Remedial Alternatives

Alternative	Overall Protection of Human Health and the Environment[1]	Compliance with ARARs	Estimated Cost in 1995 Dollars
Upgrade of the Well Field Groundwater Treatment System	Excellent	Yes, at the well field	$1,104,000
Extraction/Air Strip/Direct Emission System at AFP 59	Excellent (assuming emissions remain below NYSDEC standards)	Yes, at AFP 59	$717,406
Extraction/Liquid Phase Carbon Adsorption System at AFP 59	Excellent	Yes, at AFP 59	$646,704
Extraction/Air Strip/Dual Phase Carbon Adsorption System at AFP 59	Excellent	Yes, at AFP 59	$756,846

Key: ARARs = Applicable or Relevant and Appropriate Requirements

(1) Ratings were excellent, good, fair, poor, and none.

Table 6.1-2
Detailed Analysis of Remedial Alternatives

Criteria	Upgrade of the Well Field Groundwater Treatment System	Extraction/Air Strip/Direct Emission System at AFP 59	Extraction/ Liquid Phase Carbon Adsorption System at AFP 59	Extraction/Air Strip/Dual Phase Carbon Adsorption System at AFP 59
LONG-TERM EFFECTIVENESS AND PERMANENCE CONSIDERATIONS FOR REMEDIAL ALTERNATIVES				
Magnitude of the remaining risks	Acceptable, assuming emissions remain below NYSDEC standards	Acceptable, assuming emissions remain below NYSDEC standards	Acceptable, remediation continues until remedial action objectives met	Acceptable, remediation continues until remedial action objectives met
Remaining sources of risk: • Treatment residuals	Emissions	Emissions	Spent carbon units	Spent carbon units
• Residual chemicals	Depends on system efficiency	Depends on system efficiency	Depends on system efficiency	Depends on system efficiency
Likelihood that technology will meet required process efficiencies or performance specifications	Very likely	Very likely	Very likely	Very likely
Type and degree of long-term management	Analysis of groundwater data	Treatment system operation & maintenance, moderate maintenance	Treatment system operation & maintenance, moderate maintenance	Treatment system operation & maintenance, moderate maintenance
Long-term monitoring required?	Yes, until remedial action objectives met	Yes, until remedial action objectives met	Yes, until remedial action objectives met	Yes, until remedial action objectives met
Operation and maintenance functions to be performed	Periodic analysis of influent/effluent streams and system equipment maintenance	Periodic analysis of influent/effluent streams and system equipment maintenance	Periodic analysis of influent/effluent streams and system equipment maintenance. Reactivation of carbon units	Periodic analysis of influent/effluent streams and system equipment maintenance. Reactivation of carbon units
Difficulties and uncertainties associated with long-term operation and maintenance	None	None	None	None
Potential need for replacement of technical components	Not likely	Not likely	Not likely	Not likely
Degree of confidence that controls can adequately handle potential problems	High	High	High	High
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME				
Principal threats addressed?	Yes	Yes	Yes	Yes
Special requirements for the treatment process	None	None	None	None
Portion (mass, volume) of contaminated material destroyed	0%	0%	0%	0%

Table 6.1-2
Detailed Analysis of Remedial Alternatives

Criteria	Upgrade of the Well Field Groundwater Treatment System	Extraction/Air Strip/Direct Emission System at AFP 59	Extraction/ Liquid Phase Carbon Adsorption System at AFP 59	Extraction/Air Strip/Dual Phase Carbon Adsorption System at AFP 59
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME (CONTINUED)				
Portion (mass, volume) of contaminated material treated	100%	90 to 100%, dependent on efficiency of extraction system.	90 to 100%, dependent on efficiency of extraction system.	90 to 100%, dependent on efficiency of extraction system.
Extent total mass of toxic chemicals reduced	Dependent on system efficiency, predicted at >99%. Chemicals transferred from groundwater to atmosphere	Dependent on system efficiency, predicted at >99%. Chemicals transferred from groundwater to atmosphere	Dependent on system efficiency, predicted at >99%. Carbon units require reactivation	Dependent on system efficiency, predicted at >99%. Carbon units require reactivation
Extent mobility of toxic chemicals reduced	>99% in groundwater. 0% in atmosphere due to direct emissions	>99% in groundwater. 0% in atmosphere due to direct emissions	Dependent on system efficiency, >99% predicted	Dependent on system efficiency, >99% predicted
Extent volume of toxic chemicals reduced	Dependent on system efficiency, predicted at >99%. Chemicals transferred from groundwater to atmosphere	Dependent on system efficiency, predicted at >99%. Chemicals transferred from groundwater to atmosphere	Dependent on system efficiency, predicted at >99%. Carbon units require reactivation	Dependent on system efficiency, predicted at >99%. Carbon units require reactivation
Extent effects of treatment irreversible	100%	100%	100%	100%
Treatment residuals remaining	Yes	Yes	Yes	Yes
Treatment residual quantities and characteristics	Emissions	Emissions	Spent carbon units	Spent carbon units
Risks from treatment residuals	Negligible	Negligible	Negligible	Negligible
Are principal threats addressed within the scope of the remedial action?	Yes	Yes	Yes	Yes
Is treatment used to reduce inherent hazards posed by principal threats at the site?	No	Yes	Yes	Yes
SHORT-TERM EFFECTIVENESS				
Risks to the community that must be addressed during remedial actions	None	Exposure during installation of wells and system	Exposure during installation of wells and system	Exposure during installation of wells and system
How will community risks be addressed and mitigated?	NA	Engineering controls (dust suppression, monitoring)	Engineering controls (dust suppression, monitoring)	Engineering controls (dust suppression, monitoring)

Table 6.1-2
Detailed Analysis of Remedial Alternatives

Criteria	Upgrade of the Well Field Groundwater Treatment System	Extraction/Air Strip/Direct Emission System at AFP 59	Extraction/ Liquid Phase Carbon Adsorption System at AFP 59	Extraction/Air Strip/Dual Phase Carbon Adsorption System at AFP 59
SHORT-TERM EFFECTIVENESS (CONTINUED)				
What risks remain to the community that cannot be readily controlled?	None	None	None	None
What are worker risks that must be addressed?	Health and safety during monitoring	Health and safety during construction	Health and safety during construction	Health and safety during construction
What worker risks cannot be readily controlled?	None	None	None	None
Environmental impacts expected with the construction and implementation of the alternative	None	None	None	None
Available mitigation measures to be used and their reliability to minimize potential environmental impacts	NA	NA	NA	NA
Impacts that cannot be avoided	NA	NA	NA	NA
Time until protection against the principal threats being addressed by the specific action is achieved	Estimated at 15 years	Estimated at 15 years	Estimated at 15 years	Estimated at 15 years
Time until remedial response objectives are achieved	Estimated at 15 years	Estimated at 15 years	Estimated at 15 years	Estimated at 15 years
IMPLEMENTABILITY				
Construction and operation difficulties	None	None	None	None
Construction uncertainties	Weather delays, equipment downtime	Weather delays, equipment downtime	Weather delays, equipment downtime	Weather delays, equipment downtime
Likelihood that technical problems will lead to schedule delays	Unlikely	Unlikely	Unlikely	Unlikely
Likely future remedial actions	No	No	No	No
Difficult to implement additional remedial actions?	No	No	No	No
Do migration or exposure pathways exist that cannot be monitored adequately?	No	No	No	No
What risks or exposures exist should monitoring be insufficient to detect failure?	None	None	None	None

Table 6.1-2
Detailed Analysis of Remedial Alternatives

Criteria	Upgrade of the Well Field Groundwater Treatment System	Extraction/Air Strip/Direct Emission System at AFP 59	Extraction/ Liquid Phase Carbon Adsorption System at AFP 59	Extraction/Air Strip/Dual Phase Carbon Adsorption System at AFP 59
IMPLEMENTABILITY (CONTINUED)				
Steps required to coordinate with other agencies	Routine reporting	Emissions permitting and routine reporting	Routine reporting	Routine reporting
Steps required to set up long-term or future coordination among agencies	Routine reporting	Routine reporting	Routine reporting	Routine reporting
Can permits for off-site activities be obtained?	Already permitted	NA	NA	NA
Availability of treatment, storage capacity, and disposal services	Yes	Yes	Yes	Yes
Additional capacity necessary?	No	No	No	No
Does the lack of capacity prevent implementation?	No	NA	NA	NA
Additional provisions required to ensure the needed additional capacity	Second air stripper and booster pump	NA	NA	NA
Availability of necessary equipment and specialists	Readily available	Readily available	Readily available	Readily available
What additional equipment and specialists are required?	Second air stripper and booster pump	NA	NA	NA
Does the lack of equipment and specialists prevent implementation?	No	NA	NA	NA
Additional provisions required to ensure the needed equipment and specialists?	None	NA	NA	NA
Are technologies under consideration generally available and sufficiently demonstrated for the specific application?	Yes	Yes	Yes	Yes

Key: NA = Not Applicable system at the Camden Street Well Field versus installing an extract/air strip/direct emission system at AFP 59 is provided in Section 6.2.

6.2 Comparison of Identified Response Actions

Implementation of both response actions would effectively reduce VOCs in groundwater originating at AFP 59. However, conclusions from the detailed analyses provide information regarding which action would be most appropriate for AFP 59. These conclusions are provided below.

- A significant difference between the two response actions is that upgrading the well field treatment system would protect the Camden Street Well Field from any source of VOCs, whereas treatment at AFP 59 would only eliminate potential risk associated with exposure to VOCs originating at AFP 59. Consequently, treatment of the groundwater at AFP 59 does not protect the Camden Street Well Field from sources of VOCs other than AFP 59. Therefore, upgrading the well field treatment system would provide better protection of human health and the environment.

- Installation of a treatment system at AFP 59 would not protect the well field from VOCs originating at AFP 59 that have already migrated off-site. As a result, upgrading the well field treatment system would provide better protection of human health and the environment.

- Upgrading the well field treatment system would be easier to implement than installing a treatment system at AFP 59 because it would not involve the installation of a new system. Most of the system currently in operation at the well field would be included in the upgraded system.

6.3 Recommendations

The selected method for cleanup of VOCs in groundwater related to historical activities at AFP 59 is the upgrade of the current groundwater treatment system at the Camden Street Well Field. This alternative will best satisfy the USEPA assessment criteria outlined in Section 5.2.1. While it is the most costly alternative, it will provide the best protection of human health and the environment, will assure all groundwater at the Camden Street Well Field complies with ARARs, and is the easiest to implement.

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Section 7

7.0 Responsiveness Summary

This section provides a written summary of comments and criticisms generated during the public hearing (held August 17, 1999 at the Hilltop Retirement Community) for the *Final Proposed Plan* (Earth Tech, 1999); comments and responses are paraphrased from a transcript provided by a court recorder present at the hearing. No comments were generated during the public comment period (July 24, 1999 through August 23, 1999) for the *Final Proposed Plan*, and no comments were received from the NYSDEC concerning the *Final Proposed Plan.*

7.1 Response to Village of Johnson City Comments

1. *Comment:* I live across the street form the well field. What's going to be done about the excessive noise generated by the new groundwater treatment system?

   Response (by a representative of the Johnson City Water Department):

   Back in July there was a public meeting held at the water treatment plant to discuss issues concerning the new system. Only one gentleman showed up for the meeting, and he was satisfied that the Village was going to make an effort to minimize noise.

   When we first realized that there was a problem, we went to the tower manufacturers because they had said they had these problems in other areas. We asked them to get us the information, some recommendations. They gave us a letter with an alternative to reduce the noise. We reviewed it and didn't feel that would be good enough, plus it was very expensive to do. So, we went out and hired noise experts -- actually, we didn't hire them, they came down at their own cost to do an analysis of the sound.

   The noise expert monitored noise all around the building and at every penetration in the building, including doors, windows, exhaust ports, and intake ports. He started at our office, then went to the well field gate, the first house, and the third house. He determined that there are two sources of noise; one is the echoing of noise from the air stripper blowers off the building, and the second is the motors on the well pumps. He recommended that we order silencers, which we have done. The biggest problem area was the pump room, which is closest to Camden Street. We ordered silencers for the intake fan and the exhaust fan for the motors on those pumps. There is also a set of double doors that is another major leak of noise. They have special panels that you can put over the doors that will baffle the noise but also allows us to open it up in case there is an emergency; we will install the panels.

   The other thing we planned on doing, even though the noise expert says it won't alleviate the problem, is planting arborvitaes, an evergreen shrub.

2. *Comment:* What about the possibility of putting those (arborvitaes) also between the garage and the exhaust?

Response (by a representative of the Johnson City Water Department):

We thought about that. The problem is our water lines are right there. So, if there is ever a leak or anything, whatever gets planted there is going to be dug up. The noise expert gave us some ideas as to what to do. There are louver doors on the blower room facing the garage. We can capture that noise before it gets into the building.

3. *Comment:* If the installation of a treatment system at AFP 59 would be cheaper than the upgrade of the treatment system at the well field, why not install the system at AFP 59?

Response (by a representative of Earth Tech):

Because the treatment system at the Camden Street Well Field will protect the public from all sources of groundwater contamination in the area, whereas a treatment system at AFP 59 would only protect the public from groundwater contamination originating at AFP 59.

In addition to the environmental investigations that have been conducted at AFP 59, three environmental investigations were conducted in the area of the well field in the early to mid 1990's to identify potential sources of groundwater contamination. The investigations identified sources of contamination other than AFP 59 that contributed to groundwater contamination at the well field. As a matter of fact, 1,1,1-TCA, the contaminant that was detected at the well field and led to the installation of the current groundwater treatment system, was detected at much higher concentrations at other sites than at AFP 59. The highest concentration of 1,1,1-TCA ever detected in groundwater at AFP 59 was 34 parts per billion (ppb), while 1,1,1-TCA was detected at approximately 450 ppb at another site. Therefore, the upgrade of the treatment system at the well field is the preferred option because it will protect the well field and the public from all sources of groundwater contamination in the area.

4. *Comment:* Did they find the source of the 1,1,1-TCA?

Response (by a representative of Earth Tech):

No, there was insufficient funding to conduct enough sampling to pinpoint the exact source. They identified an area north of the well field.

5. *Comment:* What are concentrations of 1,1,1-TCA prior to being treated at the well field?

Response (by a representative of Earth Tech):

Very low. The Johnson City Water Department samples the water before and after it is treated. A representative from the Water Department informed me that the highest they have detected 1,1,1-TCA (before treatment) recently is 0.2 ppb, which is well below the NYSDEC drinking water standard of 5 ppb and the USEPA MCL of 200 ppb.

6. *Comment:* Why was there no treatment at the well field prior to 1992?

Response (by a representative of Earth Tech):

Because no contamination was detected at the well field until 1991. After 1,1,1-TCA was detected above 5 ppb, the treatment system was installed.

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APPENDIX A
REFERENCES

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APPENDIX A

REFERENCES

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