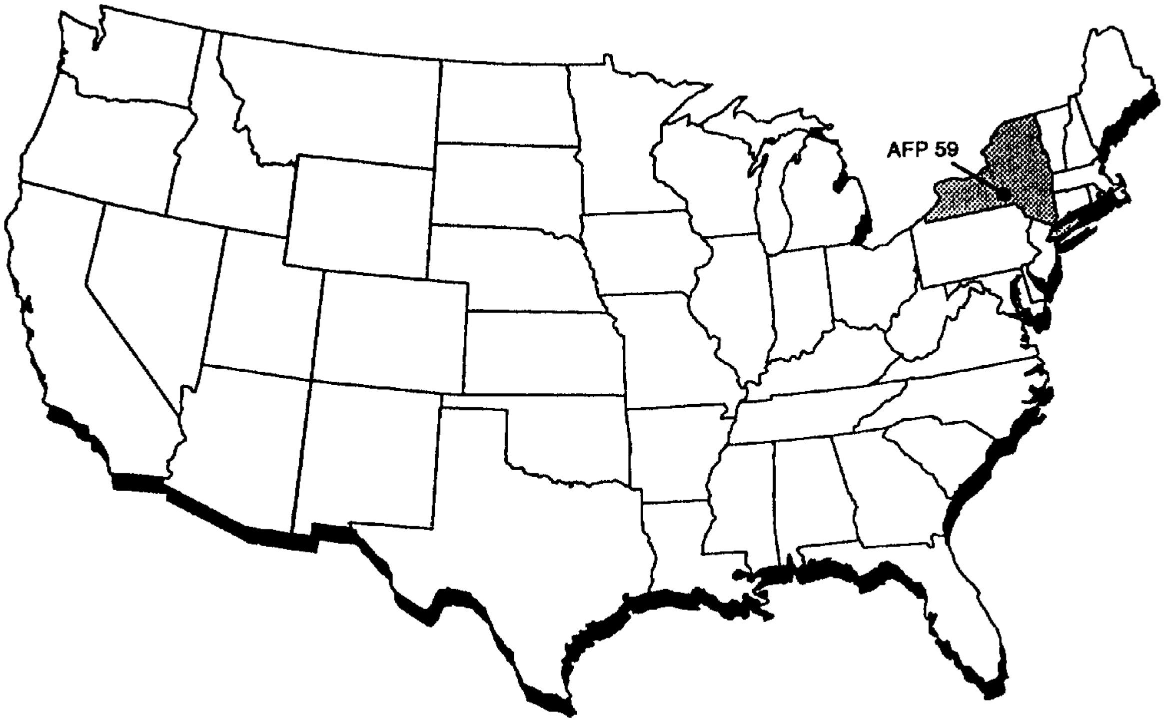
INSTALLATION RESTORATION PR
REMEDIAL INVESTIGATIO
FINAL WORK PLAN

AIR FORCE PLANT 59
JOHNSON CITY, NEW YORK

NOVEMBER 1994



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REMEDIAL INVESTIGATION FINAL WORK PLAN

AIR FORCE PLANT 59

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This Work Plan provides information on the Installation Restoration Program (IRP) Remedial Investigation (RI) which is being conducted at Air Force Plant (AFP) 59 in Johnson City, New York. A field program consisting of geophysical utility clearance surveys, direct push soil and groundwater sampling, subsurface soil sampling, monitoring well installation, groundwater sampling, sediment and surface water sampling, and aquifer testing has been developed to meet the project objectives of the RI. This Work Plan summarizes existing information about the facility; presents project objectives and the tasks proposed to meet these objectives; and describes the data evaluation process, including the human health risk assessment.

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PREFACE

This Work Plan describes the expected tasks and activities needed to complete the remedial investigation (RI) at Air Force Plant 59 according to the requirements of Contract No. F41624-94-D-8055, Delivery Order 0004, between the U.S. Air Force and EARTH TECH. It was developed to assure that all environmental data generated for the project are scientifically valid, defensible, comparable and of known and acceptable precision and accuracy. The Work Plan has been prepared in accordance with format and content requirements of the "Handbook to Support the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)", September 1993.

The Air Force Center for Environmental Excellence (AFCEE) Restoration Team Chief (RTC) is Mr. John McCown. The EARTH TECH Project Manager for this contract is Ms. Reid Wellensiek. The activities covered by this Work Plan began in July 1994, and are anticipated to be completed by September 1995.

Approved:

Robert A. Colonna, Program Manager

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LIST OF ACRONYMS

AFCEE	Air Force Center for Environmental Excellence
AFP	Air Force Plant
ANL	Argonne National Laboratory
ARAR	Applicable or Relevant and Appropriate Requirement
ASC	Aeronautical Systems Center
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
CSF	Cancer Slope Factor
DCA	Dichloroethane
DCE	Dichloroethene
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DoD	Department of Defense
EMI	Electromagnetic Imaging
FS	Feasibility Study
GC	Gas Chromatograph
GE	General Electric
gpm	Gallons Per Minute
GPR	Ground Penetrating Radar
HEAST	Health Effects Assessment Summary Table
HI	Hazard Index
HQ	Hazard Quotient
ICP	Inductively Coupled Plasma
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
ISCST	Industrial Source Complex - Short Term
ITIR	Informal Technical Information Report
MCL	Maximum Contaminant Level
MEK	Methyl Ethyl Ketone
μg/kg	Micrograms Per Kilogram
μg/L	Micrograms Per Liter
mg/kg	Milligrams Per Kilogram
mg/L	Milligrams Per Liter
MOU	Memorandum of Understanding
MSL	Mean Sea Level
MTV	Mobility, Toxicity, or Volume
NCP	National Contingency Plan
NYSDEC	New York State Department of Environmental Conservation
NYSEG	New York State Electric and Gas
O&M	Operation and Maintenance

LIST OF ACRONYMS

Continued

PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
POC	Principal Organic Contaminant
ppb	Parts Per Billion
ppm	Parts Per Million
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
R&D	Research and Development
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SARA	Superfund Amendment and Reauthorization Act
SF	Slope Factor
SPDES	State Pollution Discharge Elimination System
SSI	Supplemental Site Inspection
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TBC	To-Be-Considered
TCA	Trichloroethane
TCE	Trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
TOC	Total Organic Carbon
TOGS	Technical and Operational Guidance Series
TPH	Total Petroleum Hydrocarbon
UCL	Upper Confidence Limit
USAF	United States Air Force
USC	United States Code
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

SECTION 1.0

INTRODUCTION

This Work Plan provides information on the planned Remedial Investigation (RI) at Air Force Plant (AFP) 59 in Johnson City, New York. The RI is part of a larger program, known as the Installation Restoration Program (IRP), designed to evaluate potential hazardous waste contamination at United States Air Force (USAF) facilities. The United States Department of Defense (DoD) developed the IRP in 1983 to investigate hazardous material disposal sites on DoD facilities. To date, three investigations have been conducted under the IRP at AFP 59. The AFP 59 RI is designed to fully characterize the extent of contamination and assess potential risks to human health and the environment.

AFP 59 is listed as a Class 2 Site on the New York State Department of Environmental Conservation (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 environmental action required." AFP 59 is not on the National Priorities List and is not under a Federal Facility Agreement.

At the Johnson City municipal wellfield located approximately 1,000 feet southwest of AFP 59, 1,1,1-trichloroethane (1,1,1-TCA) has been detected at concentrations exceeding the New York State Maximum Contaminant Level (MCL). The aquifer has been designated a sole-source aquifer by the United States Environmental Protection Agency (USEPA) since it supplies drinking water to the area's 128,000 residents. The NYSDEC conducted a source investigation to determine potential sources of contamination, and an air stripper has been installed at the wellfield by Johnson City. The USAF has 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. The MOU does not constitute a finding by the State of New York or Johnson City that AFP 59 is a source of the contamination (USAF, 1993a).

A primary objective of the USAF is to determine the potential contribution of past or present activities at AFP 59 to the groundwater contamination identified at the Johnson City wellfield. To accomplish this task, potential onsite sources of contamination must be investigated. Additionally, potential offsite sources of contamination that could be contributing to the wellfield contamination must be identified. The focus of the RI described in this Work Plan is an investigation of onsite potential sources, and the nature and extent of any identified contamination. An investigation of potential offsite sources of contamination will be conducted by the United States Geological Survey (USGS). These two investigations have been designed to include complementary activities to avoid duplication of effort and maximize data collection capabilities.

This Work Plan was prepared in accordance with guidance presented in the USEPA document "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (USEPA, 1988), and in accordance to format and content requirements of the "Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)" (USAF, 1993). In addition, all applicable State of New York requirements were incorporated in the project plans.

This Work Plan provides background information on the USAF IRP, previous investigations at AFP 59, and the mission and history of AFP 59. The objectives of the current investigation are also outlined. The environmental setting and existing information concerning the nature and extent of contamination are summarized and incorporated into a conceptual site model, and data needs are identified. The tasks to be completed during the RI are described, including field activities, data analysis, and risk assessment. Finally, the reporting requirements and project schedule are provided.

1.1 United States Air Force Installation Restoration Program

The objective of the USAF IRP is to assess past hazardous waste disposal and spill sites at USAF installations and to develop remedial actions consistent with the National Contingency Plan (NCP) for those sites which pose a threat to human health and the environment. This section presents information on the program origins, objectives, and organization.

1.1.1 Program Origins

In 1980, Congress enacted the Superfund law or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA outlines the responsibility for identifying and remediating contaminated sites in the United States and its possessions. CERCLA legislation identifies the USEPA as the primary policy and enforcement agency regarding contaminated sites.

Executive Order 12316, which was adopted in 1981, gave various federal agencies, including the DoD, the responsibility to act as lead agencies to conduct investigations and implement remediation efforts when they are the sole or co-contributor to contamination on or off their properties.

In January 1987, Executive Order 12316 was revoked by Executive Order 12580. Executive Order 12580 delegates CERCLA functions vested in the President to the leads of various federal agencies, including DoD.

To ensure compliance with CERCLA, the DoD developed the IRP. The IRP was implemented to identify potentially contaminated sites, investigate these sites, and evaluate and select remedial actions for potentially contaminated sites. The DoD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP in June 1980 and implemented the policies outlined in this memorandum in December 1980. The NCP was issued as a final rule 8 March 1990, to provide the organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants.

The DoD formally revised and expanded the existing IRP directives, and amplified all previous directives and memoranda concerning the IRP through DEQPPM 81-5, dated 11 December 1981. The memorandum was implemented by a USAF Message dated 21 January 1982.

The Superfund Amendment and Reauthorization Act (SARA) of 1986 extends the requirements of CERCLA and modifies CERCLA with respect to goals for remediation and the process leading to the selection of a remedial action. Under SARA, technologies that provide permanent removal or destruction of a contaminant are preferable to action which only contains or isolates the contaminant. SARA also provides for greater interaction with public and state agencies, and extends the role of the USEPA in evaluating health risks associated with contamination. Under SARA, early determination of Applicable or Relevant and Appropriate Requirements (ARARs) is required, and the consideration of potential remedial alternatives is recommended at the initiation of an RI/FS. CERCLA, as amended by SARA, is the primary Federal legislation governing remedial action at past hazardous waste disposal sites.

The IRP is the DoD's primary mechanism for response actions on USAF installations affected by the provisions of SARA. In November 1986, in response to SARA and other USEPA interim guidance, the USAF modified the IRP to provide for an RI/FS program. The IRP was modified so that RI/FS studies could be conducted as parallel activities rather than serial activities. The program now includes ARAR determinations, identification and screening of technologies, and development of remedial alternatives. The IRP may include multiple field activities and pilot studies prior to a detailed final analysis of alternatives. Over the years, requirements of the IRP have been developed and modified to ensure DoD compliance with federal laws and regulations such as Resource Conservation and Recovery Act (RCRA), NCP, CERCLA, and SARA.

1.1.2 Program Objectives

The objectives of the IRP are to:

- Identify and evaluate sites where contamination may be present on DoD property because of past hazardous waste disposal practices, spills, leaks, or other activities;
- Control the migration of hazardous contaminants; and
- Control health hazards or hazards to the environment that may result from past DoD disposal operations.

The IRP was developed so these objectives could be met in accordance with CERCLA, NCP, SARA, RCRA, and other applicable statutes. Solutions that are developed should protect public health and the environment, meet requirements of ARARs, and be technically feasible for the evaluated site.

In order to meet these objectives, the following program tasks should be completed.

- Develop a project database through literature search, field investigation, laboratory analysis, and data evaluation.
- Develop and implement a quality assurance/quality control (QA/QC) program to assure the collection of meaningful and defensible data.
- Develop and follow health and safety plans to protect the health and safety of personnel and to prevent the release of contaminants.
- Identify data gaps and implement appropriate additional or supplemental studies during the course of the IRP.
- Use a rigorous procedure to identify, evaluate, and select appropriate solutions.
- Conduct the IRP in compliance with applicable federal, state, and local regulations and guidance.
- Provide information regarding the nature of identified contamination, effects of contamination on the community, the progress of the IRP, and the selected remedial alternative and its impact to the public and appropriate regulatory agencies.

1.1.3 Program Organization

IRP studies were originally organized into four phases: Phase I - Installation Assessment/Records Search; Phase II - Confirmation/Quantification; Phase III - Technology Base Development; and Phase IV - Remedial Action (Figure 1-1). Each phase is divided into different stages of study as knowledge of individual sites is improved and further investigations become necessary. The IRP has been modified to be consistent with the CERCLA Response Action Process (Figure 1-2). A brief description of the IRP organization is presented since previous studies performed at AFP 59 used the phased approach of the IRP.

Phase I - Installation Assessment/Records Search studies are installation-wide studies to identify and assess past disposal sites. File material, site visits, and interviews provide information for initial assessments. The Phase I assessment considers whether or not each identified site poses hazards to public health or the environment. If a site presents little or no apparent hazard, the site does not proceed to subsequent phases of study. If a site presents an imminent threat to public health, an emergency response, which is considered a Phase IV action, would be taken. If sampling and evaluation to confirm the suspected hazard are required, Phase II studies are initiated. Sites identified in Phase I are rated using the USAF Hazard Assessment Rating Methodology, a system that ranks a site for potential hazards to the public or the

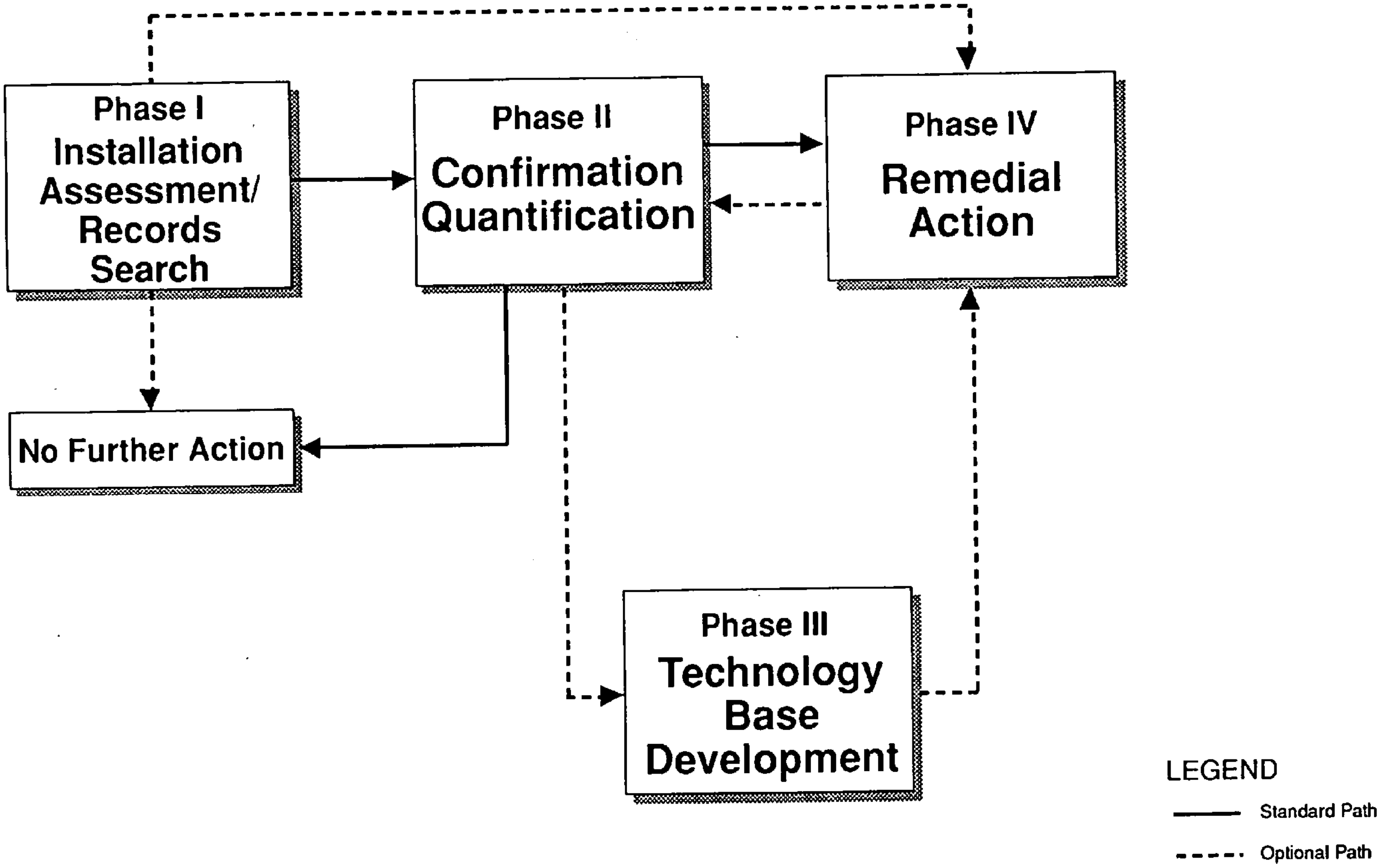

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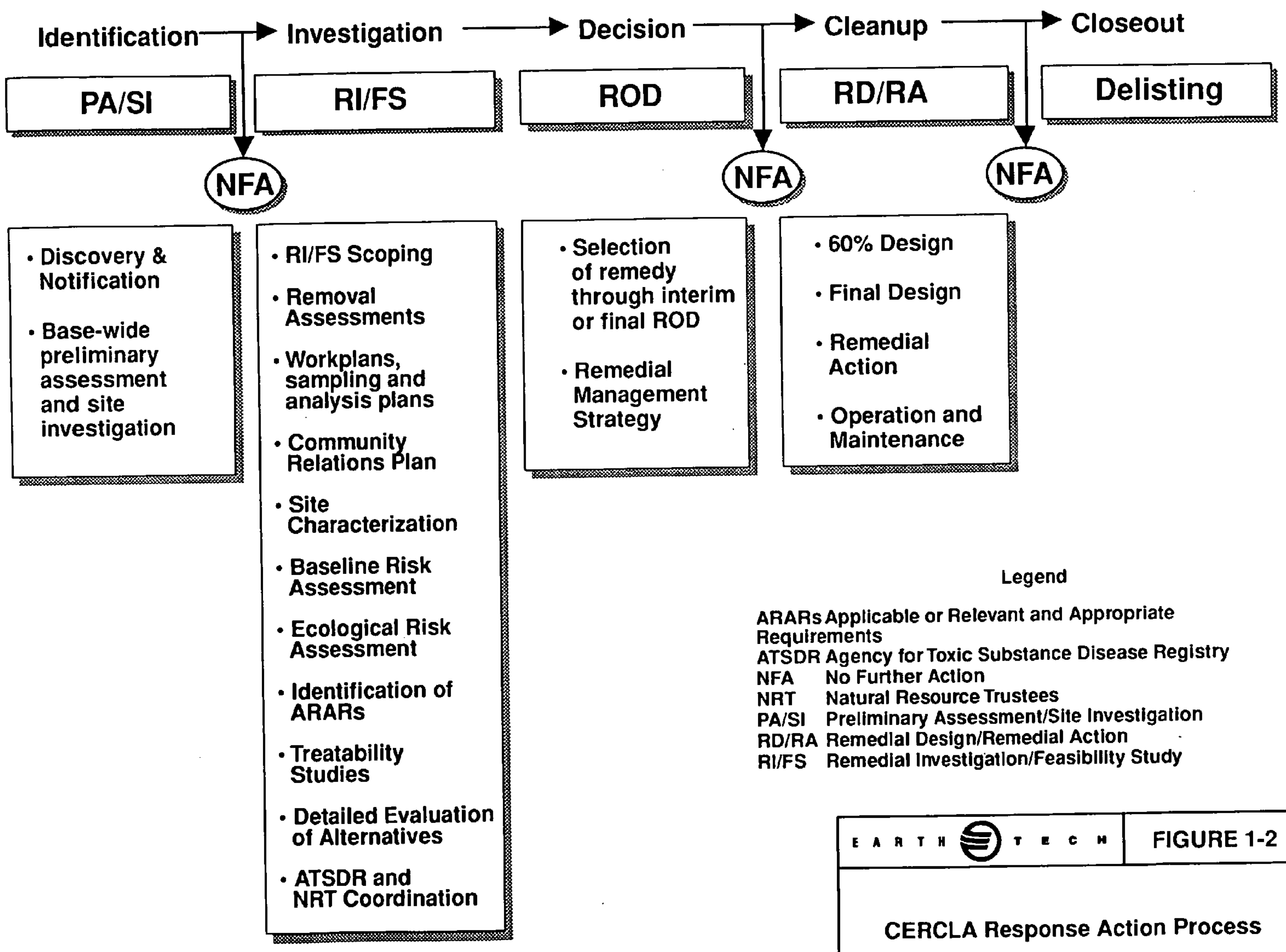
FIGURE 1-1

Installation Restoration Program

AFP59 Fig 1-1



Source: USAF, 1992

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FIGURE 1-2

CERCLA Response Action Process

environment. The USAF also uses the Defense Priority Model to rank sites according to the risks they pose to human health and the environment.

Phase II - Confirmation/Quantification studies are performed to confirm the absence or presence of contamination, to assess the extent and degree of contamination, and to provide the basis for selecting appropriate remedial alternatives. During Phase II studies, groundwater, surface water, soil, and sediment samples are collected and analyzed as necessary. If Phase II studies do not reveal contamination threatening human health or the environment, the results are documented, and no further action is taken at a site. Phase II sampling at some sites might not detect enough contamination to justify costly remediation projects, but future problems are still a possibility. Generally, the approach used for such sites is to perform additional monitoring for water, soil, and/or sediment quality. If a Phase II study demonstrates that a site presents an imminent threat to public health, an emergency response (Phase IV) action would likely be taken.

Phase III - Technology Base Development studies are not performed for every site but are intended to improve site investigation and remediation technology through research, development, and testing. Phase III studies are initiated for sites that cannot be controlled with proven technology or for sites that are suitable for evaluating new technologies.

Phase IV - Remedial Actions are usually conducted in two stages. The first stage consists of developing Remedial Action Plans to document the development, evaluation, and selection of alternatives to control the hazards posed by a waste disposal site. Selection of the best remedial action alternative is based on engineering feasibility, cost, environmental effects, public health effects, and compliance with regulatory requirements. The second stage of the Phase IV study is the implementation of the selected alternative. Documentation for this stage includes design, construction, and management methods (nonstructural control measures). Long-term monitoring is often performed in association with site remediation to ensure compliance with contaminant standards or achievement of remediation goals.

The RI/FS encompasses several key elements necessary to select an appropriate remedial action. These include:

- Determining federal and state ARARs.
- Developing Data Quality Objectives necessary to be consistent with ARARs and acceptable field and analytical procedures.
- Performing field RIs to examine water, soil, and sediment quality; to collect hydrogeologic and soil information to assess the extent and magnitude of contamination and movement of contamination at a site; and to support the development of potential remedial alternatives. The RI phase of work is described in CERCLA and NCP.
- Performing risk assessments of potential hazards by assessing the impacts on receptors through potential pathways (surface water, dermal contact, groundwater,

biota, or air) as required under CERCLA, NCP, and SARA, and defined in the Risk Assessment Guidance for Superfund (USEPA, 1989).

- Evaluating sites where results of field investigations and risk analyses indicate no significant threat to human health, welfare or to the environment.
- Developing potential alternatives (technologies) to remove contamination or control contaminant migration. The alternatives should provide a range of reduction in the mobility, toxicity, or volume (MTV) associated with contamination, and meet or exceed ARARs.

Initial screening of remedial alternatives is conducted using screening criteria for effectiveness, implementability, and cost. If necessary, field or bench test studies to support the selection of a technology are conducted, and final ARARs are identified. A detailed analysis is then conducted to evaluate alternative technologies in terms of the nine criteria stipulated by the NCP, as follows: overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of MTV through treatment; short-term effectiveness; implementability; cost; state acceptance; and community acceptance. Under the NCP, overall protection of human health and the environment and compliance with ARARs are threshold requirements that each alternative must meet in order to be eligible for selection. There are, in addition, five primary balancing criteria: long-term effectiveness and permanence; reduction of MTV through treatment; short-term effectiveness; implementability; and cost. Finally, two modifying criteria, state and community acceptance, are to be considered in remedy selection. At the completion of the RI/FS, which is the functional equivalent of the selection of a Remedy Process as outlined in the NCP, USEPA guidance, or SARA, a remedial action alternative is selected. A Record of Decision (ROD) for the site documenting the selected alternative can then be prepared using information and recommendations presented in the final RI/FS report.

The RI meets requirements of the NCP since the results identify potential contaminant receptors and delineate the extent and assess the migration of contaminants. The IRP is also consistent with USEPA guidance for conducting RI/FS investigations under SARA.

1.2 History of Past Installation Restoration Program Work at AFP 59

The mission and history of AFP 59, previous investigations, and existing remedial actions are summarized below.

1.2.1 Installation Description

AFP 59 is located in the Village of Johnson City, Broome County, New York, 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 (see Figure 1-3). The plant was designed and built in 1942 by PLANCOR, the (former) Defense Plant Corporation. The original building occupied 621,500 square feet of floor space and has remained essentially unchanged. The total land area of AFP 59 is 29.6 acres (USAF, 1993a).

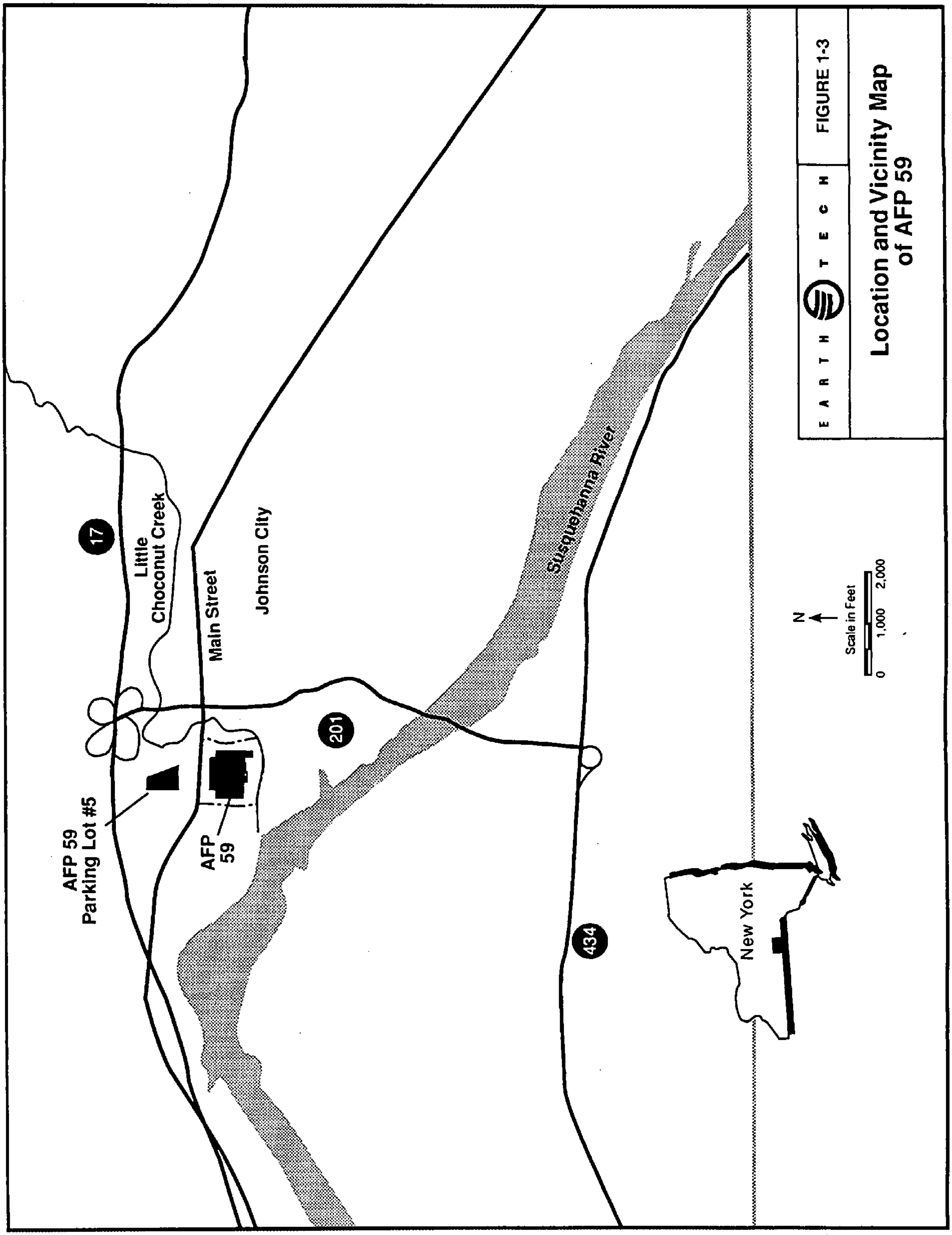


FIGURE 1-3

Location and Vicinity Map of AFP 59

GF/AFP 59/EBS/LOC & VICINITY

AFP 59 is a government-owned, contractor-operated facility. Remington Rand, Inc. was the first manufacturer to occupy the plant. Remington Rand manufactured 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 was reopened as an aircraft controls manufacturing facility. General Electric (GE) Aerospace was contracted to operate the facility and the manufacturing process. The major process at that time was the manufacture of parts for electro-mechanical aircraft control systems. Plant activity peaked in 1967 at the height of the Vietnam War. During the 1970s, technological advances in electronic control systems caused a decreasing demand for electro-mechanical control systems, resulting in a decline in machine shop activity (USAF, 1993a).

In April 1993, Martin Marietta Aircraft Controls acquired GE Aerospace and took over the operation of the facility and the manufacturing activities. Martin Marietta currently manufactures flight control, laser, weapons control, internal navigation, and guidance systems at AFP 59. These systems are used in various military aircraft including the F-18, F-15, F-111, and B-1. Control systems for Boeing 757 and 767 commercial jets also are manufactured at the plant. Currently, manufacturing at AFP 59 operates on a two-shift schedule, employing approximately 1,100 people.

Several improvements have been made to the outdoor facilities at AFP 59 since its original construction. In 1959, the gravel and dirt parking lots surrounding the manufacturing building were paved with asphalt. In the mid 1960s, the State of New York built an earthen containment dike along the banks of Little Choconut Creek south of the facility as part of a flood control project. In 1974, a water supply well was drilled immediately south of the manufacturing building to reduce the plant's demand on municipal water supplies. A water recharge well for noncontact cooling water was also drilled at this time, but was abandoned shortly after installation because of failure of geologic strata. GE discontinued use of a railroad spur into the facility in the early 1950s. The spur was subsequently paved over, and the railroad trestle over Little Choconut Creek was removed in 1980 (USAF, 1993a)..

1.2.2 Previous Investigative Activities and Documentation

The USAF initiated an IRP investigation at AFP 59 in March 1984. Phase I and Phase II studies, as described in Section 1.1.3, have been conducted. Studies of areas of concern have also been conducted in coordination with the NYSDEC to achieve closure of the areas. Additionally, offsite investigations of potential sources of contamination contributing to the municipal water supply contamination have been conducted by the NYSDEC. A summary of the activities completed during these studies is provided below. The results of the studies are summarized in Section 2.2.1.

1.2.2.1 Previous Investigative Activities Onsite. CH2M Hill conducted the IRP Phase I Records Search between March and October 1984. The purpose of the Phase I investigation was to compile all information on hazardous materials use and disposal practices and to identify potential problems associated with those practices. The search included a detailed review of pertinent installation records, contacts with 16 government organizations to obtain other relevant documents, and an installation visit, including interviews with 11 installation employees. The results of this 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 1-4) (CH2M Hill, 1984).

Fred C. Hart Associates, Inc. performed the Phase II, Stage 1 Confirmation/Quantification Study between September 1986 and March 1988. The Phase II, Stage 1 investigation was designed to provide a characterization of the plant site as well as areas of suspected contamination noted during the Phase I investigation. Additionally, the plating operations were identified as a potential source of contamination during the Phase II, Stage 1 investigation. GE personnel identified this area while repairing a leak in the underground sprinkler main beneath the plating building; personnel observed discolored soils and soil contamination was suspected. The Phase II, Stage 1 investigation included drilling and sampling three shallow borings south of the plating room and installing three monitoring wells (see Figure 1-5). Two soil samples were analyzed from each of the shallow borings for EP toxicity metals and total chromium at depths ranging from 0.5 feet to 10 feet; two soil samples from each shallow monitoring well borehole were analyzed for EP toxicity metals and volatile organics at depths ranging from 18 to 26 feet below ground surface (bgs). Additionally, GE employees obtained a soil sample from below the plating building while fixing the underground sprinkler system. Groundwater samples were collected and analyzed from the three shallow monitoring wells and the installation's production well. This preliminary study recommended that additional studies be performed to further evaluate potential sources and delineate the magnitude and extent of contamination at AFP 59 (Hart, 1988).

Argonne National Laboratory (ANL) conducted the IRP Phase II, Stage 2 Confirmation/Quantification Study, a Supplemental Site Inspection (SSI), between July 1991 and June 1993. This study focused on 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 (see Figure 1-6). 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, during two sampling periods. Existing monitoring well SW2 was not sampled due to mechanical problems with the well. A regional background groundwater sample was collected from Johnson City municipal well #7 (ANL, 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 (ANL, 1994).

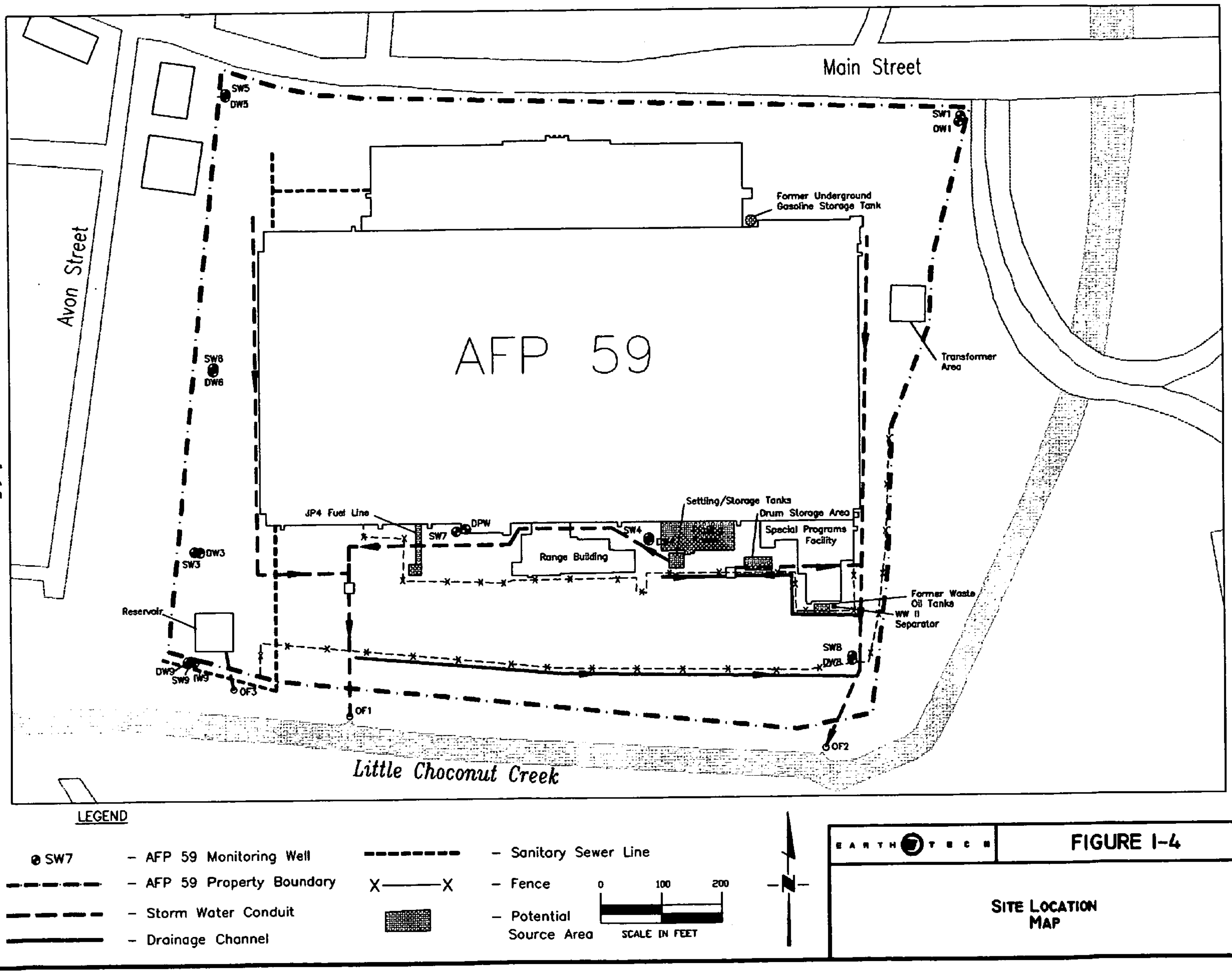


FIGURE I-4

SITE LOCATION MAP

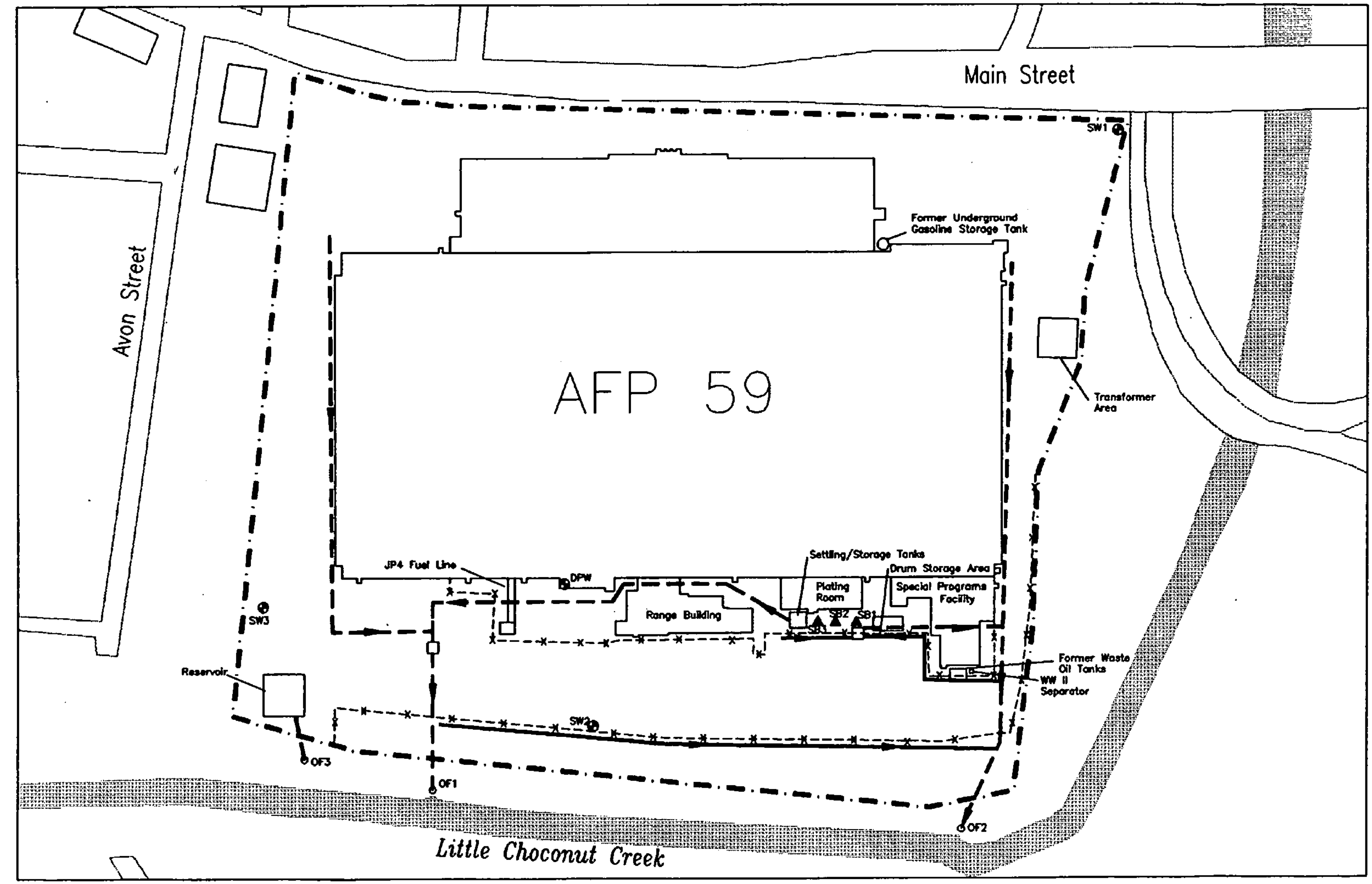
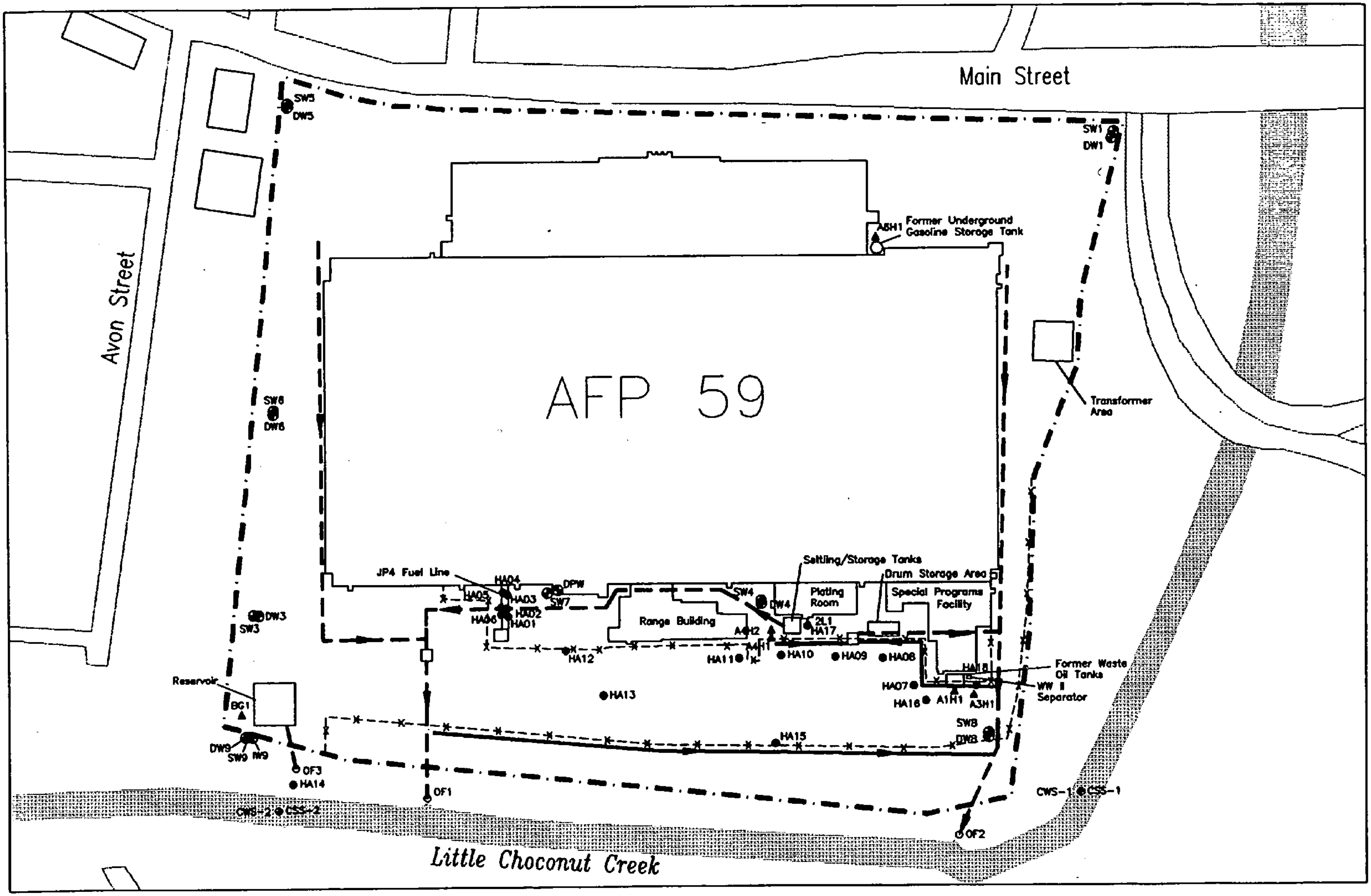


FIGURE I-5

IRP PHASE II, STAGE I SAMPLING LOCATIONS
(HART, SEPTEMBER 1986)



LEGEND

- SW7 – Monitoring Well
- ▲ A1H1 – Soil Boring Sample
- ● HA13 – Hand Auger Sample
- ⊕ CWS–1 – Surface Water and Sediment Sample
- –·–·– – AFP 59 Property Boundary
- X——X – Fence
- — — – Storm Water Conduit
- —— – Drainage Channel

Note: One upgradient, offsite water and sediment sampling point is not shown.

0 100 200
SCALE IN FEET

EARTH TECH

FIGURE I-6

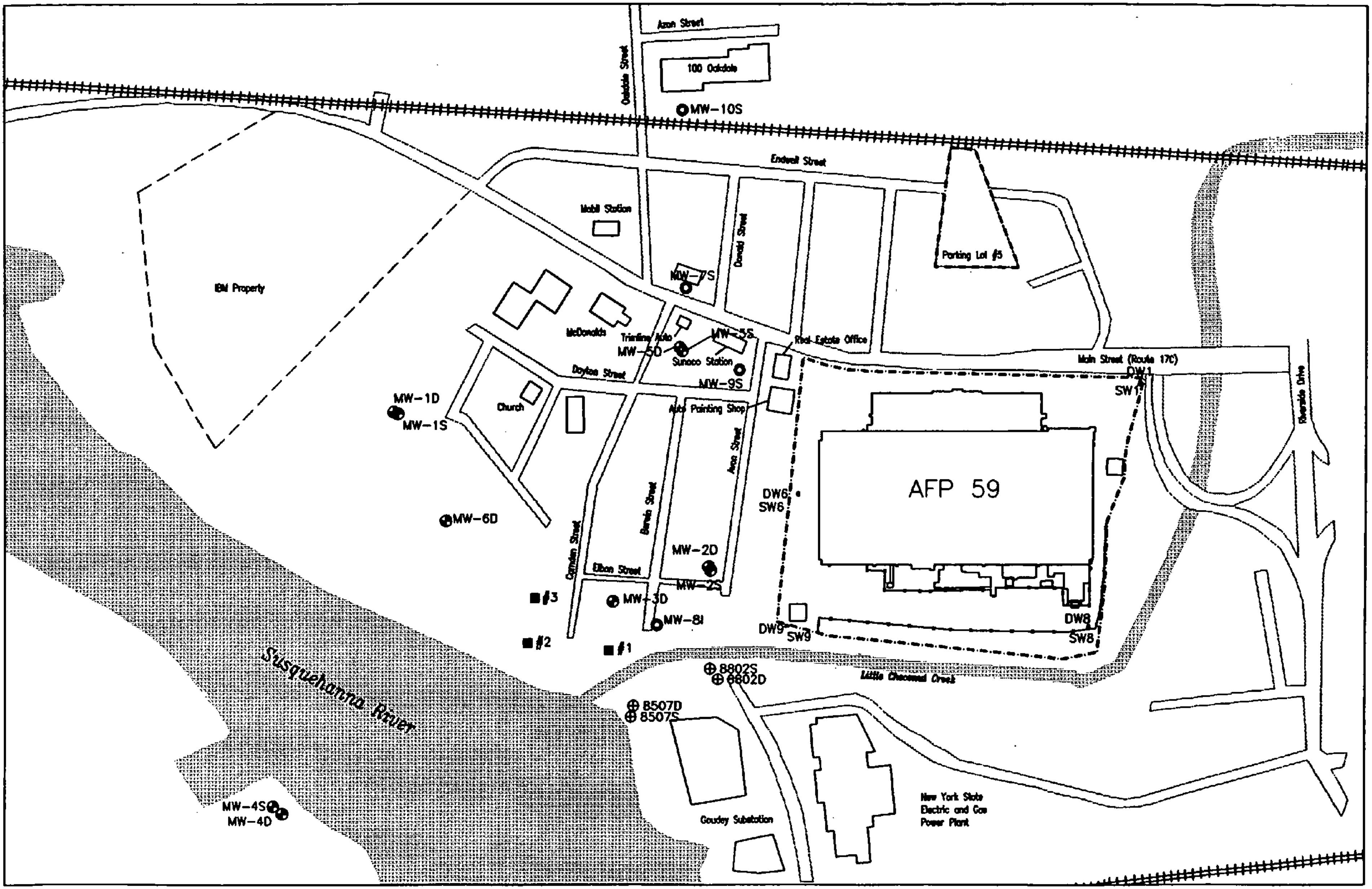
IRP PHASE II, STAGE 2 SAMPLING LOCATIONS
(ARGONNE NATIONAL LABORATORY, 1994)

Separate soil investigations have been conducted at AFP 59 outside of the IRP process. An investigation of the storage tank/settling pond area south of the plating building was completed by Marcor in May 1991 as part of the closure of the plating operations. Marcor collected two composite samples from locations adjacent to the settling tank and the spent plating storage tank. The first location (B1) was approximately 6.4 feet from the settling tank and was drilled at an angle of 30°. A composite sample was collected from a 10-15 foot depth. The second boring (B2) was drilled approximately 7 feet from the spent plating storage tank and was drilled at a 28° angle. A composite sample was collected from three depth ranges: 10-12 feet, 13-15 feet, and 15-17 feet. The samples from both borings were analyzed for heavy metals and volatiles using the Toxicity Characteristic Leachate Procedure (TCLP) and pH (Marcor, 1991).

Four additional investigations, performed by OHM Remediation Services Corporation, were conducted as part of the settling tank/spent plating storage tank closure and plating room closure. The first investigation consisted of subsurface soil sampling from three adjacent transfer pits to the west, south, and east of the metal plating storage tank. The samples were taken from depths of 10 feet, 9.8 feet, and 9.5 feet bgs (OHM, 1992). The second investigation conducted by OHM Remediation Services Corporation (OHM, 1993a) consisted of subsurface soil sampling from locations adjacent to the metal plating room settling and storage tanks. OHM collected 4 soil samples, one sample on each side (east and west) of the settling tank and waste storage tank, located south of the plating building. The second investigation consisted of collection of 22 soil samples inside the plating room in October 1993. Most samples were taken from 6 inches below the concrete floor; at two locations samples were collected from 1 and 2 feet below the concrete. Samples were located along former drain lines (OHM, 1993b). Further soil sampling of three locations inside the plating room at a depth of 6 to 12 inches bgs was completed by OHM (OHM, 1994).

Figure 1-7 shows the sampling locations inside the plating room and adjacent to the settling/storage tanks which are south of the plating room. This figure includes the locations of samples collected by Marcor, OHM Remediation Services Corporation, Argonne National Laboratories, and Fred C. Hart Associates, Inc.

1.2.2.2 Previous Investigative Activities Offsite. URS Consultants, Inc. performed a Contaminant Source Investigation of the Johnson City Camden Street Wellfield for the NYSDEC between September and December 1991 (URS, 1992) and an additional Contaminant Source Investigation between November and December 1992 (URS, 1993). The initial investigation was designed to provide emergency engineering recommendations in order to minimize the impact of chemical contamination at the Johnson City Camden Street Wellfield, and to develop and implement a plan to identify the source of groundwater contamination. The investigation included: 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 Wellfield (see Figure 1-8). The shallow monitoring wells ranged in depth from 30 to 60 feet bgs and the deep monitoring wells ranged in depth from 57.5 to 96 feet bgs. Two rounds of groundwater samples from the ten monitoring wells and Johnson City Municipal Well #2 were collected and analyzed. An aquifer pump test was performed at a constant rate of approximately 2,960 gallons per minute (gpm) with Johnson City Well #2 pumping 2,100 gpm and Johnson



LEGEND

- ⊕ – Monitoring wells installed and sampled for the Contaminant Source Investigation (URS, 1992)
- ○ – Monitoring wells installed and sampled for the Additional Contaminant Source Investigation (URS, 1993)
- ■ – Johnson City water supply wells
- ⊕ – NYSEG montioring wells which were monitored during the Contaminant Source Investigation Aquifer Test (URS, 1992)
- • – AFP 59 monitoring wells which were monitored during the Contaminant Source Investigation Aquifer Test (URS, 1992)
- ▬ ▬ ▬ – AFP 59 Property Boundary
- X——X – Fence

0 250 500

SCALE IN FEET

EARTH TECH

FIGURE I-8

SAMPLE LOCATIONS FOR THE CONTAMINANT SOURCE INVESTIGATION (URS, 1992) AND THE ADDITIONAL CONTAMINANT SOURCE INVESTIGATION (URS, 1993)

City Well #3 pumping 860 gpm. The test continued for 72 hours while water levels were measured in the ten new monitoring wells and the nine monitoring wells at AFP 59. Wells 8802 and 8507 at the Goudey Substation were also monitored. The analytical results of groundwater samples indicated a potential source of volatile organic compound (VOC) contamination north of the wellfield. Additional studies were recommended to further evaluate potential sources and delineate the magnitude and extent of contamination in the vicinity of the Camden Street Wellfield.

The additional investigation of the Camden Street Wellfield 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 wellfield; 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 (see Figure 1-8). The shallow monitoring wells ranged in depth from 34 to 37 feet bgs and the intermediate monitoring well was drilled to a depth of 62 feet bgs. One round of groundwater samples from the four new and ten existing monitoring wells installed during the initial investigation were collected and analyzed. Groundwater level measurements were taken in each of these wells in order to provide data for potentiometric maps of the shallow and deep zones of the aquifer.

In addition to the source investigations, the groundwater quality at the Camden Street Wellfield has been monitored regularly.

1.2.3 Existing Remedial Actions

Several remedial actions have been taken at areas within the AFP 59 boundaries as well as at the Camden Street Wellfield.

1.2.3.1 Onsite Remedial Actions. Several remedial actions have been taken at AFP 59. In the 1970s, the oil/water separator used during World War II was abandoned in place by filling with sand and capping with concrete. The former gasoline underground storage tank (UST) was removed in 1975. The two 1,000-gallon waste oil USTs were removed in 1985 and stained gravel was removed to a depth of 12 feet. In 1990, a concrete transformer pad in the courtyard of the building contaminated with polychlorinated biphenyl (PCB)-containing oil was remediated by jackhammering successive layers of concrete until wipe samples indicated PCB concentrations below the allowable concentration. Use of the plating room was discontinued in 1991, and all equipment was subsequently removed. The plating room was decontaminated in 1992-1993. Use of the storage tank and settling pond adjacent to the plating room has also been discontinued (USAF, 1993a).

1.2.3.2 Offsite Remedial Actions. In June 1992 an air stripper was installed by Johnson City at the Camden Street Wellfield to reduce concentrations of 1,1,1-TCA to below the New York MCL of 5 micrograms per liter (μg/L). The USAF has entered into a MOU with the Village of Johnson City to provide a cooperative effort to maintain the operation of the air stripper. Under the terms of the MOU, the USAF will provide partial financial support for the operation and maintenance (O&M) costs associated with the air stripper. This support is subject to the availability of funds. The MOU is a voluntary undertaking by the USAF and does not constitute any finding by either Johnson City or the State of New York that AFP 59 is the source of 1,1,1-TCA in the wellfield. An investigation of potential sources is being conducted by the USGS.

1.2.4 Site Inventory

Nine sites or areas of concern where past activities at AFP 59 could have resulted in releases to the environment have been identified. The numbering of these sites has varied throughout the IRP process; therefore, the sites discussed below are identified by name, without reference to site numbers.

Underground Waste Oil Storage Tanks. This site is located south of the Special Programs Facility (Room 904). It contained two, interconnected 1,000-gallon USTs that were used to store waste cutting oils on a temporary basis. Prior to 1969, nonchlorinated, kerosene-based degreasers were stored along with the waste oils. The tanks were inspected daily to prevent overtopping. Spills, however, occurred during the removal of oils from the tanks by an outside contractor. The tanks were in operation from 1953 to 1985 when they were removed (USAF, 1993a).

Stained gravel and soil that was found to be contaminated during the tank removal was excavated to a depth of 12 feet (approximately 6 feet below the bottom of the tanks) and removed from AFP 59. A single, double-walled, aboveground tank replaced the USTs. The aboveground tank is no longer used and has been formally closed (USAF, 1993a).

Drum Storage Area. The drum storage area is located south of the manufacturing building, southeast of the former plating building, and west of the Special Programs Facility. 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 most likely stored at the site. In 1963, the top 8 inches of soil was removed from the Drum Storage Area, and the site was paved (USAF, 1993a).

"Southside Z". Southside Z was deleted from the list of IRP sites because of insufficient documentation regarding its location and use (USAF, 1993a).

Little Choconut Creek. Little Choconut Creek is located on the plant's eastern and southern borders. It was placed on the IRP list because three wastewater outfalls enter the creek south of the plant. These outfalls are potential sources of contamination (USAF, 1993a).

Plating Building. The plating building is located south of the manufacturing building and east of the range building. Operations in the plating room produced various wastes containing 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. The acid wastes were pumped to the plating waste storage tank and neutralized for removal by an outside contractor. The cyanide waste was drummed for offsite disposal (CH2M Hill, 1984). Various degreasing activities also occurred in the plating room. The plating room was decommissioned in 1992 and 1993, and is currently undergoing a NYSDEC-coordinated closure (USAF, 1993a).

Storage Tank and Settling Pond. The storage tank and settling pond are located south of the southwestern corner of the plating building. The plating waste storage tank is an 8 foot wide by 14 foot long open-top, in-ground rectangular tank. The walls of the tank are approximately 8 feet high. The tank is constructed of concrete with an inner layer of acid brick and a fiberglass inner liner. The storage tank stored spent plating liquids before removal by an outside disposal contractor. Burnite was also stored in the tank from December 1990 to June 1991. Use of the storage tank was discontinued in June 1991 (USAF, 1993a).

The settling pond is a brick-lined, in-ground, open-topped tank. From 1952 to 1969 plating rinsewater was discharged to the settling tank for metal precipitation and then discharged to Little Choconut Creek via Outfall 001. Between 1969 and 1984, ferrous sulfate was added to plating rinsewaters before entering the settling tank to reduce hexavalent chromium to trivalent chromium and precipitate the metals. The treated rinsewater was discharged to the Creek via Outfall 001. The precipitate was periodically transferred to the adjoining open top, in-ground holding tank, which contained concentrated plating wastes for subsequent removal by a private contractor.

In July 1984, a new plating rinsewater treatment and reuse system was installed. The plating rinsewater passed through the open-top, in-ground settling tank and grease trap, and was treated by anion and cation exchange columns. It was then stored in an underground tank for reuse. The brine generated during this process was placed in the plating waste holding tanks and removed from the site by a contractor. In 1988, the treatment system became contaminated, and the system was abandoned. From 1988 to 1991, plating rinsewater was discharged into the sanitary sewer. Plating operations were discontinued in 1991. The plating equipment has since been removed, and the plating room has been decontaminated. The storage tank and settling pond are currently undergoing a NYSDEC-coordinated closure.

Former Gasoline Storage Tank. The gasoline storage tank was located north of the manufacturing building and east of the office building. The 1,000-gallon UST was removed in 1975. No other information on the history and condition of the site is available (USAF, 1993a).

Piping Area. The piping area is located south of the manufacturing building near the storage building. It is a grass-covered area where JP-4 was piped underground from the storage building to the manufacturing building (USAF, 1993a).

Oil/Water Separator. The oil/water separator was located south of the southeast corner of the manufacturing building, near the Programs Wing. Waste oils and kerosene-based degreasing solvents were discharged to the oil/water separator from 1942 to 1953. Effluent from the separator was discharged to the storm sewer system that emptied into Little Choconut Creek. In the 1970s, the separator was filled with sand and capped with concrete (USAF, 1993a).

1.3 Description of Current Study

The following sections discuss the objectives of the RI and the planning documents prepared to complete the project.

1.3.1 Project Objectives

Project objectives for the AFP 59 RI have been identified and are presented below. The activities planned to meet these objectives are discussed in Section 3.0 of this Work Plan.

- Identify potential onsite sources of soil and/or groundwater contamination.
- Define the nature and extent of onsite groundwater contamination in the shallow and deep zones of the aquifer.
- Define the nature and extent of soil contamination.
- Define background concentrations of both metals and organics in soil, sediment, surface water, and groundwater to determine potential contributions of upgradient sources of contamination.
- Identify migration pathways, including the degree of interconnection between the shallow and deep zones of the aquifer.
- Determine the relationship of any identified contamination at AFP 59 to contamination at municipal wells.
- Refine the conceptual site model, including source identification, contaminant migration, and evaluation of potential receptors.
- Complete a baseline risk assessment.
- Meet the requirements of CERCLA 120(h) to allow transfer of the property.

1.3.2 Scoping Documents

Three planning documents have been prepared for the completion of the RI at AFP 59. The Work Plan describes the project objectives, provides background information, and discusses the tasks to be completed. The Sampling and Analysis Plan (SAP) complements the Work Plan by providing detailed information on field procedures (Field Sampling Plan) and QA/QC procedures for both the field and analytical programs (QA Project Plan). A Health and Safety Plan has also been prepared to ensure completion of the project in accordance with all relevant safety guidelines.

SECTION 2.0

SUMMARY OF EXISTING INFORMATION

Existing information on the environmental setting and contamination at AFP 59 is summarized below. Using this existing information, a conceptual site model was developed. ARARs and data needs are also identified.

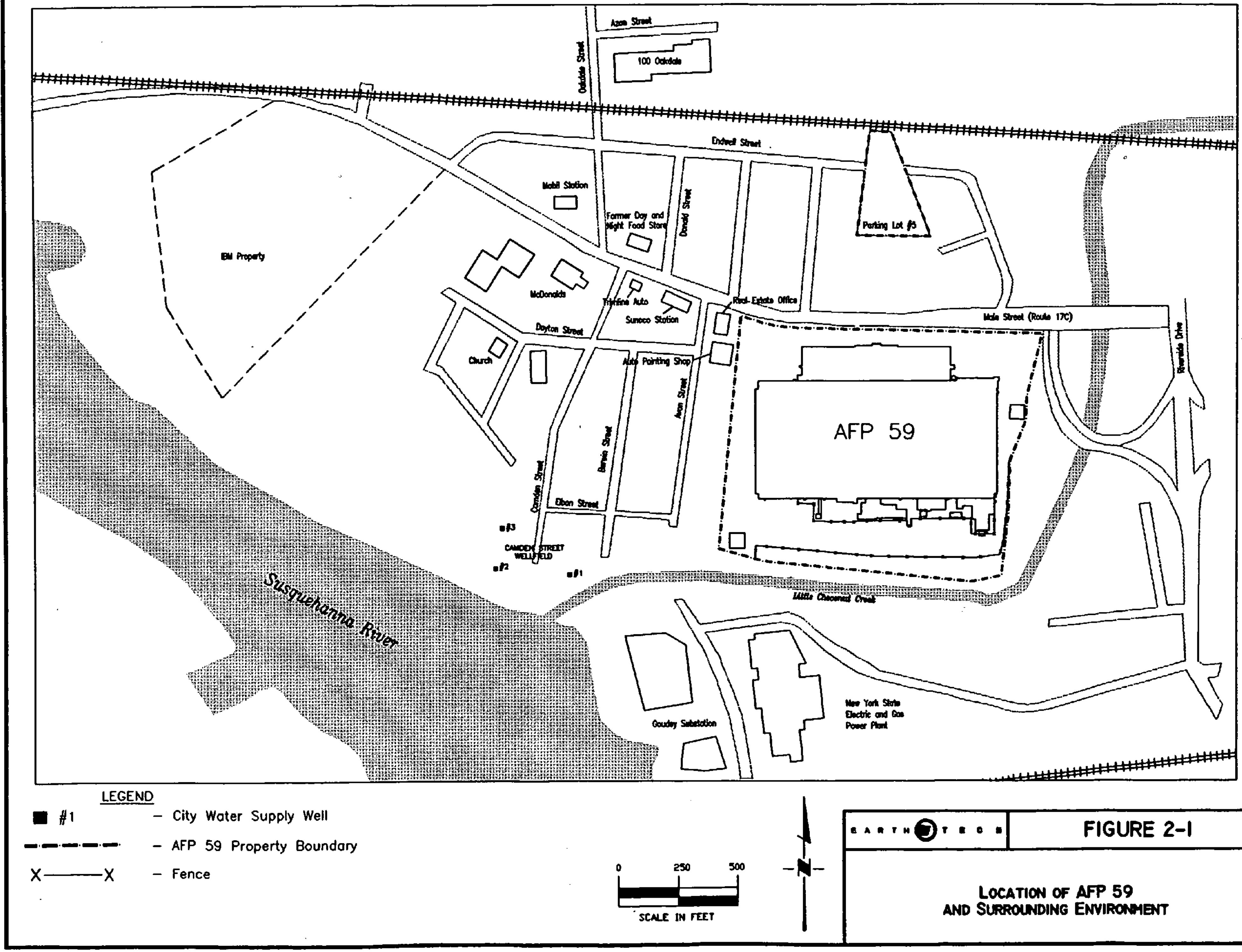
2.1 Installation Environmental Setting

AFP 59 occupies 29.6 acres and is situated in a highly urbanized area (Figure 2-1). It is bordered on the north by Main Street (State Route 17C). North of Main Street is a parking lot which is part of AFP 59 property and is used by plant employees. On the east and south, the plant is bounded by Little Choconut Creek. South of AFP 59, beyond Little Choconut Creek, is a power plant owned by New York State Electric and Gas (NYSEG). Residential areas are located immediately west of the installation and also to the east, beyond Little Choconut Creek. Other nonresidential land around the plant is used for transportation, commercial enterprises, forest land/recreation, and industrial activity. The Camden Street Wellfield, an important source of water for Johnson City, is approximately 1,000 feet southwest of the plant (USAF, 1993a).

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 fairly flat and ranges in elevation from 830 to 840 feet above mean sea level (MSL) (USAF, 1993a).

Most of AFP 59 is covered by asphalt and buildings. No natural plant or animal communities are present on the site; however, small stands of second growth hardwood forests are located adjacent to the property (USAF, 1993a).

The Clinton Street-Ballpark Aquifer is a productive, regional aquifer in the vicinity of Johnson City. In 1985, it was designated a sole-source aquifer by the USEPA under the Safe Drinking Water Act (FR 2026, 14 J 85). This classification was made because the aquifer is the principal source of drinking water for the residents of Broome and Tioga Counties, who then numbered 128,000 (USAF, 1993a).



EARTH TECH

FIGURE 2-1

LOCATION OF AFP 59 AND SURROUNDING ENVIRONMENT

2.2 Site-Specific Environmental Setting

Due to the small size of AFP 59 and the limited number of sites, the entire facility will be considered a single zone during the RI.

2.2.1 Contaminant Sources and Contamination

Potential sources of contamination both onsite and offsite are described below. Existing information concerning the nature and extent of contamination is also provided.

2.2.1.1 Onsite Contaminant Sources and Contamination

Contaminant Sources. The manufacture of aircraft-associated parts at AFP 59 has generated a variety of wastes, including waste oils from lubricating machining processes and coolants; spent solvents from degreasing and general cleaning; paint residues; and spent process chemicals including plating acids, caustics, and chromium and cyanide solutions. These latter process chemicals result from various metal preparation and treatment operations conducted at AFP 59. The quantity of these wastes generated in the past varied proportionally to the level of manufacturing activity at the plant. In 1984, the total quantity of these wastes generated was estimated to be 50,000 gallons per year (CH2M Hill, 1984). The quantities of wastes generated have varied over time. In 1980, AFP 59 became a less than 90 day storage facility. Table 2-1 summarizes the major industrial operations that have occurred at AFP 59. Waste disposal practices as identified in the Records Search (CH2M Hill, 1984) are summarized below.

Waste Oil. Bulk metal chips/waste oil slurry from parts machining processes have been extensively recovered since the opening of AFP 59. The slurry was placed in large bins located in Building 4, the Special Programs Facility. The oil was drained and emptied into an oil regeneration system. The de-oiled chips were then placed in large hoppers and transported offsite. Any oil draining from the hoppers flowed to a floor drain which discharged to an oil/water separator outside the building and then to the storm water system that emptied into Little Choconut Creek. From 1953 to 1985, waste oils were collected from the various machining areas of the plant and then pumped into two interconnected 1,000-gallon underground waste oil storage tanks and removed by a private contractor. Spills reportedly occurred when the waste oils were removed for disposal. From 1985 to 1992, waste oils were collected in a single aboveground storage tank and removed by a contractor.

Solvents. Kerosene-based degreasing solvents were used prior to 1969 and were disposed of with the waste oil in the USTs from 1953 to 1969. Halogenated solvents such as trichloroethene (TCE), 1,1,1-TCA, and freon were introduced in 1969. These waste solvents were drummed and recycled at the onsite recycling still. Unrecoverable solvents and bottoms sludge were drummed and transported offsite by a private contractor. TCE, however, could not be regenerated sufficiently to meet specifications. Other solvents used for degreasing in the assembly areas include acetone and methyl ethyl ketone (MEK).

TABLE 2-1
SUMMARY OF MAJOR INDUSTRIAL OPERATIONS

Shop Name	Location (Room No.)	Waste Material	Estimated Waste Quantity (1984) (gal/yr)	Treatment/Storage/Disposal Methods					
				1940s	1950s	1960s	1970s	1980s	1990s
Aluminum Dip Brazing	822	Solidified Caustic Sludge	70			|—	—	D —	—|
Plating Operations	926	Spent Plating Baths/Nitric Acid/Chromic Acid/Muriatic Acid	25,000	I |—| |—	—	I —	—	—	—|
		Spent Cyanide Baths	1,350	D |—| |—	—	D —	—	—	—|
Waste Treatment	South of Main Building	Metal Bearing Sludge	500	A |—| |—	—	A —	—	—	—|
Painting	812	Paint Sludge	1,500	|—	—	D —	—	—	—|
		Varnish	100	|—	—	D —	—	—	—|
		Paint Filters	Varies				|—	T —	—|
Assembly Degreasing	926 and Various	Savasol	5,000	O O |—| |—	—|—	U —|			
		Trichloroethene 1,1,1-Trichloroethane Freon Still Bottoms	5,000			|—	—	D —	—|
Small Parts Degreasing	Various	Acetone Methyl Alcohol Methyl Ethyl Ketone Solvent Soaked Rags	400		|—	T,D —	—|—	D —	—|

0461TBL.2-1

TABLE 2-1
SUMMARY OF MAJOR INDUSTRIAL OPERATIONS

Continued

Shop Name	Location (Room No.)	Waste Material	Estimated Waste Quantity (1984) (gal/yr)	Treatment/Storage/Disposal Methods					
				1940s	1950s	1960s	1970s	1980s	1990s
Machining	Various	Cutting Oils, Coolant	12,000	O	O	U	—	—	A
Aluminum Black Oxide	926	$NaNO_3$ Concentrate	750			—	D	—	—
Laboratory Activities	Various	Copper Sulfate	300			—	A	—	—
		Trichloroethene 1,1,1-Trichloroethane Acetone Methyl Ethyl Ketone Methyl Alcohol	300	—	—	D	—	—	—

Legend: D: Drummed; transported offsite by contractor.
A: Stored in aboveground storage tank; removed offsite by contractor.
O: Run through oil reclamation system.
U: Stored in underground storage tank; removed offsite by contractor.
T: Disposed of in solid waste dumpster; removed offsite by contractor.
R: Recycled onsite. Unrecoverable solvents and bottoms sludge drummed; transported offsite by Contractor.
I: Stored in an open top in ground holding tank for neutralization or disposal.

Source: CH2M Hill, 1984.

0461TBL.2-1

Paint Residues. Paint residues included waste paints, paint thinners, strippers, solvents, varnishes, and paint sludges collected during periodic cleaning of paint booths. The paint shop switched from a waterwash process to a dry filter process in 1974 thus creating wastes from the dry filters. These used filters were disposed of with other general solid wastes and removed offsite. Waste paints, thinners, strippers, and paint sludge were generally drummed in 55-gallon drums and removed by a private contractor (CH2M Hill, 1984).

Process Chemicals. Concentrated acid baths used in the plating processes were discharged to an open-top, in-ground holding tank where they were neutralized. These wastes were then transported offsite by a contractor. Plating rinsewater containing process chemicals, including chromium and other metals, was discharged to a settling tank. The method of rinsewater treatment has changed throughout the history of the facility. All other process wastes, including spent cyanide baths, were drummed and then transported offsite by various contractors.

From 1952 to 1969 plating rinsewater was discharged to the settling tank for metal precipitation and then discharged to Little Choconut Creek via Outfall 001. Between 1969 and 1984, ferrous sulfate was added to plating rinsewaters before entering the settling tank to reduce hexavalent chromium to trivalent chromium and precipitate the metals. The treated rinsewater was discharged to the creek via Outfall 001. The precipitate was periodically transferred to the adjoining open-top, in-ground holding tank, which contained concentrated plating wastes for subsequent removal by a private contractor.

A new plating rinsewater treatment and reuse system was installed in 1984. After passing through the open-top, in-ground settling tank and grease trap, the plating rinsewater was treated by anion and cation exchange columns and stored in an underground tank for reuse. The brine generated during this process was placed in the plating waste holding tanks and removed from the site by a contractor. In 1988, the treatment system became contaminated, and the system was abandoned. From 1988 to 1991, plating rinsewater was discharged into the sanitary sewer. Plating operations were discontinued in 1991. The plating equipment has since been removed, and the plating room has been decontaminated.

Miscellaneous Waste. Originally, solid waste was burned in an onsite incinerator and a contractor transported the ash offsite. The use of the incinerator was discontinued in 1968, and all solid wastes were removed offsite in an unburned form. Solid waste is removed to the Broome County Landfill.

Untreated, domestic wastewater from AFP 59 is discharged to the Binghamton/Johnson City Joint Sewage Treatment System. These wastewaters originate primarily from washrooms and the cafeteria, although one floor drain connects to the system. AFP 59 has been identified as a "nonsignificant user" and is not required to pretreat this wastewater stream.

The installation also has three direct discharge outfalls permitted under the New York State Pollution Discharge Elimination System (SPDES Permit No. NY0004073). The outfalls, located south of the plant building, discharge to Little Choconut Creek approximately 1,000 feet upstream of the confluence of the creek and the Susquehanna River. They have historically discharged plating rinsewater, non-contact cooling water, and stormwater. Prior to 1984, treated plating rinsewaters from the settling tank were discharged to Outfall 001. After installation of the anion and cation exchange columns in 1984, the rinsewater was reused, and no rinsewater was discharged to Little Choconut Creek. Stormwater from the area west of the plant is also discharged to Outfall 001. Stormwater runoff from the area south of the building is discharged to Outfall 002 after first passing through an oil/water separator to remove oil and grease. Non-contact cooling water is discharged via Outfall 003. The non-contact cooling water is drawn from the onsite production well and is cycled through a cooling tower prior to discharge. These outfalls are monitored routinely for the parameters required by the permit.

Contamination. The results of the most recent IRP investigations concerning the nature and extent of contamination at AFP 59 are summarized below. Investigations conducted outside the IRP process are also summarized below and include the soil investigations of the plating room and the storage/settling tanks south of the plating room.

Phase II, Stage 1 Investigation (Hart, 1988). The Phase II, Stage 1 sampling activities are described in Section 1.2.2.1, and the sampling locations are shown in Figure 1-5. 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 onsite production well: 1,1-dichloroethane (1,1-DCA) (16 μg/L), trans-1,2-dichloroethene (1,2-DCE) (66 μg/L), 1,1,1-TCA (9 μg/L), and TCE (11 μg/L). These chlorinated organic compounds had been previously detected in the production well when sampled in 1985. TCE was also detected in the groundwater sample from SW3 (southwestern portion of AFP 59) at a concentration of 6 μg/L. No VOCs were detected in the groundwater at SW1 or SW2. TPH was detected only in the groundwater sample from the onsite 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 at SW1. SW1 is located in the northeast corner of the plant in an area expected to be hydraulically upgradient of the site. Arsenic and barium were detected in three of the groundwater samples at low concentrations ranging from 0.01 to 0.02 mg/L and 0.05 to 0.21 mg/L, respectively. Cadmium was detected in two of the groundwater samples at 0.007 and 0.01 mg/L. Cyanide was not detected in any of the groundwater samples.

All soil samples were analyzed for EP toxicity metals. Soil samples from the soil borings and plating room were also analyzed for total chromium. Soil samples from the monitoring well borings were analyzed for VOCs and TPH in addition to metals. Total chromium was detected at concentrations ranging from 5.43 milligrams per kilogram (mg/kg) to 67.4 mg/kg in all samples analyzed for chromium. In general, barium and cadmium were found at higher concentrations in the deeper soil samples from monitoring well borings (maximum concentrations of 0.52 and 0.06 mg/L, respectively) than in the shallow soil borings south of the plating building (maximum concentrations of 0.19 and ND, respectively). Lead was detected in 14 of 15 soil samples; the highest concentrations of lead were detected at the SW1 background sample from 20 to 22 feet bgs (0.78 mg/L) and in the plating room sample (0.31 mg/L). TPH was detected in only one sample (SW1 at a depth of 24 to 26 feet bgs) at a concentration of 11.4 mg/kg.

Supplemental Site Inspection (ANL, 1994). The SSI sampling activities are described in Section 1.2.2.1, and the sampling locations are shown in Figure 1-6. During the SSI, all groundwater, creek surface water, and outfall water samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides/PCBs, and inorganics. The three major VOCs or groups of compounds detected in water samples were methylene chloride, acetone, and chlorinated compounds. Methylene chloride and acetone are both common laboratory contaminants, although acetone has been used at the facility. Methylene chloride concentrations ranged from 3 to 4 μg/L. Acetone was detected in one sample in the northwestern corner of the plant (well cluster 5) at 35 μg/L. Chlorinated compounds with elevated concentrations included: 1,1-DCA (5 μg/L); 1,1,1-TCA (15.2 μg/L); and TCE (97 μg/L). The highest concentrations of these compounds were detected at wells SW3, SW4, and SW9, respectively. These wells are all located in 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 (63 μg/L), DW5 (59 μg/L), and SW6 (30 μg/L)) and near the plating building (SW4, 38 μg/L). Lead and chromium were detected in most of the groundwater samples.

Soil samples from the soil borings and monitoring well borings were analyzed for VOCs, SVOCs, pesticides/PCBs, and inorganics. The three major VOCs or groups of compounds detected in the soil were methylene chloride, acetone, and chlorinated compounds. Methylene chloride and acetone are common laboratory contaminants and were detected at concentrations ranging from 3 micrograms per kilogram (μg/kg) to 37 μg/kg and 8 μg/kg to 12 μg/kg, respectively. TCE and 1,1,1-TCA were detected at SW9 in concentrations of 14 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 bgs at SW4.

Results from the well boring and soil boring soil samples showed the highest concentrations of inorganics at shallow depths. The highest concentrations of antimony (1.6 mg/kg), arsenic (10.2 mg/kg), barium (109 mg/kg), cadmium (7.5 mg/kg), chromium (428 mg/kg), copper (85.9 mg/kg), lead (572 mg/kg), nickel (124 mg/kg), selenium (0.40 mg/kg), and zinc (109 mg/kg) were detected in soil sample 2L1AS, which was taken from beneath the porch of the plating building. Soil sample locations 4H1AS (13-15.6 feet bgs), 4H2AS (13-16.5 feet bgs), and SW8 (7-9 feet bgs and 14-16 feet bgs) also showed elevated levels of one or more of the following metals: barium (92.9 mg/kg), chromium (91.3 mg/kg), cobalt (12.9 mg/kg), copper (45.7 mg/kg), nickel (45.6 mg/kg), and lead (15.8 mg/kg). Cyanide was detected in three soil samples located near the plating building: SW4 (3.2 mg/kg) from 6 to 8 feet bgs; SW4 (7.9 mg/kg) from 15.2 to 17.2 feet bgs; and 1H1CS (2.6 mg/kg) from 12 to 14 feet bgs.

Many SVOCs were detected in the soil samples. Analytes detected in one or more samples are listed in Table 2-2. The samples with the most SVOCs were found at depths ranging from 8 to

TABLE 2-2
SVOCs DETECTED IN SOIL AND SEDIMENT SAMPLES AT AFP 59

Contaminant	Maximum Concentration at Each Location in $\mu g/kg$															
	DW1	DW3	SW4	SW5	SW6	SW7	SW8	SW9	CSS-1[1]	CSS-2[1]	1H1CS[2]	2L1AS[2]	3H1AS[2]	4H1AS[2]	4H2AS[2]	6H1AS[2]
Phenol											250					
2-Chlorophenol					110											
4-Methylphenol											210					
2,4-Dimethylphenol											100					
Naphthalene					240		1300			270	4100		4200			35
4-Chloro-3-Methylphenol					100											
2-Methylnaphthalene					92		550			110	1400		1300			
Acenaphthylene							280				88					
Acenaphthene					1100		230			380	1900					120
Dibenzofuran					390		510			230	2100					43
Fluorene					740		750			430	2900					120
Phenanthrene	160	390			6000	33	2700			2300	9800	55	990			1000
Anthracene	17	60			1600		520			520	2800	12				250
Di-n-Butylphthalate	260		140	200	410	160		120	270	300						
Fluoranthene	140	980			9800	100	2000	140	150	2200	9900	180				2000
Pyrene	110	1100			9100	84	1800			1800	7900	140	67			1900
Benzo(a)anthracene		530			5300		850				4200	120				1000
bis(2-ethylhexyl) phthalate				530	11000	540	150		210		600		770		91	74
Chrysene		520			4900		780			790	3500	120				1000
Benzo(b)fluoranthene		550			5200		850			830	4900	150	89			1300
Benzo(k)fluoranthene		180			1900		220			330	1400	48	92			600
Benzo(a)pyrene		340			3700		580			610	3500	89	75			830
Indeno(1,2,3-cd)pyrene		140			1600		280			190	190	67	62			
Dibenz(a,h)anthracene					440						400					140
Benzo(g,h,i)perylene					1500		140			190	1700	89	64			470

Note: Data are from the Supplemental Site Inspection for AFP 59 (ANL, 1994).

[1] Creek sediment sample. See Figure 1-6 for sample locations.

[2] Soil borehole sample. See Figure 1-6 for sample locations.

16 feet bgs. Monitoring well boring 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 (7.6 - 9.2 μg/kg), 4,4'-DDE (6 μg/kg), heptachlor epoxide (62 - 84 μg/kg), gamma chlordane (24 μg/kg), endosulfan II (84 μg/kg), and aroclor-1260 (130 μg/kg). These compounds were detected across the site at low concentrations and appear unrelated to past activities.

Hand auger soil samples were analyzed using field screening techniques for organics and metals. Hand auger samples with the highest concentrations of metals were generally collected at depths of 0 to 3 feet bgs. Samples HA13 and HA18 had the highest concentrations of the following metals: cadmium (82.3 mg/kg), copper (4,722 mg/kg), lead (201 mg/kg), nickel (49.7 mg/kg), selenium (8.7 mg/kg), zinc (1,522 mg/kg), and arsenic (374 mg/kg). The maximum chromium concentration of 446 mg/kg was detected at HA10, which is located directly south of the plating building. Unidentified VOCs were also detected during the field screening at locations HA7, near the former waste oil storage tank, and at HA13, in the south-central portion of AFP 59. SVOCs were detected at HA11, in the parking lot ditch near the range building, and at HA17, beneath the porch of the plating building. These SVOCs included anthracene/phenanthrene, fluoranthene, and pyrene.

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. Table 2-2 provides a list of semivolatiles detected in the creek sediment samples. Aldrin was detected in the sediment samples upstream and downstream of the plant at concentrations of 8.8 and 18 μg/kg, respectively. Copper (16.3 - 20.5 mg/kg) and vanadium (13.4 - 14.1 mg/kg) were detected at slightly elevated concentrations in the sediment. 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 (317 μg/L), calcium (35,400 μg/L), iron (362 μg/L), magnesium (6,590 μg/L), manganese (83 μg/L), potassium (1,950 μg/L), and sodium (23,400 μg/L)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 with maximum concentrations of 1,000 μg/L, 1,970 μg/L, and 408 μg/L, respectively. No VOCs, SVOCs, and pesticides/PCBs were detected in background surface water samples. The regional background surface water sample exceeded regulatory limits for iron (362 μg/L), aluminum (317 μg/L), and zinc (418 μg/L); however, the local background surface water sample only exceeded the limits for aluminum (122 μg/L). 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 (ANL, 1994).

Settling Tank/Spent Plating Storage Tank Soil Study (Marcor, July 1991). Results from the two soil borings adjacent to the settling tank and spent plating storage tank (see Figure 1-7) indicated the presence of some metals and tetrachloroethene; however, levels were below the TCLP regulatory level. Results from soil boring sample B1 (adjacent to the settling tank) indicated barium at 0.328 parts per million (ppm) with the regulatory TCLP level equal to 100.0 ppm. Tetrachloroethene was detected at 0.05 ppm with the regulatory TCLP level equal to 0.70 ppm. Results from soil boring sample B2 (adjacent to the storage tank) indicated barium, cadmium, and chromium at concentrations of 0.304 ppm, 0.037 ppm, and 0.034 ppm, respectively. These levels are all below their respective TCLP regulatory levels. Tetrachloroethene was detected at 0.02 ppm, well below the TCLP regulatory limit.

Plating Room Soil Investigation (OHM Remediation Services Corp., 1992, 1993a,b, 1994). The first of the four investigations conducted by OHM Remediation Services Corp. (OHM, 1992), included collection of three soil samples from locations adjacent to the west, south, and east of the spent plating storage tank and analyses for TCLP pesticides and herbicides, total metals, TCLP metals, TCLP base/neutral/acids, VOCs, and TCLP volatiles. 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) associated with the closure of the plating room included 22 soil samples from the inside of the plating room. Soil samples were analyzed for metals, VOCs, SVOCs, TCLP metals, and/or TCLP VOCs. Results from the soil investigation of the plating room indicate the presence of several metals as well as TCE (0.071 mg/kg) and acetone (1.54 mg/kg). The results of analyses were reported on an as received "wet weight" basis. The percent moisture in each sample was unknown; thus sample results could not be compared on an equal basis for all samples. Several of the samples had high pH values, ranging from 8.76 to 11.4.

The metals analyses of the soil samples indicated the presence of chromium, lead, nickel, and zinc, with the highest levels found near points 006 and 007 (see Figure 1-7). These points are located on the east side of the middle section of the plating building. Chromium was detected at 410 mg/kg at 006 and at 305 mg/kg at 007. At locations 006, 007, and 009 lead was detected at concentrations of 2,350 mg/kg, 15.1 mg/kg, and 12.2 mg/kg, respectively. The highest concentration of nickel was also detected at point 006 (295 mg/kg). Zinc was detected in all samples with the highest concentration of 72.3 mg/kg at 007. Other metals detected were cadmium (84.3 mg/kg), copper (137 mg/kg), mercury (0.071 mg/kg), and vanadium (5.95

mg/kg). The only metal to exceed the Federal TCLP regulatory standards was cadmium, which was detected at 1.19 mg/L at sampling location 007. The Federal standard for cadmium is 1.0 mg/L.

Results from the VOC analyses indicate the presence of acetone and TCE, possibly from previous degreasing operations in the plating room. Acetone was found in every sample ranging from 0.023 mg/kg to 1.54 mg/kg. The highest levels of acetone were found in the center section of the plating building, with the highest concentration at 004 equal to 1.54 mg/kg. Acetone is also a common laboratory contaminant. TCE was found above the detection limit in seven soil samples ranging in concentration from 0.005 mg/kg to 0.071 mg/kg.

In the third investigation performed by OHM Remediation Services Corp. (OHM, 1993a), four soil samples were collected adjacent to the settling/storage tanks south of the plating building and analyzed for metals and VOCs. Results indicated acetone, methylene chloride, and TCE, 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). The highest metals concentrations were located on the east side of the settling tank.

In addition to the 22 soil samples collected in the plating room in 1993, OHM Remediation Services Corp. collected and analyzed three soil samples to the east, west, and north of point 007 (see Figure 1-7) (OHM, 1994). The soil samples were collected from 6 to 12 inches below ground surface and analyzed for total pesticides and PCBs, TCLP metals, base/neutral/acids, and VOCs. Results indicated the presence of acetone (0.119 - 0.173 mg/kg), methylene chloride (0.008 mg/kg), and/or trichloroethene (0.006 - 0.019 mg/kg) in all three soil samples; all detections, however, were below NYSDEC cleanup levels. Barium, cadmium, and chromium were also detected in the three soil samples, with maximum concentrations of 0.684, 0.015, and 1.30 mg/L, respectively. These metals concentrations were all below TCLP limits.

2.2.1.2 Offsite Contaminant Sources and Contamination

Contaminant Sources. As part of the Contaminant Source Investigation, URS Consultants, Inc. (URS, 1992) conducted a review of NYSDEC files to identify potential sources of contamination in the vicinity of the Johnson City Camden Street Wellfield. The following is a summary of the investigation findings. 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 Wellfield; Robintech Site, located on Commerce Road in the Village of Vestal; and Monarch Chemical, located on Prentiss Road in the Village 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, 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 Wellfield: 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 (see Figure 2-2). Information regarding materials that were disposed of at these sites was not obtained at the time of the review (URS, 1992).

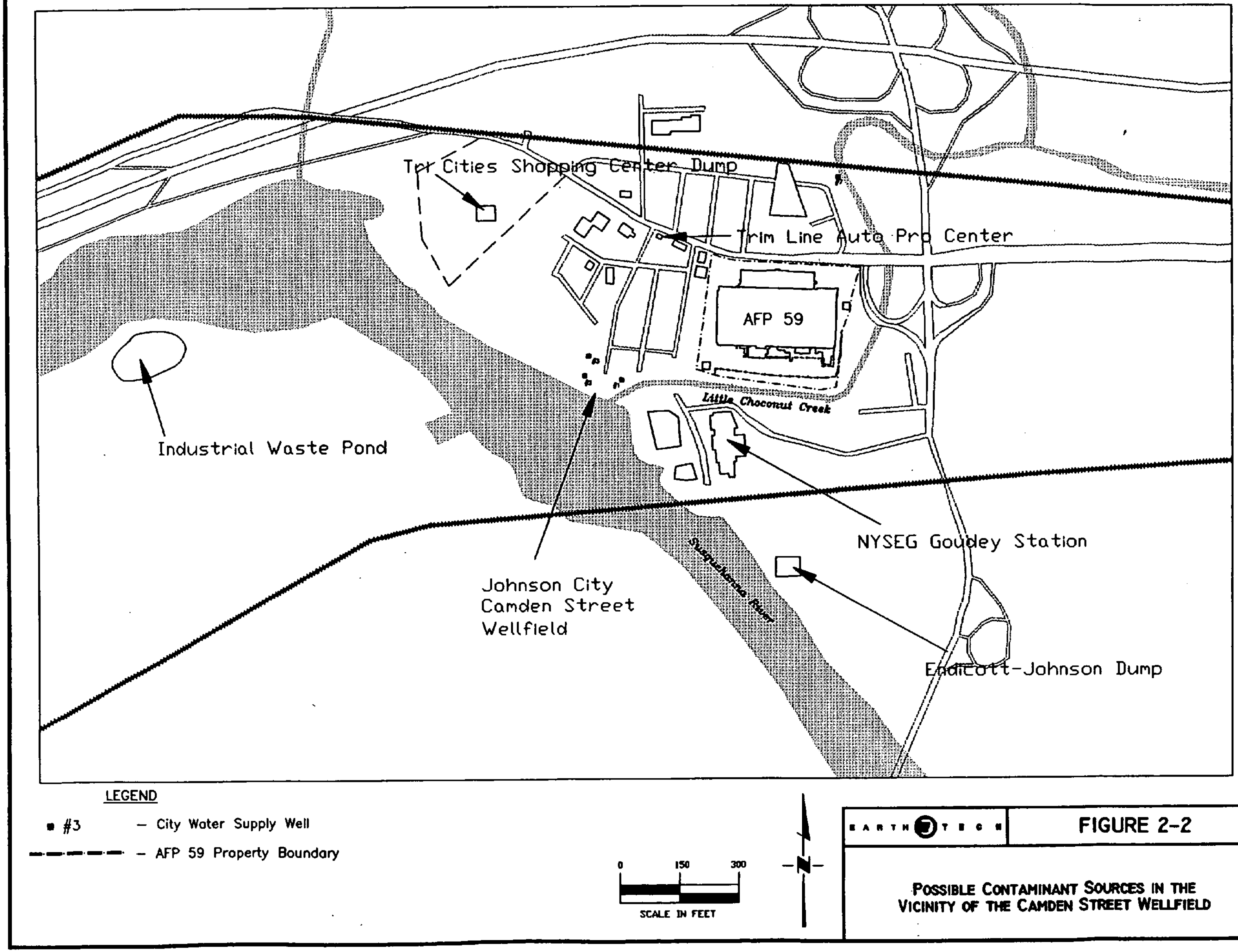
The files also include several SPDES-permitted discharges in the vicinity of the Camden Street Wellfield: IBM, located approximately 1,500 feet to the northwest; NYSEG Goudey Substation, located approximately 1,500 feet to the southeast; and Champion Oil, located 2,500 feet to the northeast (see Figure 2-2). Information regarding discharge or chemistry was not obtained at the time of the review (URS, 1992).

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 Wellfield. The waste pond was situated near a gravel-mining operation. Information regarding the contents of the waste pond or operation practices was not available at the time of the review (URS, 1992).

Contamination. The results of the two investigations conducted by the NYSDEC concerning potential contaminant sources in the vicinity of the Johnson City Camden Street Wellfield are summarized below. The sampling history and analytical results for the Johnson City Municipal Wells at the Camden Street Wellfield are also provided.

Contaminant Source Investigation (URS, 1992). Sampling activities during the contaminant source investigation are described in Section 1.2.2.2, and the sampling locations are shown in Figure 1-8. Groundwater samples from the ten monitoring wells installed during the investigation were analyzed for purgeable organic compounds (USEPA 524.2), freon, acetone, MEK, 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. Groundwater samples from the following wells contained 1,1,1-TCA in October 1991: MW-5D (8.1 μg/L) and MW-5S (11.0 μg/L). Groundwater samples from the following monitoring wells contained 1,1,1-TCA in December 1991: MW-3D (7.1 μg/L), MW-5D (12.0 μg/L), and MW-5S (13.0 μg/L). Benzene was detected in MW-1D (0.1 μg/L), MW-2D (0.7 μg/L), MW-3D (1.3 μg/L), and MW-5D (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



EARTH TECH

FIGURE 2-2

POSSIBLE CONTAMINANT SOURCES IN THE VICINITY OF THE CAMDEN STREET WELLFIELD do not show any trends or patterns except for an increase in chromium concentrations in the shallow wells. Magnesium, iron, and sodium concentrations fluctuate over the study area.

Additional Contaminant Source Investigation (URS, 1993). Sampling activities during the Additional Contaminant Source Investigation are described in Section 1.2.2.2, and the sampling locations are shown in Figure 1-8. Fifty-eight geoprobe water table samples from eight sites were analyzed in the field for VOCs. The results of the sampling indicated two potential source areas: the former Day and Night Food Store and 100 Oakdale Avenue (see Figure 2-1). Two water table 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 (USEPA 524.2), TAL metals, and cyanide during the December 1992 groundwater sampling event. One or more VOCs were detected in each of the monitoring wells sampled with the exception of MW-4D. 1,1,1-TCA was detected in eight wells and ranged from 2.4 μg/L (MW-2S) to 28 μg/L (MW-10S). TCE was detected in eight wells ranging from 0.2 μg/L (MW-10S) to 3.1 μg/L (MW-2D). Acetone was detected in nine wells ranging from 1.2 μg/L (MW-3D) to 9.2 μg/L (MW-1S). However, acetone was also detected in six of the eight method blank samples. 1,1-DCA was detected in seven samples ranging from 0.2 μg/L (MW-5S) to 2 μg/L (MW-10S). The highest concentrations of 1,1,1-TCA and 1,1-DCA were found north of the wellfield. Cis-1,2-DCE was detected in four samples ranging from 0.9 μg/L (MW-8I) to 49 μg/L (MW-2D) (estimated concentration exceeds the linear range of calibration). The highest concentration of cis-1,2-DCE was detected in the southern portion of the wellfield. The only contaminants that exceeded the New York Standards Criteria and Guidance were 1,1,1-TCA and cis-1,2-DCE.

TAL metals were detected in excess of SCG values in all 14 monitoring wells during this investigation. Chromium ranged from 9.6 μg/L (MW-4D) to 2,200 μg/L (MW-1S), manganese ranged from 20.4 μg/L (MW-5D) to 59,900 μg/L (MW-10S), and lead ranged from 3.1 μg/L (MW-3D) to 606 μg/L (MW-9S). Other metals that were found to exceed SCG values 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 Wellfield. The Trim Line Auto Pro Center was a suspected potential source of contamination because above standard concentrations of organic compounds were found 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.

History of Contamination at Johnson City Municipal Wells. The Johnson City Municipal Wells have a history of 1,1,1-TCA contamination and have been routinely tested for this contaminant since at least 1990. Table 2-3 summarizes the history of the municipal wells, including contamination results which led to the closing or inoperative status of Johnson City Municipal Wells #2 and #3. Wells #1, #2, and #3 were installed at the foot of Camden Street in 1931. Wells #4 and #6 on Olive Street, Well #5 on Endwell Street, and Well #7 on North Broad Street are all northeast of the Camden Street Wellfield. Wells #1 and #4 are currently inoperative due to mechanical problems. In January 1985 the USEPA designated the Clinton Street-Ballpark aquifer as a sole-source aquifer for the Johnson City area. At that time, the main water supply came from Wells #2, #3, and #6. Well #3 was operated as the main well, supplemented by Well #6. Well #2 was a backup well which could be converted to operate by natural gas in the event of a power outage. In September 1990, 1,1,1-TCA was not detected in routine sampling of Well #3; however, by March 29, 1991 1,1,1-TCA was detected in this well at 3.7 ppb, and by June 29, 1991 1,1,1-TCA was detected at 9 ppb. Wells #3 and #2 were sampled again on July 18 and 19, respectively. The concentration of 1,1,1-TCA at Well #3 was 8 ppb, while 1,1,1-TCA was below the detection limit (0.5 ppb) in Well #2.

Well #3 was again sampled on July 22, 1991, and 1,1,1-TCA was detected at 12 ppb. At this point, Well #3 was taken offline and replaced with Well #2. The next day, on July 23, 1991, groundwater from Well #2 was sampled and analyzed, and 1,1,1-TCA was found to be below the detection limit of 1.0 ppb. Wells #5, #6, and #7 were also tested on this date and were found to contain 2 ppb, 0.7 ppb, and 2 ppb of 1,1,1-TCA, respectively. Well #6 also contained 2 ppb of TCE, and trace levels of TCE and benzene were found in Wells #5 and #7.

On August 1, 1991, testing of Well #2 showed a 1,1,1-TCA concentration of 7 ppb and a freon concentration of 35 ppb. A local homeowner tap was tested as well and revealed a 1,1,1-TCA concentration of 7 ppb and a freon concentration of 22 ppb. At this point URS was contracted to investigate potential sources of contamination.

During the Contaminant Source Investigation, Well #2 was sampled in the first round of sampling in October 1991. 1,1,1-TCA was detected in Well #2 at 2.9 ppb. During the aquifer test performed from December 17-20, 1991, both Wells #2 and #3 were sampled; the 1,1,1-TCA concentration in Well #3 increased from 11.0 ppb to 14.0 ppb. Well #2 also contained 1,1,1-TCA at a concentration of 2.6 ppb. Small amounts of 1,1-DCA, cis-1,2-DCE, and TCE were detected in Well #3 at concentrations of 0.3 ppb, 0.2 ppb, and 0.8 ppb, respectively.

On June 16, 1992 an air stripper was installed by Johnson City to reduce the 1,1,1-TCA concentrations at the wellfield. The USAF entered into a MOU with Johnson City and agreed to provide partial financial support for the O&M costs of the air stripper, subject to the availability of funds, from October 1, 1992 to September 30, 1994. This MOU was not intended to constitute any finding that AFP 59 was a source of 1,1,1-TCA in the Camden Street Wellfield and should not be interpreted as such.

TABLE 2-3
HISTORY OF WELLS AND WELLFIELD CONTAMINATION, JOHNSON CITY MUNICIPAL WELLS

Date	Event
1931	Wells #1, #2, and #3 are installed at the foot of Camden Street.
Unknown	Wells #4, #5, #6, and #7 are installed.
Unknown	Wells #1 and #4 inoperative due to mechanical problems.
January 14, 1985	USEPA designates the Clinton Street-Ballpark aquifer as a sole-source aquifer under the Safe Drinking Water Act
December 1988	1,1,1-TCA detected in Well #2 @ 2.1 ppb.
September 12, 1990	No 1,1,1-TCA detected at Well #3.
March 29, 1991	1,1,1-TCA detected in Well #2 @ 3.7 parts per billion (ppb).
June 29, 1991	1,1,1-TCA detected in Well #3 @ 9 ppb. Tetrachloroethane detected in Well #6 @ 0.7 ppb.
July 18, 1991	1,1,1-TCA detected in Well #3 @ 8 ppb.
July 19, 1991	1,1,1-TCA below detection limit in city Well #2.
July 22, 1991	1,1,1-TCA detected in Well #3 @ 12 ppb. Well #3 taken offline and replaced by Well #2.
July 23, 1991	1,1,1-TCA below detection limit in Well #2. 1,1,1-TCA detected in Well #6 @ 0.7 ppb. TCE detected in Well #6 @ 2 ppb. 1,1,1-TCA detected in Well #5 @ 2 ppb. 1,1,1-TCA detected in Well #7 @ 2 ppb. Trace levels of TCE and benzene detected in Wells #5 and #7.
August 1, 1991	1,1,1-TCA detected in Well #2 @ 7 ppb. Freon detected in Well #2 @ 35 ppb. 1,1,1-TCA detected in homeowner tap @ 7 ppb. Freon detected in homeowner tap @ 22 ppb.
October 21-24, 1991	First round of sampling for Contaminant Source Investigation. 4 shallow and 6 deep monitoring wells, and Well #2 are sampled. 1,1,1-TCA detected in Well #2 @ 2.9 ppb.
December 10-11, 1991	Second round of sampling for Contaminant Source Investigation. 4 shallow and 6 deep monitoring wells, and Trim Line Auto sump are sampled.

TABLE 2-3
HISTORY OF WELLS AND WELLFIELD CONTAMINATION, JOHNSON CITY MUNICIPAL WELLS

Continued

Date	Event
December 17-20, 1991	Aquifer Test performed for Contaminant Source Investigation. Johnson City Municipal Wells #2 and #3 are sampled. 1,1,1-TCA detected in Well #3 @ 14.0 ppb after 72 hour of pump test. 1,1,1-TCA detected in Well #2 @ 2.6 ppb after 72 hour of pump test. TCE detected in Well #3 @ 0.8 ppb after 24 hour of pump test. TCE detected in Well #2 @ 0.4 ppb after 72 hour of pump test. 1,1-DCA detected in Well #3 @ 0.3 ppb after 48 hour of pump test. Cis-1,2-DCE detected in Well #3 @ 0.2 ppb after 72 hour of pump test.
June 16, 1992	Air stripper is installed by Johnson City to reduce the 1,1,1-TCA concentrations at the wellfield.
October 1, 1992 - September 30, 1995	USAF agrees to provide partial financial support for the O&M costs of the air stripper subject to availability of funds through a MOU.

2.2.2 Geology

This section describes the geological setting, glacial and bedrock geology, and soils for AFP 59 and the surrounding area.

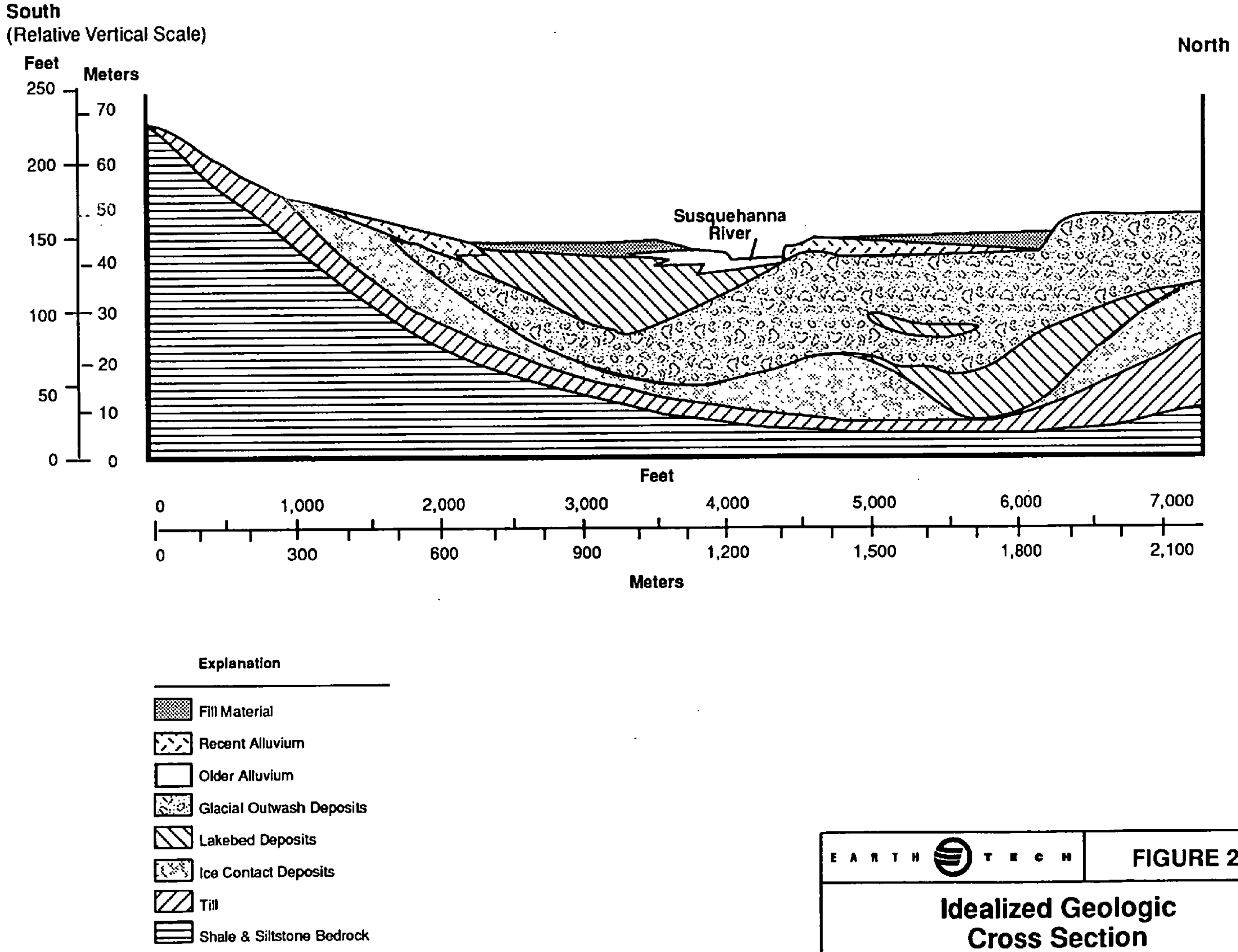
2.2.2.1 ***Regional Geology.*** Numerous geological studies have been conducted in the Susquehanna River basin in the vicinity of Johnson City and Binghamton, New York. The following section describes regional characteristics obtained from the NYSDEC Bulletin 73 (NYSDEC, 1977) and the USGS Water-Resources Investigations Report 85-4099 (USGS, 1986).

The Susquehanna River basin and vicinity is underlain by Pleistocene-age glacial deposits consisting of sand, gravel, silt, and clay. These deposits began forming approximately 18,000 years ago when the area was covered by glaciers. Figure 2-3 is an idealized cross-section that illustrates the geology in the vicinity of AFP 59. The advancing ice sheet widened stream-formed valleys and scoured the land surface, depositing glacial till. A warming climate caused ice in the uplands to melt rapidly while the valleys remained clogged with ice. The first stratified deposits began to form when meltwater from the uplands carried sediment to the valleys, depositing their sediment load on top of melting ice. Meltwater ponds formed as the ice melted and were rapidly filled with coarse-grained sediments that were interspersed with silt. Masses of debris slumped down into the ponds from adjacent slopes. These early deposits were derived from local bedrock (olive-gray shale and siltstone) and have been historically termed "drab". As the meltwater drainage system extended north, the presence of pebbles derived from distant regions increased. These first stratified deposits are called ice-contact deposits because they were laid down on top of ice. Thicknesses of the ice-contact deposits range from a few feet in places to between 50 and 100 feet locally. The thicker deposits tend to occur as "belts parallel to the valley axes" (USGS, 1986).

As the ice surface lowered due to melting, the ice-contact deposits began to slump, and in some areas meltwater lakes were created. Fine-grained sediments composed of very fine sand, silt, and clay settled in the lakes on top of the ice-contact deposits. The meltwater streams then began to deposit coarse sand and gravel (outwash) originating from the Chenango Valley on top of the fine-grained lake sediments in broad stream channels and deltas. These outwash deposits have historically been termed "bright" because the gravel is derived from colorful, more distant bedrock. The outwash deposits covered practically the entire width of the Susquehanna Valley, with thicknesses ranging from 10 to 100 feet.

When the buried ice blocks finally melted, the overlying deposits sagged and formed depressions called kettleholes. Sediments have been accumulating in these depressions for 15,000 years (USGS, 1986). Kettleholes that are near rivers have been filled primarily with silt, with occurrences of coarse-grained sediments derived from floods. Remote kettleholes formed peat swamps. Many kettleholes have been filled by man with trash and debris.

The most recent deposits in the area are alluvial fan and floodplain deposits that formed in post-glacial streams and rivers. Silt, fine sand, and gravel make up these deposits.



From: NYSDEC Bulletin 73, 1977

EARTH TECH

FIGURE 2-3

Idealized Geologic Cross Section in the Vicinity of AFP59

GF/AFP 59/RI/FS/FIG 2-4

The lithologic units found in the Susquehanna River basin are described in detail below in order from youngest to oldest. Figure 2-4 is an idealized diagram showing the sequence of stratified-drift deposition during deglaciation. Figure 2-5 shows the surficial geology in the vicinity of AFP 59.

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

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

Postglacial Lakebeds. Postglacial lakebeds formed in kettleholes 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.

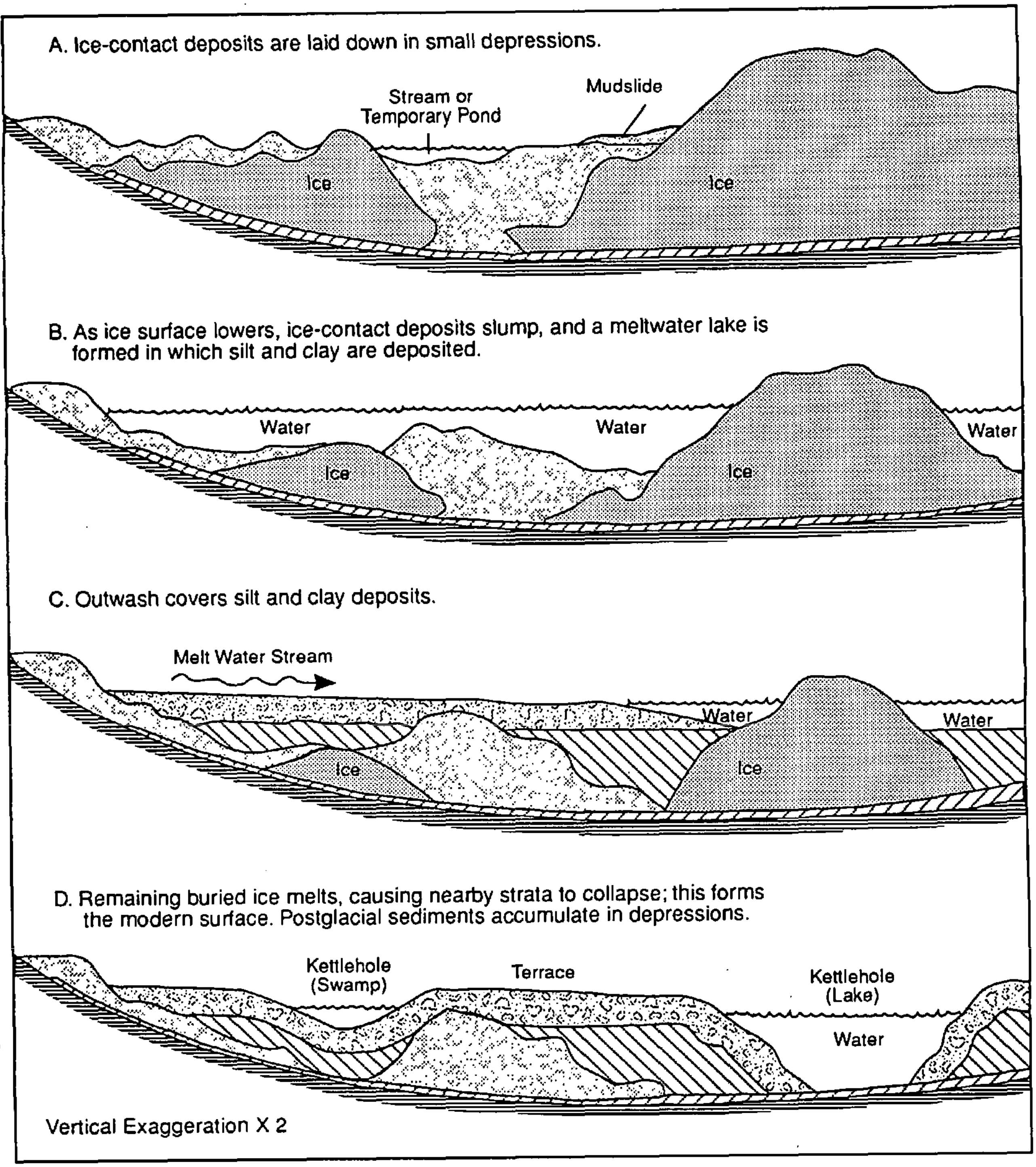
Glacial Outwash. Glacial outwash deposits are composed of 10 to 40 feet of sandy-pebble gravel and pebbly coarse- to fine-grained sand. Trace to moderate amounts of highly calcareous silts are also present. In some areas, the thickness of this deposit reaches 100 feet. The material for the coarse sediments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

Glacial Lakebeds. Glacial lakebed 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 glacial lakebed deposits varies from 0 to 80 feet. The deposits typically occur as lenses of limited areal extent; however, extensive deposits are present west of Johnson City. Glacial lakebed deposits typically overlie ice-contact deposits but have been found in some areas to interfinger with or overlie glacial outwash deposits (USGS, 1986).

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


A. Ice-contact deposits are laid down in small depressions.

B. As ice surface lowers, ice-contact deposits slump, and a meltwater lake is formed in which silt and clay are deposited.

C. Outwash covers silt and clay deposits.

D. Remaining buried ice melts, causing nearby strata to collapse; this forms the modern surface. Postglacial sediments accumulate in depressions.

GF/AFP-59/RI/FS/Fig 2-5

Explanation

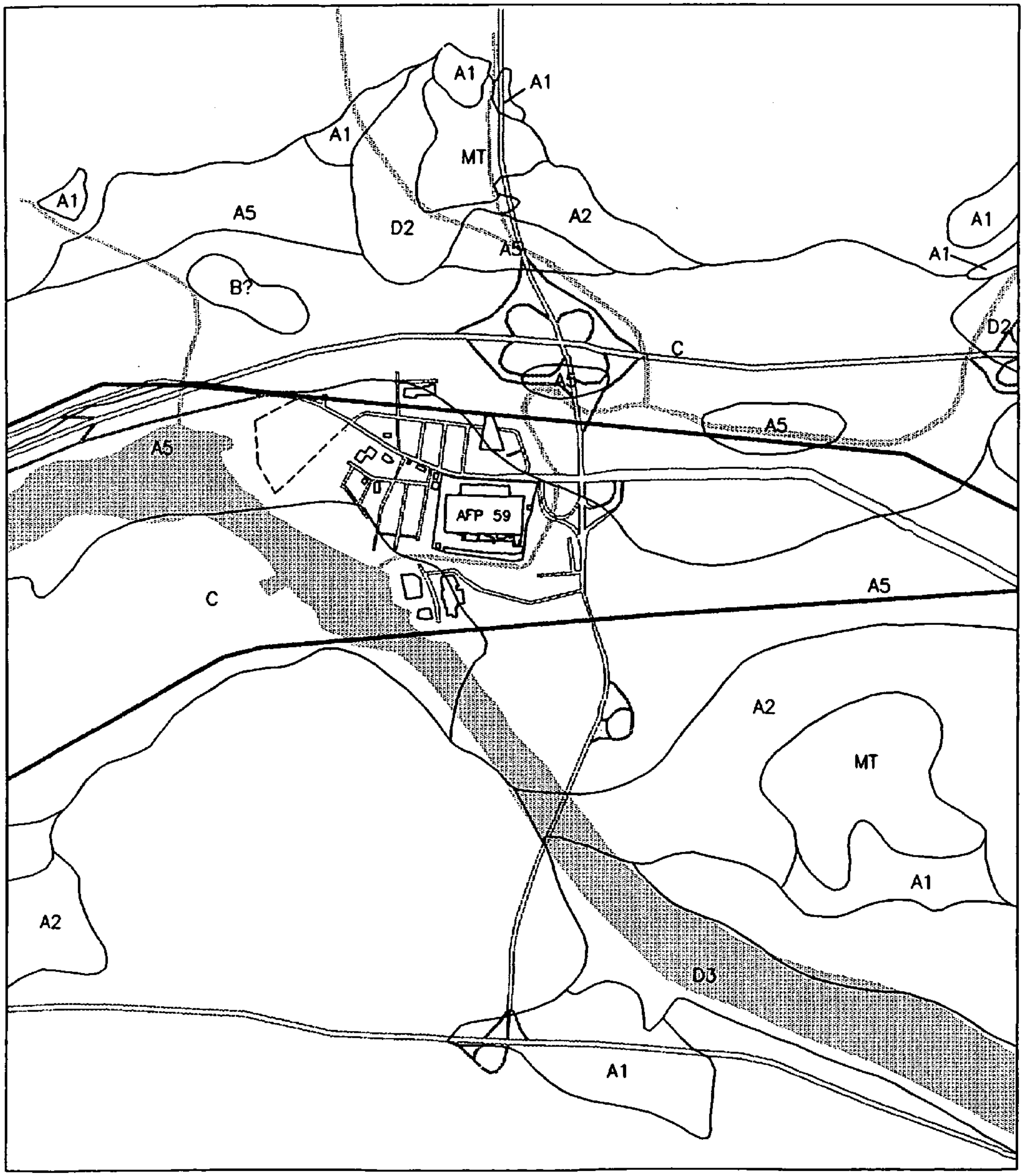
- ▨ Glacial Outwash Deposits
- ▧ Lakebed Deposits
- ▨ Ice-Contact Deposits
- ▨ Glacial Till
- ▤ Shale Bedrock

From: USGS Water-Resources Investigations Report 85-4099

EARTH TECH

FIGURE 2-4

Sequence of Stratified-Drift Deposition During Deglaciation



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A1 – Ice-contact Deposits Along Valley Walls

A2 – Unsaturated Glacial Outwash Overlying Ice-contact Deposiits

A5 – Glacial Outwash Overlying Ice-contact Deposits

B – Postglacial Lakebeds

C – Glacial Outwash Overlying Glacial Lakebeds

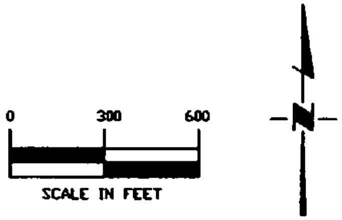
D2 – Alluvial Fans of Tributary Streams

D3 – Alluvium of Susquehanna River

MT – Morainal Till

NOTE: Areas with no label reperesent Till.

Source: USGS Water Resources
Investigations Report 85–4099



EARTH TECH

FIGURE 2-5

SURFICIAL GEOLOGY IN THE VICINITY OF AFP 59

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.

*2.2.2.2 **Local Geology**.* Historical subsurface investigations of AFP 59 and the surrounding area have revealed that the geology consists of glacial outwash overlying ice-contact deposits. The basic stratigraphic sequence consists of shale and siltstone bedrock at 85 to 95 feet bgs, 1 to 2 feet of glacial till, 50 to 70 feet of ice-contact deposits, and 20 to 36 feet of glacial outwash.

Historical borehole logs of monitoring wells drilled on the AFP 59 property have shown the presence of a fine-grained sand and silt layer that, in places, lies between the glacial outwash and ice-contact deposits. This fine-grained deposit has been found in more than half of the monitoring wells installed at AFP 59, and varies from 13 to 30 feet thick. It has generally been described as a silty-fine sand, and has been interpreted by some to be a lakebed deposit although distinct individual sand and silt layers have not been described (ANL, 1994). Descriptions of similar fine-grained deposits have been reported in other areas of the Susquehanna River basin (USGS, 1986).

*2.2.2.3 **Soil**.* Soils present at AFP 59 are composed of silty alluvial materials. The soils do not support heavy loads well and are subject to erosion. The materials were emplaced during the construction of the plant to elevate buildings above the floodplain. The western edge of AFP 59 is covered by disturbed or reworked loamy materials of glacial origin. Soils to the east of AFP 59 are gravelly and generally good for highways and for building sites.

2.2.3 Groundwater

Numerous hydrogeological studies have been conducted in the Susquehanna River basin in the vicinity of Johnson City and Binghamton, New York. The following sections summarize aquifer characteristics described in these studies (NYSDEC, 1977; CH2M Hill, 1984; USGS, 1986; Hart, 1988; URS, 1992; and ANL, 1994).

2.2.3.1 Aquifer Identification

Bedrock Aquifer. Groundwater is present in bedrock but generally provides limited quantities of water. Typically, wells completed in bedrock average less than 10 gpm. However, some bedrock wells that are completed several hundred feet deep into the bedrock have yielded 100 to 300 gpm (ANL, 1994). The bedrock aquifer is generally considered a limited groundwater source.

Clinton Street-Ballpark Aquifer. The Clinton Street-Ballpark aquifer is a highly productive aquifer that occupies three square miles within the Greater Binghamton area. This aquifer yields 400 to 2290 gpm (CH2M Hill, 1984). It is associated with the Endicott-Johnson City aquifer, but due to boundary conditions is considered a separate aquifer. The Clinton Street-Ballpark aquifer's boundaries are: impermeable bedrock to the north, glacial till and impermeable bedrock to the south, the Chenango River to the east, and the Susquehanna River to the southwest (Figure 2-6). AFP 59 is located on the western edge of the aquifer.

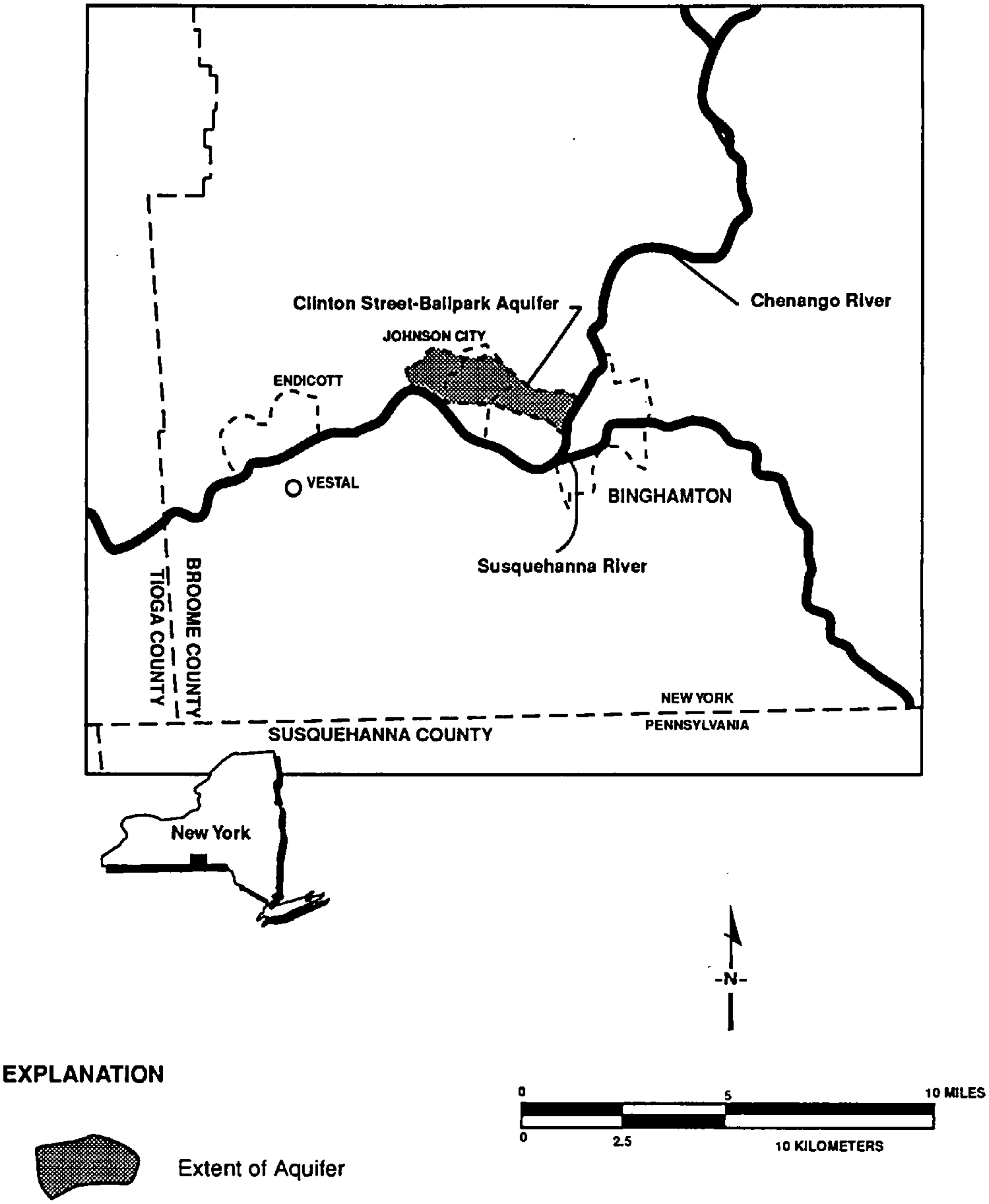
The formations that make up the Clinton Street-Ballpark aquifer are the glacial outwash deposits and the underlying ice-contact deposits, with occurrences of glacial lakebed deposits that may locally restrict groundwater movement. Section 2.2.2.1 describes these deposits in detail. The aquifer is locally separated into two zones (shallow and deep) separated by discontinuous lakebed deposits. In general, the glacial outwash deposits make up the shallow zone and the ice-contact deposits make up the deep zone.

2.2.3.2 Groundwater Use and Well Inventory. Groundwater from the Clinton Street-Ballpark aquifer is used for municipal and industrial purposes. Figure 2-7 displays the locations of observation wells and municipal and industrial production wells in the vicinity of AFP 59. In 1985, the USEPA designated the aquifer as a sole-source aquifer under the Safe Drinking Water Act (50 FR 2026, January 14, 1985). To be designated as a sole-source aquifer the act requires: 1) the aquifer to be the sole or principal drinking water source in the area; and 2) that contamination of the aquifer would create a significant public health hazard. The Clinton Street-Ballpark aquifer serves approximately 128,000 people in the communities of Johnson City, Endicott, Nichols, Owego, Vestal, and Waverly.

The Johnson City Water Department maintains seven deep production wells (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 and IBM which lie north of the village (URS, 1992). Three Johnson City Water Department municipal production wells are located southwest of AFP 59, and one municipal production well is located northeast of AFP 59 (see Figure 2-7). The overall capacity of the seven production wells is 4.0 million gallons per day.

A production well used intermittently for non-contact cooling purposes is located on the AFP 59 property. The capacity of the industrial production well is 350 gpm. Monthly pumping rates supplied for the period May 1993 to May 1994 indicate that May through August are the peak pumping months, with rates ranging from 194 gpm to 282 gpm, and an average rate of 250 gpm. Although the pump was inoperable from late September to late January of the reported period, pumping for cooling purposes is typically not necessary during the winter months. This is illustrated by the fact that no pumping occurred in February, and the rate for March averaged only 2.8 gpm.

In May 1994, a chemical treatment system was installed at AFP 59 to reduce the volume of water pumped from the production well for cooling purposes. Prior to installation of the system, the production well was rehabilitated and redeveloped, the pump was replaced, and the piping for the cooling system was treated to remove any buildup. The well treatment and pump replacement resulted in a 30-40 gpm increase in well capacity, for a total capacity of 380-390 gpm. The chemical treatment system was then installed to prevent problems formerly associated with production well pumping and water circulation through the cooling system. By chemically treating the water in the system, problems such as biofouling and metals precipitation can be



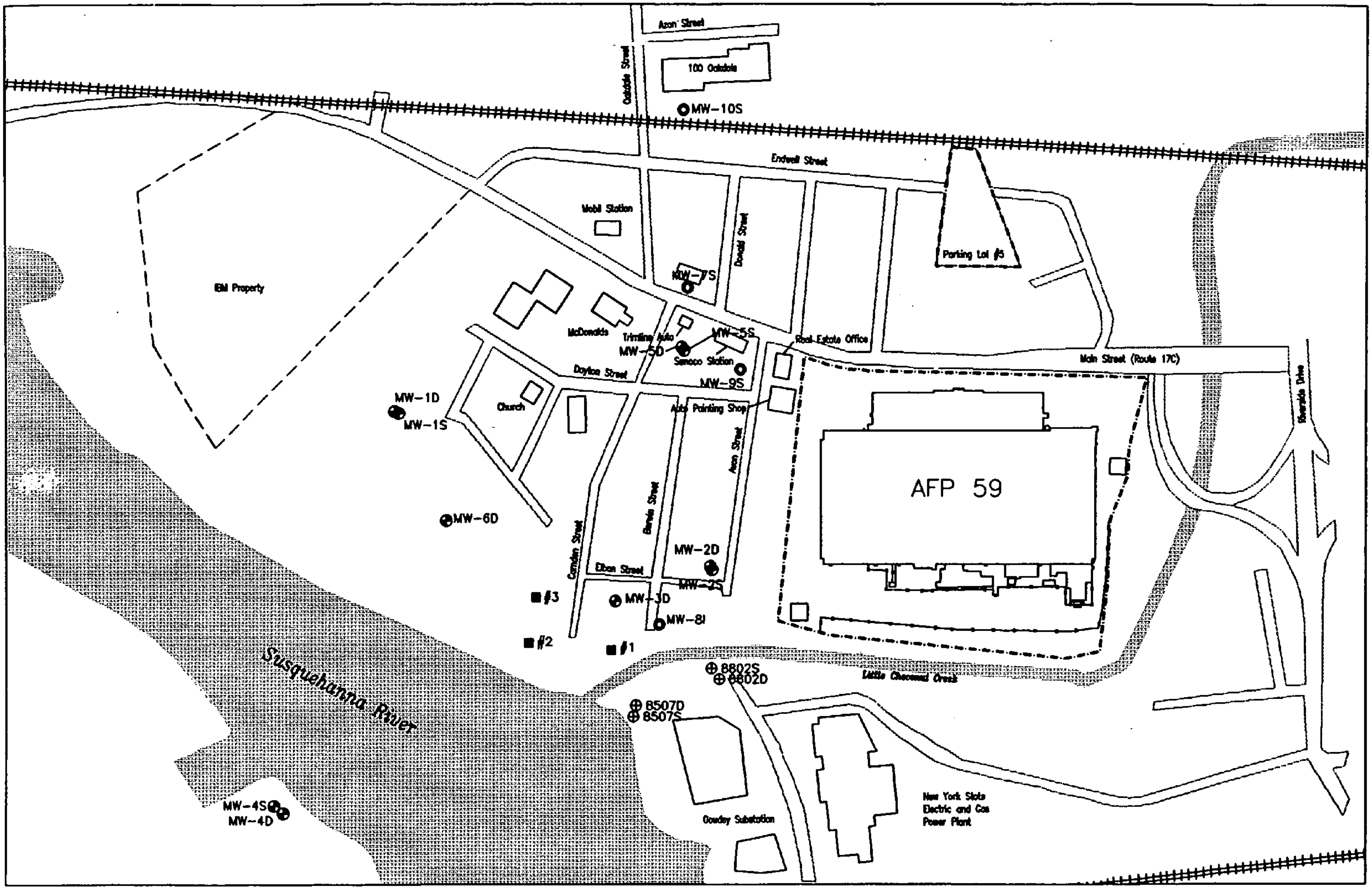
EARTH TECH

FIGURE 2-6

Location of the Clinton Street-Ballpark Aquifer

Source: NYSDEC Bulletin 73, 1977

AFP-59/RI/FS/Fig 2-6



LEGEND

- ⊕ – Monitoring wells installed in 1991 for the Contaminant Source Investigation (URS, 1992)
- ○ – Monitoring wells installed in 1992 for the Additional Contaminant Source Investigation (URS, 1993)
- ■ – Johnson City water supply wells
- ⊕ – NYSEG montioring wells
- –·–·– – AFP 59 Property Boundary

X———X – Fence

EARTH TECH

FIGURE 2-7

LOCATIONS OF OBSERVATION WELLS AND MUNICIPAL AND INDUSTRIAL PRODUCTION WELLS IN THE VICINITY OF AFP 59 reduced, and cooling waters can be recycled for long term use. As a result, since May of 1994, pumping of the production well has been limited.

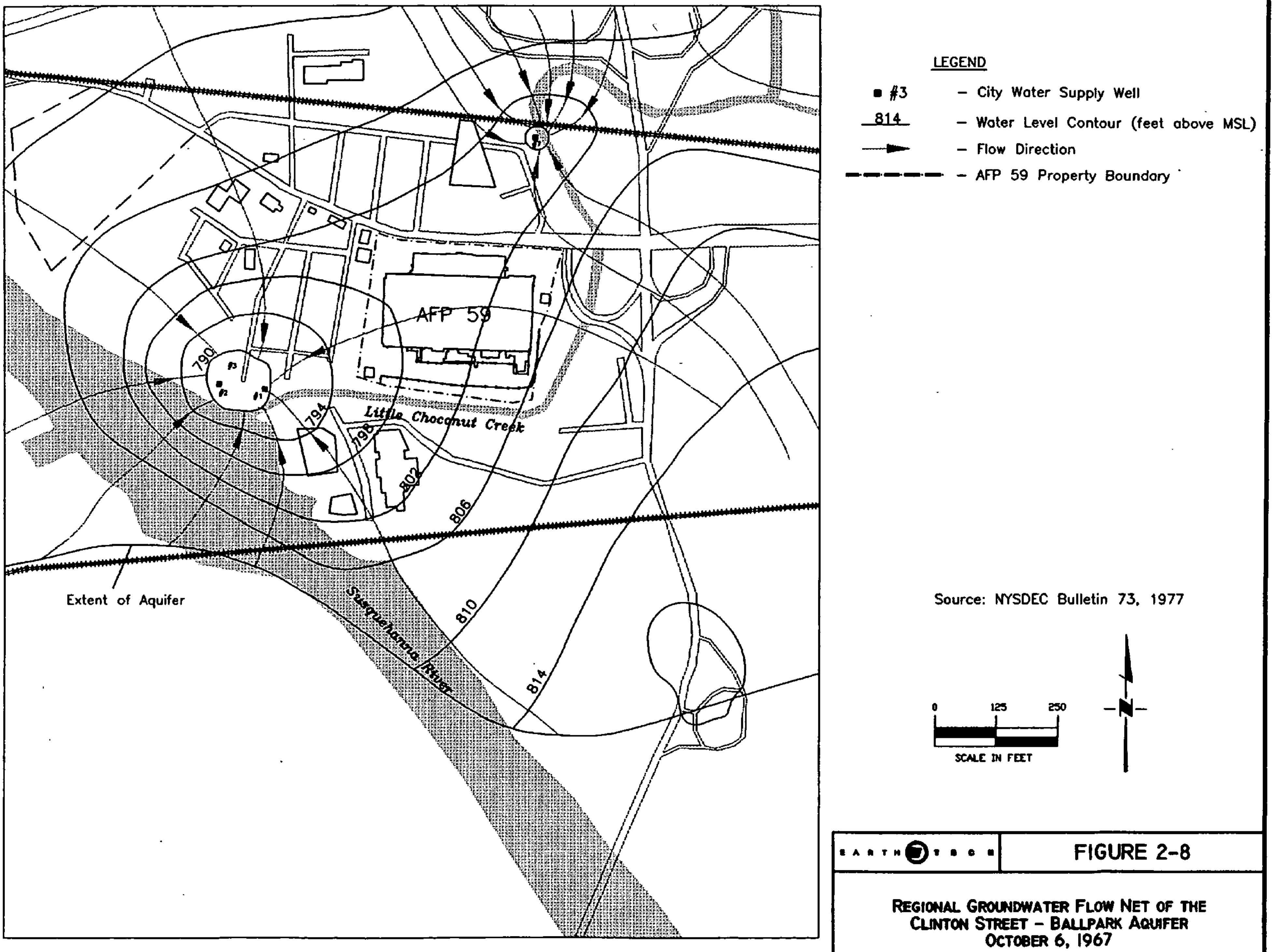
2.2.3.3 ***Aquifer Characteristics***. The Clinton Street-Ballpark aquifer ranges in thickness from 80 to 180 feet and covers an area of approximately three square miles. Transmissivity of the Clinton Street-Ballpark aquifer ranges from 10,000 ft^2/day to 50,000 ft^2/day. The hydraulic conductivity of the aquifer beneath AFP 59 was reported in a 1992 study to range from 200 to 2,000 feet per day (URS, 1992). Depth to water in monitoring wells completed in the Clinton Street-Ballpark aquifer on AFP 59 property ranges from 15 to 22 feet bgs in the shallow zone, and 13 to 22.5 feet bgs in the deep zone.

Figure 2-8 displays a regional groundwater flow net of the aquifer as of October 6, 1967. Groundwater flow lines point in the direction of production wells that were in operation on or around October 6, 1967 (NYSDEC, 1977). Flow to the northwest across the plant was also confirmed in an IRP Phase II, Stage 1 Final Report for AFP 59 (Hart, 1988). Historic potentiometric surface maps portraying the groundwater flow directions prior to high volume pumping of the Clinton Street-Ballpark aquifer have not been found. Therefore, no information is available on groundwater flow directions without the influence of production wells.

Other maps of the potentiometric surface have been generated that show the presence of a groundwater divide between the Camden Street Wellfield and AFP 59. This situation may exist when the Camden Street Wellfield municipal production wells and the AFP 59 industrial production well are in operation simultaneously. On either side of the divide, groundwater flow direction is to the southwest (towards the Camden Street Wellfield) and to the northeast (towards the AFP 59 production well) (URS, 1992). Historic reports indicate that groundwater flow directions fluctuate and depend upon which wells are (or are not) pumping.

2.2.3.4 ***Aquifer Discharge and Recharge***. Prior to large-scale groundwater development, the Clinton Street-Ballpark aquifer received water from precipitation and discharged groundwater into the Susquehanna and Chenango Rivers and their tributaries. Since the 1940s, the aquifer has been heavily used for the Johnson City public water supply and for industrial purposes. Studies have shown that groundwater no longer discharges into the Susquehanna and Chenango Rivers (NYSDEC, 1977 and USGS, 1986). Instead, groundwater is discharged through pumped municipal and industrial production wells. The potentiometric surface has been lowered by as much as 23 feet in the Clinton Street-Ballpark aquifer, causing the channels of Little Choconut Creek and the Susquehanna and Chenango Rivers to lie above the potentiometric surface (NYSDEC, 1977).

Today, recharge to the aquifer is primarily from precipitation. Infiltration from streams may also play a role in aquifer recharge. Evidence for hydraulic communication between the Clinton Street-Ballpark aquifer and streams have been documented based on the presence of coliform bacteria in a municipal well located several miles west of Johnson City (NYSDEC, 1977). The study also noted that: 1) groundwater temperatures in the aquifer near rivers fluctuate from 1°C to 22°C, while groundwater temperatures in deeper portions of the aquifer remain steady at 11°C; and 2) the aquifer is more mineralized in deeper portions of the aquifer than in portions of the aquifer near rivers where infiltration from river water occurs.



LEGEND

■ #3 – City Water Supply Well
814 – Water Level Contour (feet above MSL)
→ – Flow Direction
– – AFP 59 Property Boundary

Source: NYSDEC Bulletin 73, 1977

EARTH TECH

FIGURE 2-8

REGIONAL GROUNDWATER FLOW NET OF THE
CLINTON STREET – BALLPARK AQUIFER
OCTOBER 6, 1967

Excavations in or adjacent to river channels which remove fine sediments and expose more permeable deposits may increase infiltration of river water into the aquifer (USGS, 1986). However, it is also possible that excavation may cause a reduction in riverbed permeability since the deep pools left by excavations may trap large quantities of silt, effectively sealing that portion of the river to the aquifer. To date, no large scale investigations have been performed to prove that riverbed excavations increase or decrease infiltration into the Clinton Street-Ballpark aquifer.

2.2.3.5 Groundwater Quality. According to a 1986 study, the groundwater temperature in the Clinton Street-Ballpark aquifer ranges from 9°C to 11.5°C (USGS, 1986). Seasonal fluctuations occur in the aquifer within 20 feet of the land surface. The largest temperature fluctuations occur in the most permeable layers, especially when they are close to rivers. Temperatures have been reported to fluctuate from near 0°C in March to 22°C in September. Groundwater temperatures have been used to locate induced infiltration in the aquifer.

The New York State Department of Health has monitored the sanitary quality of groundwater pumped from Johnson City Water Department municipal production wells. The presence of coliform bacteria had never been reported in Production Wells #1 through #3 as of 1977 (NYSDEC, 1977). It has been suggested that the bacteria are naturally filtered out of the water by fine-grained riverbed sediments and aquifer deposits (NYSDEC, 1977). Coliform bacteria have been reported in a municipal well several miles west of Johnson City (NYSDEC, 1977). Riverbed excavation near the well resulting in the removal of fine-grained sediments may have allowed river water contaminated with coliform bacteria to enter the aquifer. Modern sewage treatment processes should decrease bacteria populations. However, penetration of bacteria into the aquifer may be expected under conditions of maximum groundwater development (NYSDEC, 1977).

Calcium and bicarbonate are the most abundant dissolved chemical constituents in the Clinton Street-Ballpark aquifer. According to a 1972 study, the central portion of the aquifer is more mineralized and harder than at the outside edges (NYSDEC, 1977). Water hardness is mostly caused by calcium and magnesium ions. Hardness was found to be 300 mg/L to 400 mg/L in the central portion of the aquifer, and 150 mg/L to 210 mg/L near the borders of the aquifer near streams or rivers. The lower concentrations of dissolved solids at the borders of the Clinton Street-Ballpark aquifer were due to infiltration of river water. Increased mineral content in the aquifer occurred during the late 1950s and 1960s. The increase in mineral content over time in the aquifer was attributed to: 1) human activities, and 2) development of the shallow zone of the aquifer. The shallow zone of the aquifer contains glacial outwash material with abundant quantities of limestone and dolomite, which are calcium and magnesium rich rocks.

2.2.4 Surface Water

Two surface water bodies are in proximity to AFP 59, Little Choconut Creek and the Susquehanna River (Figure 1-3). 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 course of the northern branch of Little Choconut Creek was dramatically altered during the development of shopping malls in the area. The course of the creek has also been altered south of the plant; sometime between 1935 and 1968 the creek was moved north, most likely to accommodate trestle construction for the railroad. Little Choconut Creek is considered waters of the state by the U.S. Army Corps of Engineers for purposes of permitting under Section 404 of the Clean Water Act. The U.S. Fish and Wildlife Service classifies the stream as an upper perennial riverine wetland with unconsolidated bottom which is permanently flooded. In addition, there are areas of palustrine forested wetlands on islands and along the margins of the Susquehanna River downstream from its confluence with Little Choconut Creek.

AFP 59 is constructed on the former flood plain of the Susquehanna River. As part of a flood control project in the mid 1960s, the State of New York built an earthen containment dike along the banks of Little Choconut Creek south of the facility. Since the installation of the Camden Street Wellfield and the associated lowering of the groundwater table, both Little Choconut Creek and the Susquehanna River are believed to be losing streams (recharging groundwater). The degree of interconnection between these surface water bodies and the aquifer is unknown.

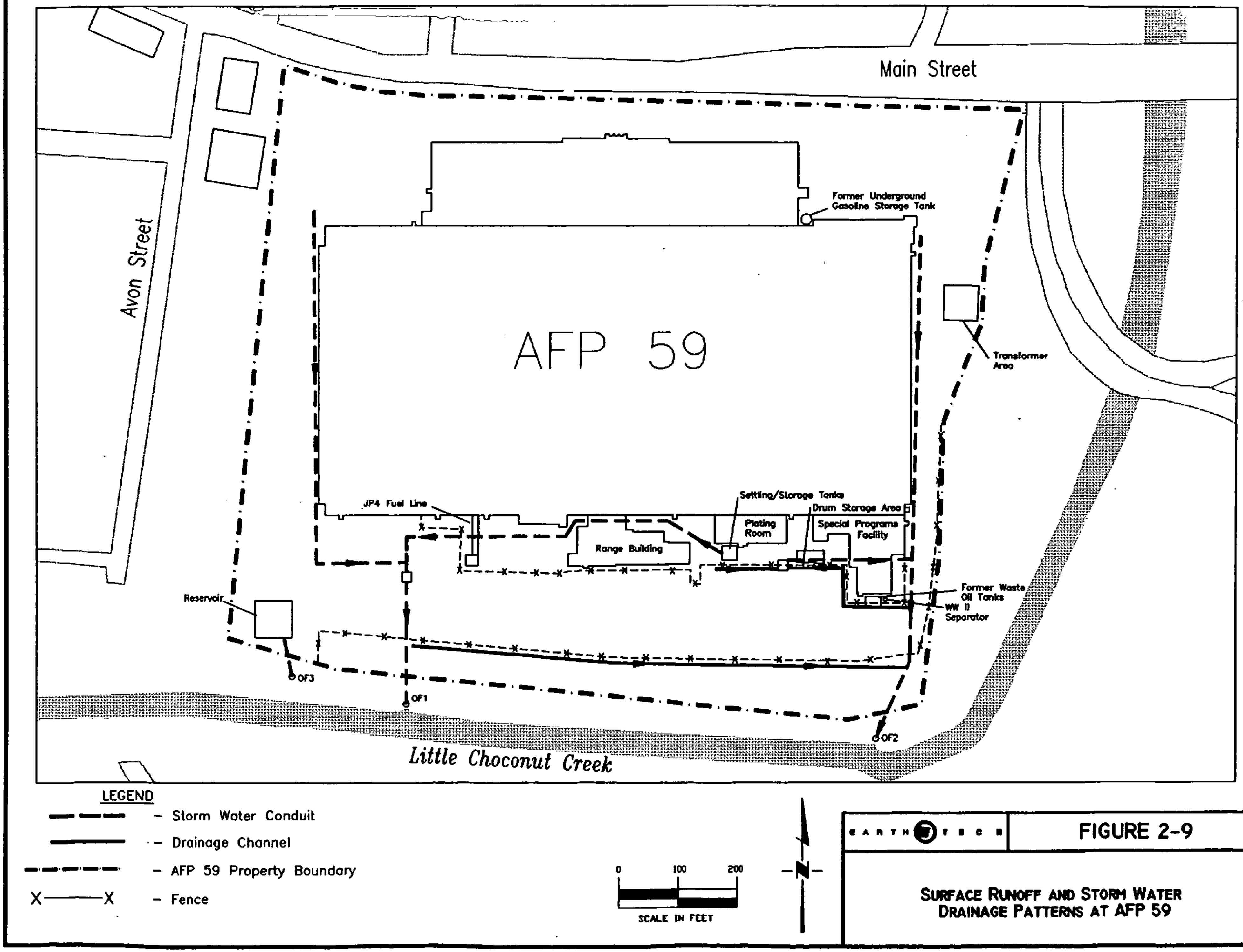
No municipal users of surface water have been reported within 3 miles downstream of AFP 59 (CH2M Hill, 1984). The City of Binghamton is the nearest municipal user of water from the Susquehanna River, and the surface water intakes are approximately 5 miles upstream of AFP 59.

Surface runoff and storm water drainage patterns at AFP 59 are shown in Figure 2-9. Surface water from a large part of the southern portion of the plant discharges into Little Choconut Creek south of the plant through two permitted outfalls (001 and 002). A pump located on the flood control structure allows discharge during flood conditions. Much of the surface water from the hazardous waste storage areas, the back loading dock, and the work areas of the plant flows through a drain with an oil/water separator prior to discharge to Outfall 002. Non-contact cooling water drawn from the onsite production well is discharged from the reservoir via Outfall 003.

2.2.5 Air

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 (ISMCS, 1990). The average daily minimum temperature in January is 15°F while the average daily maximum temperature in July is 79°F. Freezing temperatures occur at Binghamton on the average of 147 days per year. The prevailing wind direction is west-southwest. Monthly mean temperature, precipitation, and wind speeds are presented in Table 2-4.

Mean annual precipitation recorded in the vicinity of AFP 59 is 36.7 inches per year. The greatest precipitation occurs in June and July, and the least in February. For the most part, precipitation is evenly distributed throughout the year. Snowfall accounts for a large portion of the total precipitation during the winter months, with an annual average of about 85 inches at the Broome County airport. Mean annual lake evaporation, commonly used to estimate the



EARTH TECH

FIGURE 2-9

SURFACE RUNOFF AND STORM WATER DRAINAGE PATTERNS AT AFP 59

TABLE 2-4
METEOROLOGICAL DATA FOR BINGHAMTON (1949-1989)

Month	Mean Temperature (°F)	Mean Precipitation (inches)	Mean Wind Speed (knots)
January	22	2.4	11W
February	24	2.3	11W
March	32	2.8	11NW
April	45	3.2	10W
May	56	3.4	9S
June	65	3.6	9W
July	70	3.6	8W
August	68	3.4	7S
September	60	3.2	8S
October	49	2.8	9S
November	38	3.1	10S
December	27	2.8	10W
Annual	**46**	**36.7**	**9W**

Source: ISMCS, 1990.

mean annual evapotranspiration rate, is estimated to be 28 inches per year. Evapotranspiration over land areas may be greater or less than lake evaporation depending on the amount and type of vegetation and the availability of moisture. Mean annual net precipitation (mean annual precipitation minus mean annual evapotranspiration) is approximately 9 inches per year (CH2M Hill, 1984).

The background air quality or air attainment status at AFP 59 is designated by the county in which it is located (Broome County, New York). Based on a June 1993 report which studied AFP 59's cost of compliance with the 1990 Clean Air Act Amendments, it was determined that AFP 59 is located in an O_3 transportation region. This means that AFP 59 must comply with the same restrictions as a moderate nonattainment area for O_3 (PRC Environmental Management, Inc., 1993). The report also indicated that AFP 59 did not meet any of the criteria of a major source as defined by the Clean Air Act Amendments of 1990 (PRC, 1993). USEPA regulations designating areas for air quality planning are given in 40 Code of Federal Regulation (CFR) 81. The Broome County area had the following designations: Total Suspended Particulate - better than national standards; CO - unclassifiable/attainment; Lead - not designated; and NO_2 - cannot be classified or better than national standards (40 CFR 81, 1991).

2.2.6 Biology

No plant or animal communities are present on the installation. Small strands of second growth hardwood forests are located adjacent to the property, along Little Choconut Creek and the Susquehanna River. These include sycamores, elms, willows, and others. No endangered or threatened wildlife or plant species are known to occur in the vicinity of AFP 59.

2.2.7 Demographics

The number of residents in both Broome and Tioga Counties was 128,000 in 1984. AFP 59, which occupies 29.6 acres, is situated in a highly urbanized area. The main plant entrance is off Main Street (State Route 17C), which marks the northern boundary of the installation. North of Main Street is a parking lot used by plant employees and a school. On the east and south, the plant is bordered by Little Choconut Creek. The plant and the creek are separated by a system of levees, flood gates, and flood walls. South of AFP 59, beyond Little Choconut Creek, is a power plant owned by NYSEG and a substation. The Camden Street Wellfield, a source of water for Johnson City, is southwest of the plant and north of the confluence of the Susquehanna River and Little Choconut Creek. East of AFP 59 is a residential area, including a church and a school. To the northwest is an auto painting shop and a real estate office. Other nonresidential land around the plant is used for transportation, commercial enterprises, forest land/recreation, and industrial activity (see Figure 2-1).

2.3 Conceptual Site Model

A conceptual site model of the installation has been developed to incorporate existing information about contamination and natural conditions (i.e., geologic and hydrologic) at AFP 59. The five elements of the conceptual site model are described below.

- Contaminant Identification and Background Assessment. Detected analytes are considered site contaminants when present at concentrations greater than background. Therefore accurate background and site data must be available.

- Source Characterization. If contamination is confirmed, potential sources are identified (including location, volume, hazardous constituents, and rate of release).

- Potential Migration Pathways Identification. For each source, potential migration pathways through groundwater, surface water, soil, and air are identified.

- Receptor Identification. Areas with human or ecological receptors along the identified migration pathways are presented.

- Contaminant Concentrations at Receptor. For each complete pathway, contaminant concentrations at the receptor nearest the source are estimated.

The complexity of the conceptual site model is dependent on the available data. The current conceptual site model, presented below, will be used to identify data gaps and plan subsequent sample collection activities. Since the development of a conceptual site model is an on-going, iterative process, the model for AFP 59 will be revised throughout the RI as appropriate when additional data become available.

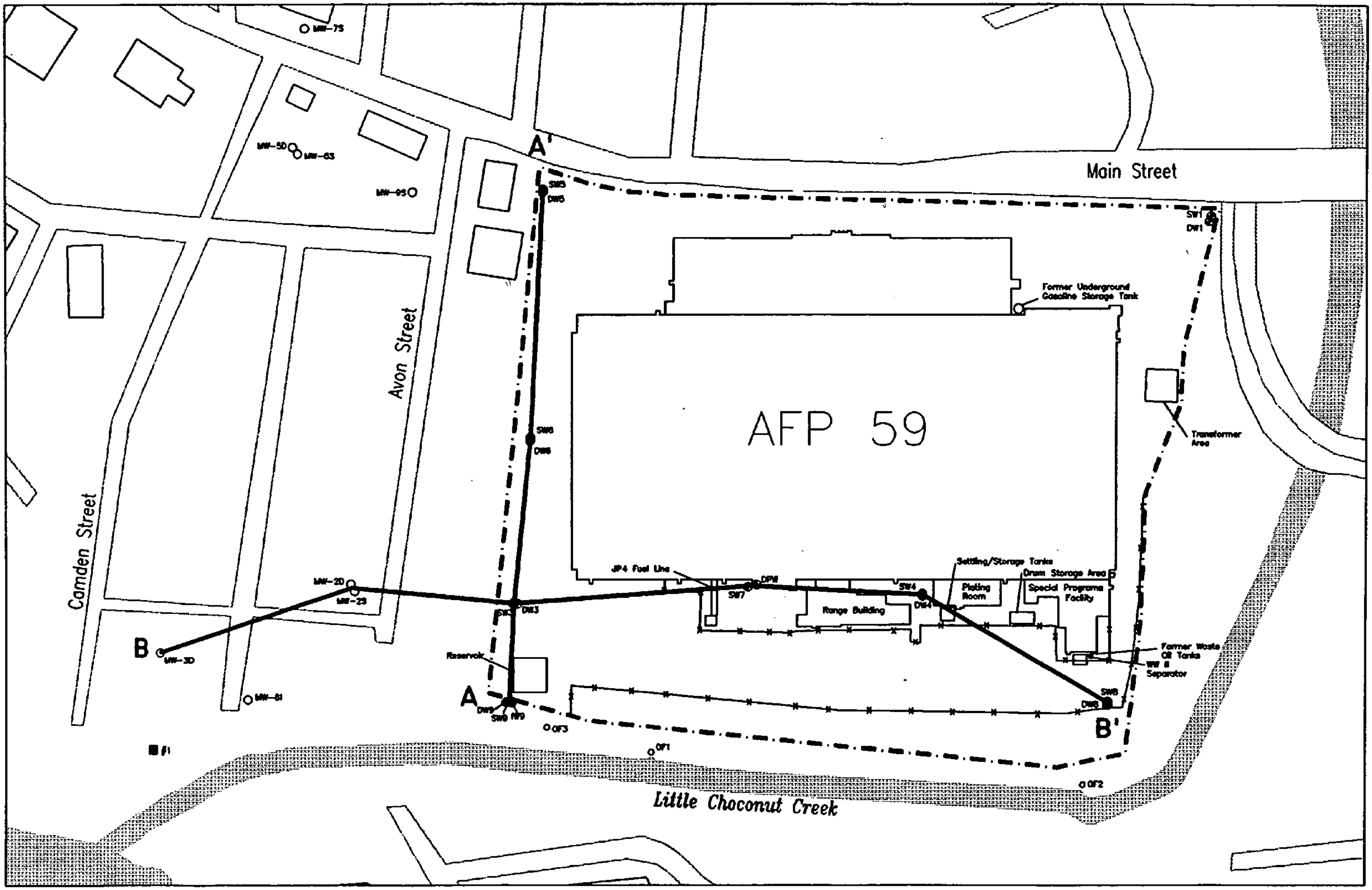
Figures 2-10, 2-11, and 2-12 depict the conceptual site model for AFP 59. The subsurface lithology and contaminant distribution are summarized in these figures based on data compiled from existing reports.

2.3.1 Identification of Contaminants and Background

Contaminants are identified below based on a comparison to background results. For each media, the background results and contaminants detected are summarized (see Tables 2-5 through 2-9). For purposes of the conceptual site model only, analytes were considered to be contaminants where the maximum sample concentration exceeded the maximum background concentration by at least 10 percent. Metals detected at the site but not identified as exceeding background are not included in the conceptual site model tables (Tables 2-5 through 2-9) and are considered to be present at naturally occurring concentrations. During the RI contaminants of concern will be determined statistically as described in Section 3.7.1.

Soil. Background soil samples were collected onsite during the SSI at several locations. A surface soil sample was collected in the southwest corner of the plant along the embankment.

Three subsurface soil samples were collected while drilling monitoring well DW1: a sample and a replicate from 8 to 10 feet bgs and a sample from 18 to 20 feet bgs. Samples collected while drilling SW8 were also intended to characterize background conditions, but SVOCs and pesticides were detected in the samples. Well cluster 8 is therefore not considered representative of background conditions for this conceptual site model. The surface soil sample has also been



LEGEND

■ – City Water Supply Well

● – AFP 59 Monitoring Well

○ – Offbase Monitoring Well

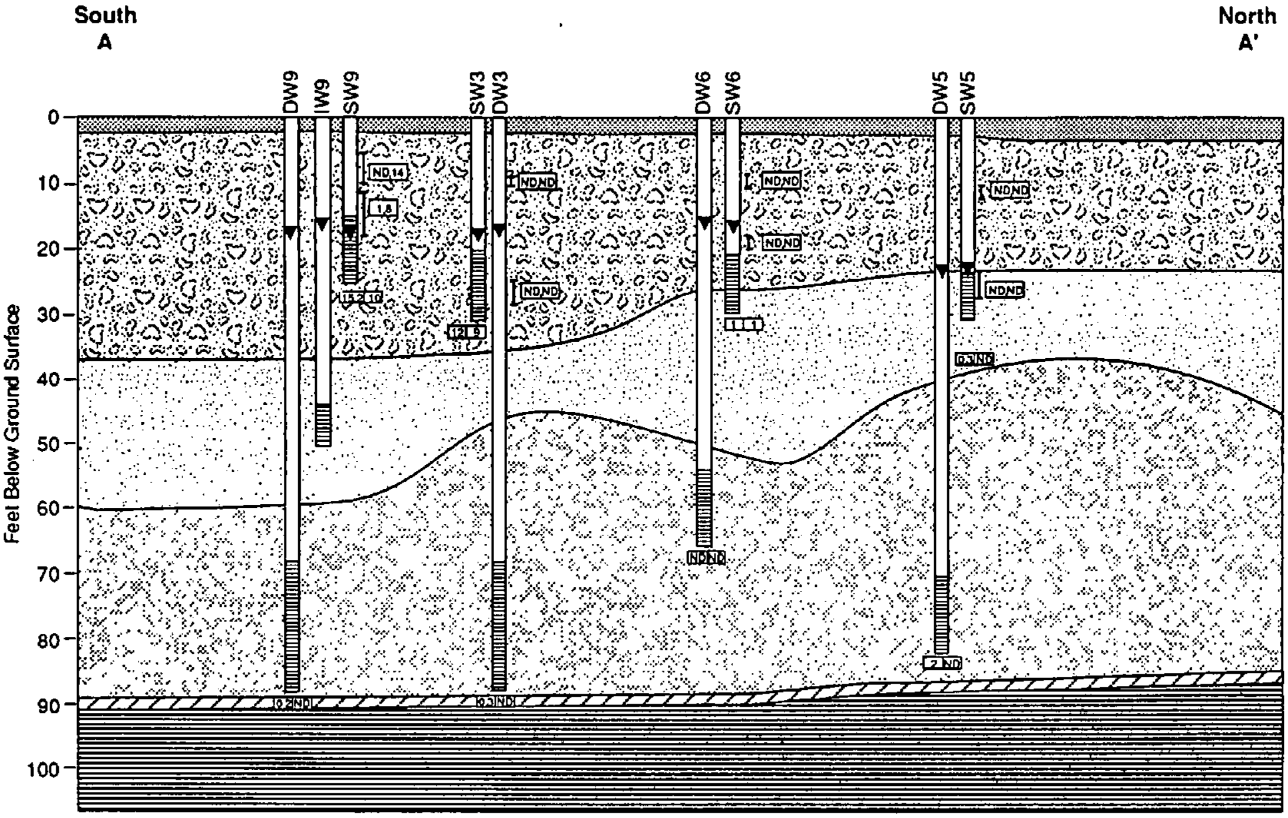
–·–·–·– – AFP 59 Property Boundary

X———X – Fence

EARTH TECH

FIGURE 2-10

LOCATIONS OF CROSS SECTIONS A-A' AND B-B'



Explanation

- ▒ Fill
- ▨ Glacial Outwash Deposits
- ░ Fine-Grained Deposits
- ▧ Potential Lakebed Deposits
- ▨ Ice-Contact Deposits
- ▨ Glacial Till
- ☰ Bedrock
- ▼ Water Level Measured January 11-13, 1992

15.2 | 10 — 1,1,1-TCA and TCE groundwater concentration µg/L, respectively.

I ND,14 — 1,1,1-TCA and TCE soil concentration in µg/kg, respectively. Brackets indicate the depth of soil sample.

Note: Not to Scale

Note: Contaminant concentrations are from the Supplemental Site Inspection (ANL 1994).

ND = Not Detected

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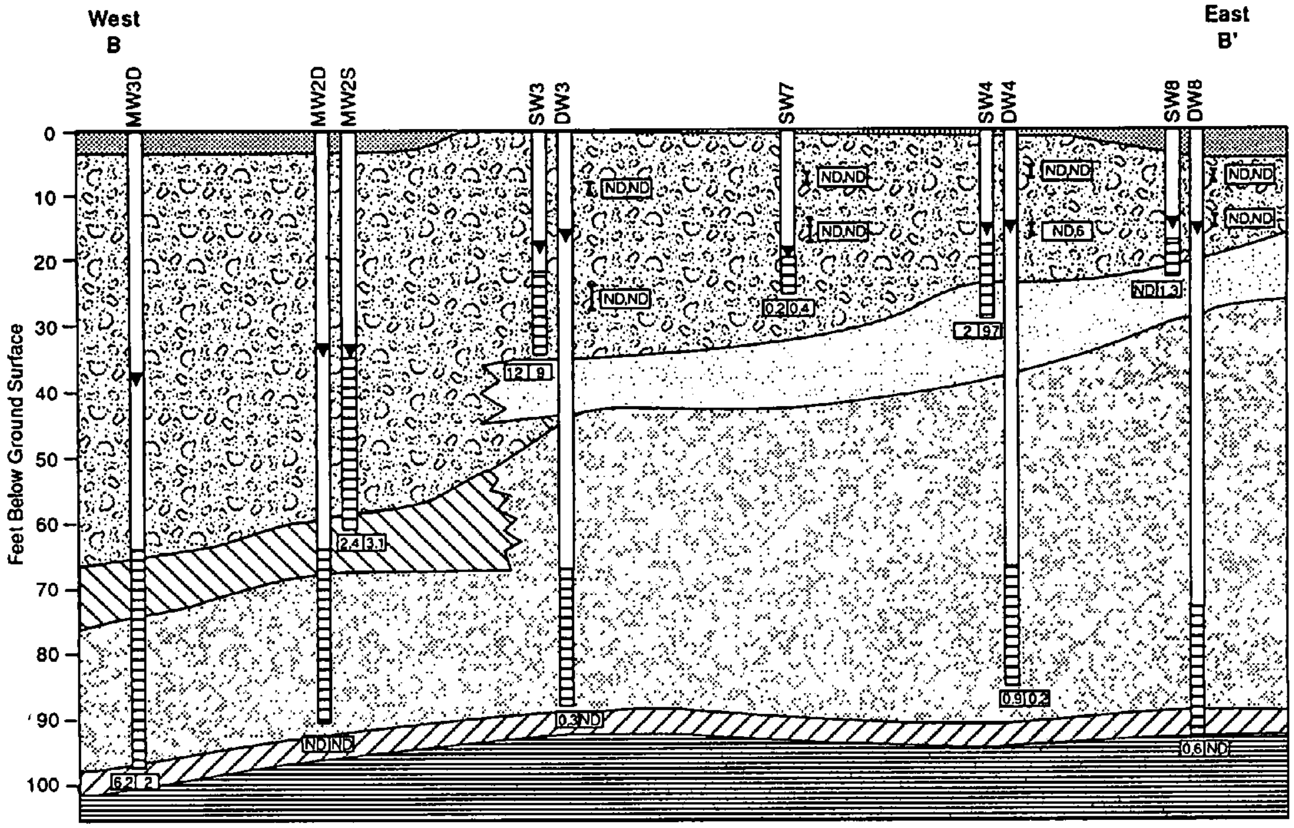
FIGURE 2-11

Cross Section A-A'

Fig Cross Sec. A-A



Explanation

- ▒ Fill
- ▨ Glacial Outwash Deposits
- ☐ Fine-Grained Deposits
- ▧ Potential Lakebed Deposits
- ▨ Ice-Contact Deposits
- ▨ Glacial Till
- ▤ Bedrock
- ▼ Water Level Measured January 11-13, 1992 for DW & SW Wells and December 18, 1992 for MW Wells

| 6.2 | 2 | 1,1,1-TCA and TCE groundwater concentration in µg/L, respectively.

I | ND, 6 | 1,1,1-TCA and TCE soil concentration in µg/kg, respectively. Brackets indicate the depth of soil sample.

Note: Not to Scale

Note: Contaminant concentrations are from the Supplemental Site Inspection (ANL 1994), except for MW3D, MW2D, and MW2S which are from the Contaminant Source Investigation, (URS 1993).

ND = Not Detected

EARTH TECH

FIGURE 2-12

Cross Section B-B'

TABLE 2-5
AFP 59 CONCEPTUAL SITE MODEL - SOIL

Site Identification[1]	Site Description[2]	Background Concentrations[3]		Soil Contaminants[4]		Migration Pathways	Exposed Population[5]	Risk Estimate[6]
		Compound	Range of Concentration	Compound	Maximum Concentration			
				ORGANICS (μg/kg)				
AFP 59	AFP 59	Methylene Chloride	ND	Methylene Chloride	37	1. Surface runoff 2. Leaching to ground-water	See note.	See note.
		Acetone	ND	Acetone	12			
		1,1,1-Trichloroethane	ND	1,1,1-Trichloroethane	1			
		Trichloroethene	ND	Trichloroethene	14			
		Phenol	ND	Phenol	250			
		2-Chlorophenol	ND	2-Chlorophenol	110			
		4-Methylphenol	ND	4-Methylphenol	210			
		2,4-Dimethylphenol	ND	2,4-Dimethylphenol	100			
		Naphthalene	ND	Naphthalene	4,200			
		4-Chloro-3-methylphenol	ND	4-Chloro-3-methylphenol	100			
		2-Methylnaphthalene	ND	2-Methylnaphthalene	1,400			
		Acenaphthylene	ND	Acenaphthylene	280			
		Acenaphthene	ND	Acenaphthene	1,900			
		Dibenzofuran	ND	Dibenzofuran	2,100			
		Fluorene	ND	Fluorene	2,900			
		Phenanthrene	ND-160	Phenanthrene	9,800			

TABLE 2-5
AFP 59 CONCEPTUAL SITE MODEL - SOIL

Continued

Site Identification[1]	Site Description[2]	Background Concentrations[3]		Soil Contaminants[4]		Migration Pathways	Exposed Population[5]	Risk Estimate[6]
		Compound	Range of Concentration	Compound	Maximum Concentration			
		Anthracene	ND-17	Anthracene	2,800			
		Di-n-butylphthalate	ND-260	Di-n-butylphthalate	410			
		Fluoranthene	ND-140	Fluoranthene	9,900			
		Pyrene	ND-110	Pyrene	9,100			
		Benzo(a)anthracene	ND	Benzo(a)anthracene	5,300			
		Bis(2-ethylhexyl)phthalate	ND	Bis(2-ethylhexyl)phthalate	11,000			
		Chrysene	ND	Chrysene	4,900			
		Benzo(b)fluoranthene	ND	Benzo(b)fluoranthene	5,200			
		Benzo(k)fluoranthene	ND	Benzo(k)fluoranthene	1,900			
		Benzo(a)pyrene	ND	Benzo(a)pyrene	3,700			
		Indeno(1,2,3-cd)pyrene	ND	Indeno(1,2,3-cd)pyrene	1,600			
		Dibenzo(a,h)anthracene	ND	Dibenz(a,h)anthracene	440			
		Benzo(g,h,i)perylene	ND	Benzo(g,h,i)perylene	1,700			
		Aldrin	ND-9.2	Aldrin	ND			
		Arochlor-1260	ND	Arochlor-1260	130			
		4,4'-DDE	ND	4,4'-DDE	6			
		Endosulfan II	ND	Endosulfan II	84			
		Gamma-Chlordane	ND	Gamma-Chlordane	24			
		Heptachlor Epoxide	ND	Heptachlor Epoxide	84			

TABLE 2-5
AFP 59 CONCEPTUAL SITE MODEL - SOIL

Continued

Site Identification[1]	Site Description[2]	Background Concentrations[3]		Soil Contaminants[4]		Migration Pathways	Exposed Population[5]	Risk Estimate[6]
		Compound	Range of Concentration	Compound	Maximum Concentration			
INORGANICS (mg/kg)								
		Arsenic	3.2-5.5	Arsenic	10.2			
		Barium	23.5-54.3	Barium	109			
		Beryllium	ND	Beryllium	0.97			
		Cadmium	ND	Cadmium	7.5			
		Calcium	307-52,200	Calcium	80,400			
		Chromium	8.3-16.4	Chromium	428			
		Cobalt	6.9-10.9	Cobalt	13.3			
		Copper	13.7-15.0	Copper	85.9			
		Iron	13,600-22,800	Iron	28,400			
		Lead	5.2-10.8	Lead	572			
		Magnesium	3,230-5,240	Magnesium	10,800			
		Manganese	401-533	Manganese	2,110			
		Mercury	ND	Mercury	0.13			
		Nickel	13.0-19.2	Nickel	124			
		Potassium	537-695	Potassium	1,520			
		Selenium	ND	Selenium	0.4			
		Silver	ND	Silver	2.8			
		Sodium	ND	Sodium	578			

TABLE 2-5
AFP 59 CONCEPTUAL SITE MODEL - SOIL

Continued

Site Identification[1]	Site Description[2]	Background Concentrations[3]		Soil Contaminants[4]		Migration Pathways	Exposed Population[5]	Risk Estimate[6]
		Compound	Range of Concentration	Compound	Maximum Concentration			
		Thallium	ND	Thallium	0.67			
		Vanadium	11-14	Vanadium	75.2			
		Zinc	41.8-73.5	Zinc	109			
		Cyanide	ND	Cyanide	7.9			

Key:
mg/kg = Milligrams per kilogram
μg/kg = Micrograms per kilogram
ND = Not Detected

Note:
(1) For purposes of the RI, the entire facility is being considered a single zone.
(2) Descriptions of all identified sites at the facility are provided in Section 1.2.4.
(3) Background concentrations were obtained from the SSI (ANL, 1994).
(4) Only contaminants identified as exceeding background are included. Maximum concentrations were obtained from the SSI (ANL, 1994).
(5) Potential receptors cannot be identified based on existing information.
(6) Risk estimates cannot be determined based on existing information.

TABLE 2-6
AFP 59 CONCEPTUAL SITE MODEL - GROUNDWATER

Site Identification[1]	Site Description[2]	Local Background Concentrations[3]		Groundwater Contaminants[4]		Migration Pathways	Exposed Population[5]	Risk Estimate[6]
		Compound	Range of Concentration (μg/L)	Compound	Maximum Concentration (μg/L)			
AFP 59	AFP 59	Methylene Chloride	ND	Methylene Chloride	4	1. Horizontal and Vertical Flow	See note.	See note.
		Acetone	ND	Acetone	35			
		1,1-Dichloroethene	ND	1,1-Dichloroethene	0.3			
		1,1-Dichloroethane	ND	1,1-Dichloroethane	5			
		Chloroform	ND	Chloroform	0.3			
		1,1,1-Trichloroethane	0.5-0.6	1,1,1-Trichloroethane	15.2			
		Trichloroethene	ND	Trichloroethene	97			
		Dibromochloromethane	ND-0.2	Dibromochloromethane	0.3			
		Bromoform	ND-0.3	Bromoform	0.6			
		Tetrachloroethene	ND	Tetrachloroethene	0.2			
		Toluene	ND-0.2	Toluene	0.3			
		Styrene	ND	Styrene	0.1			
		Xylene	ND	Xylene	0.4			
		Aluminum	152-1,000	Aluminum	19,800			
		Antimony	ND	Antimony	28.5			
		Arsenic	ND	Arsenic	6.7			
		Barium	71-122	Barium	211			
		Beryllium	ND	Beryllium	3			
		Cadmium	ND-8	Cadmium	14			
		Calcium	93,900-168,000	Calcium	186,000			
		Chromium	ND-17	Chromium	63			

TABLE 2-6
AFP 59 CONCEPTUAL SITE MODEL - GROUNDWATER

Continued

Site Identification[1]	Site Description[2]	Local Background Concentrations[3]		Groundwater Contaminants[4]		Migration Pathways	Exposed Population[5]	Risk Estimate[6]
		Compound	Range of Concentration (µg/L)	Compound	Maximum Concentration (µg/L)			
		Cobalt	ND	Cobalt	24			
		Copper	ND-9	Copper	26			
		Iron	151-1,970	Iron	26,700			
		Lead	1.5-5.5	Lead	14.6			
		Magnesium	22,400-31,400	Magnesium	36,600			
		Manganese	40-255	Manganese	4,400			
		Mercury	ND	Mercury	0.11			
		Nickel	ND	Nickel	115			
		Potassium	2,380-7,630	Potassium	50,300			
		Selenium	ND-1.6	Selenium	2.1			
		Vanadium	ND	Vanadium	72			
		Zinc	ND-92	Zinc	195			

Key:

µg/L	=	Micrograms per liter
ND	=	Not Detected

Note:

(1) For purposes of the RI, the entire facility is being considered a single zone.
(2) Descriptions of all identified sites at the facility are provided in Section 1.2.4.
(3) Background concentrations were obtained from the SSI (ANL, 1994).
(4) Only contaminants identified as exceeding background are included. Maximum concentrations were obtained from the SSI (ANL, 1994).
(5) Potential receptors cannot be identified based on existing information.
(6) Risk estimates cannot be determined based on existing information.

TABLE 2-7
AFP 59 CONCEPTUAL SITE MODEL - SEDIMENT

Site Identification[1]	Site Description[2]	Local Background Concentrations[3]		Sediment Contaminants[4]		Migration Pathways	Exposed Population[5]	Risk Estimate[6]
		Compound	Background Concentration	Compound	Maximum Concentration			
				ORGANICS (μg/kg)				
AFP 59	AFP 59	Methylene Chloride	ND	Methylene Chloride	8	1. Suspension in surface water	See note.	See note.
		Naphthalene	ND	Naphthalene	270			
		2-Methylnaphthalene	ND	2-Methylnaphthalene	110			
		Acenaphthene	ND	Acenaphthene	380			
		Dibenzofuran	ND	Dibenzofuran	230			
		Fluorene	ND	Fluorene	430			
		Phenanthrene	ND	Phenanthrene	2,300			
		Anthracene	ND	Anthracene	520			
		Di-n-butylphthalate	270	Di-n-butylphthalate	300			
		Fluoranthene	150	Fluoranthene	2,200			
		Pyrene	ND	Pyrene	1,800			
		Bis(2-ethylhexyl)phthalate	210	Bis(2-ethylhexyl)phthalate	210			
		Chrysene	ND	Chrysene	790			
		Benzo(b)fluoranthene	ND	Benzo(b)fluoranthene	830			
		Benzo(k)fluoranthene	ND	Benzo(k)fluoranthene	330			
		Benzo(a)pyrene	ND	Benzo(a)pyrene	610			
		Indeno(1,2,3-cd)pyrene	ND	Indeno(1,2,3-cd)pyrene	190			
		Benzo(g,h,i)perylene	ND	Benzo(g,h,i)perylene	190			
		Aldrin	8.8	Aldrin	18			

TABLE 2-7
AFP 59 CONCEPTUAL SITE MODEL - SEDIMENT

Continued

Site Identification[1]	Site Description[2]	Local Background Concentrations[3]		Sediment Contaminants[4]		Migration Pathways	Exposed Population[5]	Risk Estimate[6]
		Compound	Background Concentration	Compound	Maximum Concentration			
INORGANICS (mg/kg)								
		Copper	16.5	Copper	20.5			
		Mercury	0.07	Mercury	0.08			
		Sodium	72.4	Sodium	82			

Key:
mg/kg = Milligrams per kilogram
μg/kg = Micrograms per kilogram
ND = Not Detected

Note:
(1) For purposes of the RI, the entire facility is being considered a single zone.
(2) Descriptions of all identified sites at the facility are provided in Section 1.2.4.
(3) Background concentrations were obtained from the SSI (ANL, 1994).
(4) Only contaminants identified as exceeding background are included. Maximum concentrations were obtained from the SSI (ANL, 1994).
(5) Potential receptors cannot be identified based on existing information.
(6) Risk estimates cannot be determined based on existing information.

TABLE 2-8
AFP 59 CONCEPTUAL SITE MODEL - SURFACE WATER

Site Identification(1)	Site Description(2)	Local Background Concentrations(3)		Surface Water Contaminants(4)		Migration Pathways	Exposed Population(5)	Risk Estimate(6)
		Compound	Background Concentration (μg/L)	Compound	Maximum Concentration (μg/L)			
AFP 59	AFP 59	Aluminum	122	Aluminum	136	1. Discharge to Susquehanna River 2. Recharge to aquifer	See note.	See note.
		Calcium	33,400	Calcium	345,400			
		Iron	145	Iron	183			
		Manganese	13	Manganese	40			
		Mercury	ND	Mercury	4.9			

Key:
μg/L = Micrograms per liter
ND = Not Detected

Note:
(1) For purposes of the RI, the entire facility is being considered a single zone.
(2) Descriptions of all identified sites at the facility are provided in Section 1.2.4.
(3) Background concentrations were obtained from the SSI (ANL, 1994).
(4) Only contaminants identified as exceeding background are included. Maximum concentrations were obtained from the SSI (ANL, 1994).
(5) Potential receptors cannot be identified based on existing information.
(6) Risk estimates cannot be determined based on existing information.

TABLE 2-9
AFP 59 CONCEPTUAL SITE MODEL - OUTFALLS

Site Identification[1]	Site Description[2]	Local Background Concentrations[3]		Outfall Contaminants[4]		Migration Pathways	Exposed Population[5]	Risk Estimate[6]
		Compound	Range of Concentration (μg/L)	Compound	Maximum Concentration (μg/L)			
AFP 59	AFP 59	Acetone	NA	Acetone	17	1. Discharge to Little Choconut Creek	See note.	See note.
		1,1,1-Trichloroethane	NA	1,1,1-Trichloroethane	0.6			
		Trichloroethene	NA	Trichloroethene	4			
		Bromoform	NA	Bromoform	0.4			
		Fluoranthene	NA	Fluoranthene	4			
		Pyrene	NA	Pyrene	3			
		Bis(2-ethylhexyl)phthalate	NA	Bis(2-ethylhexyl)phthalate	8			
		Chrysene	NA	Chrysene	2			
		Aluminum	NA	Aluminum	399			
		Barium	NA	Barium	94			
		Calcium	NA	Calcium	99,100			
		Chromium	NA	Chromium	6			
		Iron	NA	Iron	310			
		Lead	NA	Lead	5.3			
		Magnesium	NA	Magnesium	21,400			
		Manganese	NA	Manganese	168			
		Potassium	NA	Potassium	2,010			

TABLE 2-9
AFP 59 CONCEPTUAL SITE MODEL - OUTFALLS

Continued

Site Identification[1]	Site Description[2]	Local Background Concentrations[3]		Outfall Contaminants[4]		Migration Pathways	Exposed Population[5]	Risk Estimate[6]
		Compound	Range of Concentration ($\mu g/L$)	Compound	Maximum Concentration ($\mu g/L$)			
		Selenium	NA	Selenium	1.1			
		Silver	NA	Silver	5			
		Sodium	NA	Sodium	57,200			
		Zinc	NA	Zinc	93			

Key: $\mu g/L$ = Micrograms per liter
NA = Not Applicable, no background samples exist for the outfalls

Note:
(1) For purposes of the RI, the entire facility is being considered a single zone.
(2) Descriptions of all identified sites at the facility are provided in Section 1.2.4.
(3) No background concentrations are available for the outfalls.
(4) All analytes detected are included. Maximum concentrations were obtained from the SSI (ANL, 1994).
(5) Potential receptors cannot be identified based on existing information.
(6) Risk estimates cannot be determined based on existing information.

eliminated from the background data for this conceptual site model since the sample may not be lithologically comparable to subsurface samples collected during drilling. The background results from DW1 are summarized in Table 2-5. No VOCs were detected in the background soil samples. SVOCs, metals, and aldrin were detected in background subsurface soil samples.

Contaminants detected in subsurface soil samples collected from monitoring well borings or soil borings installed during the SSI are listed in Table 2-5 with the maximum concentration detected. All VOCs and SVOCs detected were determined to exceed background conditions. TCE and 1,1,1-TCA were the only chlorinated VOCs detected in soil samples. Acetone and methylene chloride were also detected in soil samples, but they are common laboratory contaminants and their presence must be confirmed. The distribution of chlorinated VOCs detected in soil samples at the site is shown in Figures 2-11 and 2-12. Numerous SVOCs were detected at the site; their presence has not been correlated with specific past activities at the site, and may be related to the emplacement of the asphalt parking lot. Elevated concentrations of metals that could be associated with past activities at the plant were detected primarily in the vicinity of the plating room.

Groundwater. During the SSI, background groundwater samples were collected onsite from monitoring well clusters 1 and 8, which were considered hydraulically upgradient of the facility. However, since contaminated soils were identified at well cluster 8, and since well cluster 8 is in the immediate vicinity of potential sources (former USTs and drain lines), only the results from well cluster 1 have been considered representative of background groundwater conditions for this conceptual site model. The background groundwater results obtained during the SSI are summarized in Table 2-6. Both background groundwater samples contained 1,1,1-TCA with the maximum concentration of 0.6 μg/L. Other VOCs detected in background groundwater samples at concentrations less than 1 μg/L include dibromochloromethane, bromoform, and toluene. Inorganic compounds detected in background samples include aluminum, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, potassium, selenium, and zinc.

Contaminants detected in groundwater samples collected onsite during the SSI are listed in Table 2-6 with the maximum concentration detected. All VOCs and SVOCs detected were determined to exceed background conditions. Chlorinated compounds were detected across the site, with the maximum concentrations near the plating room and in the southwest corner of the plant (see Figures 2-10 through 2-12). No SVOCs or pesticides/PCBs were detected in any of the groundwater samples. Metals were detected in groundwater samples throughout the site at concentrations exceeding background. The presence of metals at elevated concentrations has not been confirmed, however, since: 1) background concentrations are based on one well cluster and may not fully represent actual background conditions; and 2) groundwater samples were often turbid and the elevated metals concentrations in the samples may represent the metals content of the suspended sediment rather than groundwater.

Sediment. Regional background sediment and surface water samples were collected during the SSI from a location upgradient of Johnson City near the source of the creek to represent conditions unaffected by industry or other activities in the Johnson City area. VOCs, SVOCs, and pesticides/PCBs were not detected in the regional background sample. Local background sediment and surface water samples were collected from a location immediately upgradient of the AFP 59 outfalls, near the southeast corner of the plant boundary to represent conditions impacted by activities in the Johnson City area but not the plant. Local background sediment results are provided in Table 2-7. SVOCs, metals, and aldrin were detected in the local background sediment sample. No VOCs were detected in the local background sample.

Contaminants which have been identified as exceeding background concentrations in sediments are included in Table 2-7. Methylene chloride, a common laboratory contaminant, was the only VOC detected in the sediment sample collected downgradient of AFP 59. Several SVOCs were detected at concentrations greater than local background (see Table 2-7). Bis(2-ethylhexyl) phthalate was detected at a concentration equivalent to the background concentration, but is included on Table 2-7 for comparison. Copper, mercury, and sodium were the only metals that were determined to be above background in the sediment sample.

Surface Water. Inorganics were the only analytes detected in the local and regional background surface water samples and the downgradient surface water sample. The results are summarized in Table 2-8. Only metals which have been identified as exceeding background concentrations are included.

Water samples were also collected from Outfalls 001 and 002. There are no applicable background concentrations for the outfall samples. All analytes detected in the outfall samples are therefore provided in Table 2-9. The chlorinated compounds TCE and 1,1,1-TCA were detected in the outfall samples. SVOCs and metals were also detected (see Table 2-9).

2.3.2 Source Characterization

Potential source areas have been identified based on the results of the previous investigations at AFP 59. These sites are described in Section 1.2.4 and shown in Figure 1-4. The potential sources and areas where contamination has been identified are primarily located in the area south of the manufacturing building. Hazardous materials historically used or stored at AFP 59 are described in Section 2.2.1.1.

2.3.3 Potential Migration Pathways

Potential migration pathways are identified below, treating the southern portion of the plant as the zone of contamination. Migration pathways from specific source areas of contamination will be identified as additional data become available.

Soil. Potential soil migration pathways include runoff in surface water from unpaved areas and contaminants leaching into groundwater. The plant is primarily paved or covered by buildings and therefore little surface runoff is expected. The areas where runoff might occur are not immediately adjacent to identified potential source areas and therefore are not expected to be contaminated. Leaching of contaminants into groundwater may be inhibited by the limited surface infiltration of water due to the covered surface area; however, vertical migration of contaminants due to soil leaching is still considered a potential migration pathway. Contaminant migration might also be possible along conduits provided by drains and piping even with the reduced surface infiltration in paved areas.

Groundwater. Potential migration of contaminated groundwater from AFP 59 is a concern since the facility is located approximately 1,000 feet from the Camden Street Wellfield, a municipal water supply for Johnson City. The Clinton Street-Ballpark aquifer has been designated a sole-source aquifer by the USEPA due to its importance to the residents of the area. Parameters affecting groundwater transport, including flow directions and contaminant source areas, have not been fully characterized.

Surface Water. Surface water runoff at AFP 59 is discharged to Little Choconut Creek via two permitted outfalls. The creek in turn discharges to the Susquehanna River. Both the creek and the river are presumed to recharge the aquifer. Contaminants present in the storm drainage system could potentially migrate to surface water in the vicinity of the facility.

Air. Most of AFP 59 is either paved or covered by buildings. Therefore migration of contaminants to the air from the soil is considered an incomplete pathway.

2.3.4 Potential Receptors

Since source areas and migration pathways have not yet been defined for AFP 59, human and/or ecological contaminant receptors cannot be identified. However, potential types of human receptors include people exposed to contaminated media through the following routes:

- Ingestion of soil, groundwater, and/or surface water
- Direct contact with soil, groundwater, and/or surface water
- Inhalation of VOCs while showering.

2.3.5 Concentrations at Receptors

Concentrations at receptors cannot be estimated based on the existing information since complete migration pathways and source areas have not been defined.

2.4 Remedial Action

Remedial action objectives and preliminary alternatives for the facility will be addressed as part of a feasibility study. This Work Plan applies to activities to be conducted during the RI.

2.5 Applicable or Relevant and Appropriate Requirements

Section 121 of CERCLA requires that site cleanups comply with Federal ARARs or state ARARs in cases where these requirements are more stringent than federal requirements. 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.

In addition to ARARs, non-promulgated 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.

ARARs fall into the following three broad categories, based on the site characteristics, chemicals present, and remedial alternatives for cleanup.

Chemical-specific ARARs include those environmental laws and regulations which 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. See Preamble to Proposed NCP, 53 Federal Register at 51437. Chemical-specific ARARs are triggered by the specific chemical contaminants found at a particular site. Federal and State of New York chemical-specific ARARs that are relevant to AFP 59 are listed in Table 2-10. Federal and New York State chemical-specific TBCs that may be relevant to AFP 59 are listed in Table 2-11.

Federal primary and secondary MCLs were obtained from a variety of sources as listed in the footnotes in Tables 2-10 and 2-11. The New York State chemical-specific standards and guidance were obtained from Water Quality Regulations: Surface Water and Groundwater Classifications and Standards New York State Codes, Rules, and Regulations Title 6, Chapter X, Parts 700-705 (NYSDEC, 1991a). A memorandum concerning Division of Water Technical and Operational Guidance Series TOGS (1.1.1) Ambient Water Quality Standards and Guidance Values (NYSDEC, 1993a) outlines the regulations in Title 6, Chapter X, Parts 700-705 and was also used in preparing Tables 2-10 and 2-11. This document contained several types of standards: for individual chemical compounds; for a general group of compounds such as phenols; and for a group of compounds with the specific compounds listed (i.e., Aldrin and Dieldrin). Chemical compounds included in Tables 2-10 and 2-11 were selected from the conceptual site model tables (2-5 through 2-9).

The standards and guidance values listed in the TOGS (NYSDEC, 1993a) were developed for several water classes and types. The standards and guidance values obtained for Tables 2-10 and 2-11 were for groundwater (abbreviated GA in the regulations) and surface water Class C, since Little Choconut Creek is considered to be a Class C water by the State of New York. Different types of standards listed in the document included: Health (Water Source) - H(WS) for protection of sources of drinking water, Health (Bioaccumulation) - H(B) for protection of human consumers of fish, and Aquatic - A for protection of aquatic life and for wildlife consumers of fish. Standards and guidance values for each of these three types are included in Tables 2-10 and 2-11, although most standards listed in the table are for Health (Water Source). Where a standard or guidance value was not for H(WS), a footnote was indicated.

TABLE 2-10
FEDERAL AND NEW YORK STATE CHEMICAL-SPECIFIC ARARS FOR GROUNDWATER AND SURFACE WATER

Analyte	Federal Primary MCL	New York (7) Groundwater Standard	New York (7) Surface Water Standard
ORGANIC COMPOUNDS (μg/L)			
Aldrin		ND	0.001(25)(26)
Bis(2-ethylhexyl) phthalate	6(1)	50	0.6(13)
Benzo(a)pyrene	0.2(1)	ND	
Chlordane	2(2)	0.1	
Chloroform		7	
4-Chloro-3-methylphenol		1(8)	1.0(13)(15)
2-Chlorophenol		1(8)	1.0(13)(15)
4,4'-DDE		ND(9)	0.001(9)(13)
Dibromochloromethane	100		
Di-n-butylphthalate		50	
1,1-Dichloroethane		5	
1,1-Dichloroethene	7(3)	5	
2,4-Dimethylphenol		1(8)	5.0(13)(16)
Endosulfan II			0.009(13)
Gamma-Chlordane		0.1 (chlordane)	
Heptachlor Epoxide	0.2(2)	ND(10)	0.001(10)(13)
Methylene Chloride	5(1)	5	
4-Methylphenol		1(8)	5.0(13)(16)
Phenol		1(8)	5.0(13)(16)
Polychlorinated biphenyls	0.5(2)	0.1(11)	0.001(13)(11)
Styrene	100(2)	5	
Tetrachloroethene	5(6)	5	
Toluene	1,000(2)	5	
1,1,1-Trichloroethane	200(3)	5	
Trichloroethene	5(3)	5	
Xylene	10,000(2)	5(12)	
INORGANIC COMPOUNDS (mg/L)			
Aluminum			0.1(13)
Antimony	0.006(4)		
Arsenic	0.05	0.025	0.190(13)(17)
Barium	2.0(5)	1	
Beryllium	0.004(4)		0.011 or 1.1(13)(18)
Cadmium	0.005(6)	0.01	See note (19) and (13)
Chromium (hexavalent)	0.1(6)	0.05	0.011(13)
Cobalt			0.005(13)
Copper	1.3	0.2	See note (20) and (13)
Cyanide	0.2(1)	0.1	0.0052(21)(13)
Iron		0.3 and 0.5(14)	0.3(13)

TABLE 2-10
FEDERAL AND NEW YORK STATE CHEMICAL-SPECIFIC ARARS FOR GROUNDWATER AND SURFACE WATER

Continued

Analyte	Federal Primary MCL	New York (7) Groundwater Standard	New York (7) Surface Water Standard
Lead	0.015 (at tap)(6)	0.025	See note (22) and (13)
Manganese		0.3 and 0.5(14)	
Mercury	0.002(6)	0.002	
Nickel	0.1(4)		See note (23) and (13)
Selenium	0.05(6)	0.01	0.001(13)(24)
Silver	0.05(6)	0.05	0.0001(13) ionic silver
Sodium		20	
Thallium	0.002(4)		0.008(13)
Vanadium			0.014(13)
Zinc		0.3	0.03(13)

Note: ND = Not Detectable

(1) Phase V Rule, May 1992
(2) National Primary Drinking Water Regulations for 38 Inorganic and Synthetic Chemicals Factsheet, January 1991
(3) *Drinking Water Regulations Under the SDWA Factsheet, December 1990*
(4) U.S. CFR, July 17, 1992, 40 CFR Parts 141, 142, 143, National Primary Drinking Water Regulations
(5) U.S. CFR, July 1, 1991, 40 CFR Parts 141, 142, 143, National Primary Drinking Water Regulations
(6) U.S. Code of Federal Regulations (CFR), January 30, 1991, 40 CFR Parts 141, 142, 143, National Primary Drinking Water Regulations
(7) Water Quality Regulations: Surface Water and Groundwater Classifications and Standards New York State Codes, Rules, and Regulations Title 6, Chapter X, Parts 700-705 (NYSDEC, 1991a). All standards are for Health (Water Source) WS unless otherwise designated
(8) Standard applies to the sum of total phenols
(9) Standard applies to the sum of DDT, DDD, and DDE
(10) Standard applies to the sum of Heptachlor and Heptachlor Epoxide
(11) Standard applies to the sum of Polychlorinated biphenyls
(12) Standard applies to each xylene isomer (1,2-, 1,3-, and 1,4-) individually
(13) Aquatic (A) standard
(14) The first standard applies to iron only. The second standard applies to the sum of Iron and Manganese
(15) Standard applies to the sum of total chlorinated phenols
(16) Standard applies to the sum of total unchlorinated phenols
(17) Dissolved arsenic form only
(18) 0.011 mg/L when hardness is < or = to 75 ppm; 1.1 mg/L when hardness is >75 ppm
(19) *Standard = exp(0.7852[ln(ppm hardness)]-3.490)/1,000 mg/L*
(20) Standard = exp(0.8545[ln(ppm hardness)]-1.465)/1,000 mg/L
(21) Standard applies to the sum of total free cyanide (HCN and CN-)
(22) Standard = exp(1.266[ln(ppm hardness)]-4.661)/1,000 mg/L
(23) Standard = exp(0.76[ln(ppm hardness)]+1.06)/1,000 mg/L
(24) Aquatic Standard applies to acid-soluble form
(25) Health (Bioaccumulation) H(B) standard
(26) Standard applies to the sum of Aldrin and Dieldrin

TABLE 2-11
FEDERAL AND NEW YORK STATE CHEMICAL-SPECIFIC TBCs FOR GROUNDWATER AND SURFACE WATER

Analyte	Federal Secondary MCL	Surface Water Quality Criteria (3)	New York (4) Groundwater Guidance	New York (4) Surface Water Guidance
ORGANIC COMPOUNDS (µg/L)				
Acenaphthene		0.0028(7)	20	
Acetone			50	
Aldrin		0.000074		
Anthracene		0.0028(7)	50	
Benzo(a)anthracene		0.0028(7)	0.002	
Benzo(b)fluoranthene		0.0028(7)	0.002	
Benzo(k)fluoranthene		0.0028(7)	0.002	
Benzo(a)pyrene		0.0028(7)		0.0012(5)
Bromoform			50	
Chlordane		0.00046		0.002(5)
Chrysene		0.0028(7)	0.002	
Dibromochloromethane			50	
Di-n-butylphthalate		35,000		
Fluoranthene		42	50	
Fluorene		0.0028(7)	50	
Gamma-Chlordane		0.00046(chlordane)		0.002(5) (chlordane)
Indeno(1,2,3-cd)pyrene		0.0028(7)	0.002	
Naphthalene			10	
Phenanthrene		0.0028(7)	50	
Polychlorinated biphenyls		0.000079		6E-07(5)(6)
Pyrene		0.0028(7)	50	
Tetrachloroethene		0.8		1(5)
Toluene		14,300		
1,1,1-Trichloroethane		18,400		
Trichloroethene		2.7		11(5)
INORGANIC COMPOUNDS (mg/L)				
Aluminum	0.05 to 0.2(1)			
Antimony		0.146	0.003	
Arsenic		2.2E-06		
Barium		1		
Beryllium		6.8E-06	0.003	
Cadmium		0.01		

TABLE 2-11
FEDERAL AND NEW YORK STATE CHEMICAL-SPECIFIC TBCs FOR GROUNDWATER AND SURFACE WATER

Continued

Analyte	Federal Secondary MCL	Surface Water Quality Criteria (3)	New York (4) Groundwater Guidance	New York (4) Surface Water Guidance
Chromium (hexavalent)		0.05		
Copper	1.0[1]			
Cyanide		0.2		
Iron	0.3[1]	0.3		
Lead		0.05		
Magnesium			35	
Manganese	0.05[1]	0.05		
Mercury		0.000144		0.0002[5]
Nickel		0.0134		
Selenium		0.01		
Silver	0.1[2]	0.05		
Thallium		0.013	0.004	
Zinc	5.0[1]			

Note: ND = Not Detectable

(1) U.S. CFR, July 1, 1991, 40 CFR Part 143, National Primary Drinking Water Regulations
(2) USEPA National Secondary Drinking Water Regulations, July 1, 1991
(3) USEPA, Water Quality Criteria for Protection of Human Health (USEPA, 1986). Guidance for water and fish ingestion.
(4) Water Quality Regulations: Surface Water and Groundwater Classifications and Standards New York State Codes, Rules, and Regulations Title 6, Chapter X, Parts 700-705 (NYSDEC, 1991a). All guidance values are for Health (Water Source) WS unless otherwise designated
(5) Health (Bioaccumulation) H(B) guidance value
(6) Guidance applies to the sum of Polychlorinated biphenyls
(7) Guidance applies to all Polycyclic Aromatic Hydrocarbons (PAHs) except if a specific value is listed for that substance.

A general groundwater standard which is also given in the New York State water quality regulations applies individually to an unlimited number of substances in six chemical classes. This standard is the Principal Organic Contaminant (POC) standard. The POC standard is 5 μg/L and is applied to a substance if it meets the criteria listed in the NYSDEC TOGS. If a particular substance has a listed groundwater standard or guidance value, then the POC standard is not used. If the substance does not have a listed standard or guidance value but is listed as a substance regulated by the POC, the POC standard applies. If the substance does not have a listed groundwater standard or guidance value but is listed as a substance not regulated by the POC, then the POC standard does not apply. If none of these three cases apply, then the substance must be compared with the definitions of individual POC classes to determine if the POC standard applies. Tables 2-10 and 2-11 do not contain any substances to which the POC standard applies. Substances which did not have a POC standard, listed standard, or guidance value were not listed in Tables 2-10 or 2-11.

Federal and New York State chemical-specific TBCs are listed in Table 2-11. These TBCs include the Federal secondary MCL, surface water quality criteria for protection of human health as set by the USEPA (USEPA, 1986), New York groundwater guidance values (NYSDEC, 1991a), and New York surface water guidance values (NYSDEC, 1991a). Other TBCs which were not listed in Table 2-11 are guidance values for sediments contained in Technical Guidance for Screening Contaminated Sediments (NYSDEC, 1993b) and guidance values for soil contained in a memorandum by the NYSDEC on Determination of Soil Cleanup Objectives and Cleanup Levels (NYSDEC, 1994). The soil and sediment guidance criteria were not included in Table 2-11 because guidance values were based on the fraction of organic carbon in the soil or sediment and therefore these criteria are site-specific.

Location-specific ARARs govern activities in certain environmentally sensitive areas. Examples of location-specific ARARs include:

- Endangered Species Act (50 CFR 16 United States Code (USC), Section 1531, Parts 12 and 17.11)
- Executive Order on Flood Plain Management (Executive Order No. 11988)
- National Historic Preservation Act (16 USC Section 470 et seq. 36 CFR Part 800)
- Clean Water Act, Section 404(b)(1) and Executive Order 11990 "Protection of Wetlands" (40 CFR Section 230.10 and Executive Order 11990)
- Freshwater Wetlands Act and implementing regulations (Article 24 ECL, 6 NYCRR Parts 663 and 664)
- Tidal Wetlands Act (Article 25ECL, 6 NYCRR Part 661)
- Laws and regulations regulating streams and navigable water bodies (Article 15 ECL, 6 NYCRR Part 608).

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 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)
- National Pollutant Discharge Elimination System (40 CFR Parts 122-125)
- Statement of Policy on Control of Air Stripper Emissions (OSWER Directive 9355.028)
- RCRA: Standards for Interim Status Facilities (40 CFR Part 265); Standards Applicable to Transporters of Hazardous Waste (40 CFR Part 263); Land Disposal Restrictions (40 CFR Part 268); Underground Injection Control Program (40 CFR Parts 144-146); New Source Performance Standards (Clean Air Act, Section III).

2.6 Data Needs

Data gaps have been identified based on a review of the existing conceptual site model. The data gaps are summarized below for each medium at the installation.

Groundwater Data Gaps

- Source and extent of chlorinated and petroleum hydrocarbon contamination
- Presence of metals contamination
- Background conditions
- Migration potential between shallow and deep zones of aquifer (vertical migration)
- Offsite migration potential (horizontal migration)
- Regional potentiometric surface and groundwater flow directions.

Sediment and Surface Water Data Gaps

- Impact of installation activities on Little Choconut Creek
- Interconnection between surface water and groundwater.

Soil Data Gaps

- Nature and extent of subsurface soil contamination
- Source of contamination
- Background
- Extent and continuity of lithologic units.

SECTION 3.0

REMEDIAL INVESTIGATION TASKS

The AFP 59 RI activities and the rationale for these activities are described in the following sections. Details of field investigation procedures, sampling methodologies, chain of custody requirements, equipment calibrations, and analytical procedures required for completion of the activities described in this Work Plan are presented in the SAP.

3.1 Site Objectives

The project objectives for the RI are described in Section 1.3.1, and specific data gaps are identified in Section 2.6. The planned field activities for the RI will address these data needs. Additionally, the RI activities will allow further site characterization and completion of a quantitative risk assessment.

Earth Tech will conduct the field investigation using a phased approach in order to efficiently characterize the site. The first phase of the investigation, a Reconnaissance Survey of AFP 59, will consist of: a geophysical clearance survey; soil and groundwater sampling; onsite analyses for screening; offsite analyses for site characterization; water level measurements in existing monitoring wells; and groundwater quality screening at selected existing monitoring wells. A geophysical survey will be conducted to locate subsurface utilities prior to sampling. Soil and groundwater samples will be collected using a direct push sampling technique and analyzed at an onsite mobile laboratory for VOCs. The screening data will be used to locate potential source areas and delineate areas of contamination. The grid spacing for sampling can be modified as the field program progresses to provide more detailed information in any areas where contamination is identified. Selected soil samples will also be sent offsite for analysis at a fixed laboratory to provide data for site characterization, including definition of background. Groundwater samples from select existing monitoring wells will also be analyzed onsite during the first phase to obtain screening data on the existing groundwater quality. A synoptic round of water level measurements will be obtained to generate a potentiometric map and determine groundwater flow directions.

The data collected during the Reconnaissance Survey will be analyzed to determine optimal locations to install monitoring wells and obtain additional soil and groundwater samples. Groundwater monitoring wells will be installed during the second phase of the field program to define the extent of contamination, provide reproducible sampling locations, and define the subsurface hydrogeology. Clusters of monitoring wells consisting of a shallow well screened in the outwash deposits and a deep well screened in the ice-contact deposits will be installed. Where fine-grained lakebed deposits separate the two units an intermediate depth well will be installed and screened immediately above the lakebed deposits. Soil samples will be collected continuously from the surface through the lakebed deposits when drilling the deep wells to observe the subsurface lithology. Samples collected for chemical analysis will be obtained while drilling the shallow wells and from soil borings. Soil samples will be analyzed for VOCs (SW8260), SVOCs (SW8270), pesticides/PCBs (SW8080), ICP metals (SW6010), arsenic (SW7060), lead (SW7421), mercury (SW7471), selenium (SW7740), thallium (SW7841), cyanide (SW9010), percent moisture (ASTM D2216), and TOC (SW9060). Groundwater from existing wells and all newly installed monitoring wells will be sampled and analyzed for VOCs (SW8260), SVOCs (SW8270), pesticides/PCBs (SW8080), ICP metals (SW6010), arsenic (SW7060), lead (SW7420), mercury (SW7470), selenium (SW7740), thallium (SW7841), cyanide (SW9010), and hardness (E130.1). A synoptic round of water level measurements will be obtained from all onsite wells. An aquifer pump test will be conducted to determine the degree of interconnection between the upper and lower zones of the aquifer.

Sediment and surface water samples will be collected from Little Choconut Creek to determine the impact of installation activities on the creek. Samples will be analyzed for VOCs (SW8260), SVOCs (SW8270), pesticides/PCBs (SW8080), ICP metals (SW6010), arsenic (SW7060), lead (SW7420/7421), mercury (SW7470/7471), selenium (SW7740), thallium (SW7841), and cyanide (SW9010). Additionally, surface water samples will be analyzed for hardness (E130.1), and sediment samples will be analyzed for percent total organic carbon (SW9060) and percent moisture (ASTM D2216). A Fish and Wildlife Impact Analysis (NYSDEC, 1991b) will be conducted through at least Step IIB.

3.2 Field Investigation

The objectives of the RI will be achieved through the field investigation which will include the following activities: a geophysical survey, direct push soil and groundwater sampling, subsurface soil sampling, monitoring well installation and development, groundwater sampling, surface water sampling, sediment sampling, groundwater level measurements, aquifer testing, and a fish and wildlife impact analysis.

3.2.1 Field Tasks

Brief descriptions of each of the field tasks to be conducted as part of the RI are provided in the following sections. A summary of the field tasks is provided in Table 3-1.

3.2.1.1 Geophysical Survey. Several surface geophysical techniques will be used to detect buried utilities at subsurface sampling locations prior to sampling. The surveys will be performed using electromagnetic imaging (EMI), ground penetrating radar (GPR), and magnetics profiling. Technique efficiency depends on the targets of interest, site hydrogeology, and interference from surrounding cultural features. Several complementary techniques are used because underground utilities are made of many different materials (ferrous steel, aluminum, polyvinyl chloride (PVC), fiberglass, and ceramic). EMI profiling can locate changes in electrical properties. GPR responds to changes in dielectric properties. Magnetics can detect

TABLE 3-1
SUMMARY OF FIELD TASKS
AFP 59 RI

Activity	Phase I	Phase II
Geophysical Survey	✓	
Soil and Groundwater Sampling using Direct Push Techniques	✓	
Onsite Analysis for VOCs	✓	
Water Level Measurements	✓	✓
Soil Sampling via Soil Borings/ Monitoring Well Borings		✓
Monitoring Well Installation		✓
Groundwater Sampling		✓
Little Choconut Creek Sediment and Surface Water Sampling		✓
Aquifer Testing		✓
Fish & Wildlife Impact Analysis		✓

only ferrous objects. Use of a combination of these techniques can increase the confidence that buried hazards will be detected and avoided. Procedures for the geophysical surveys are described in Section 2.1.2 of the SAP.

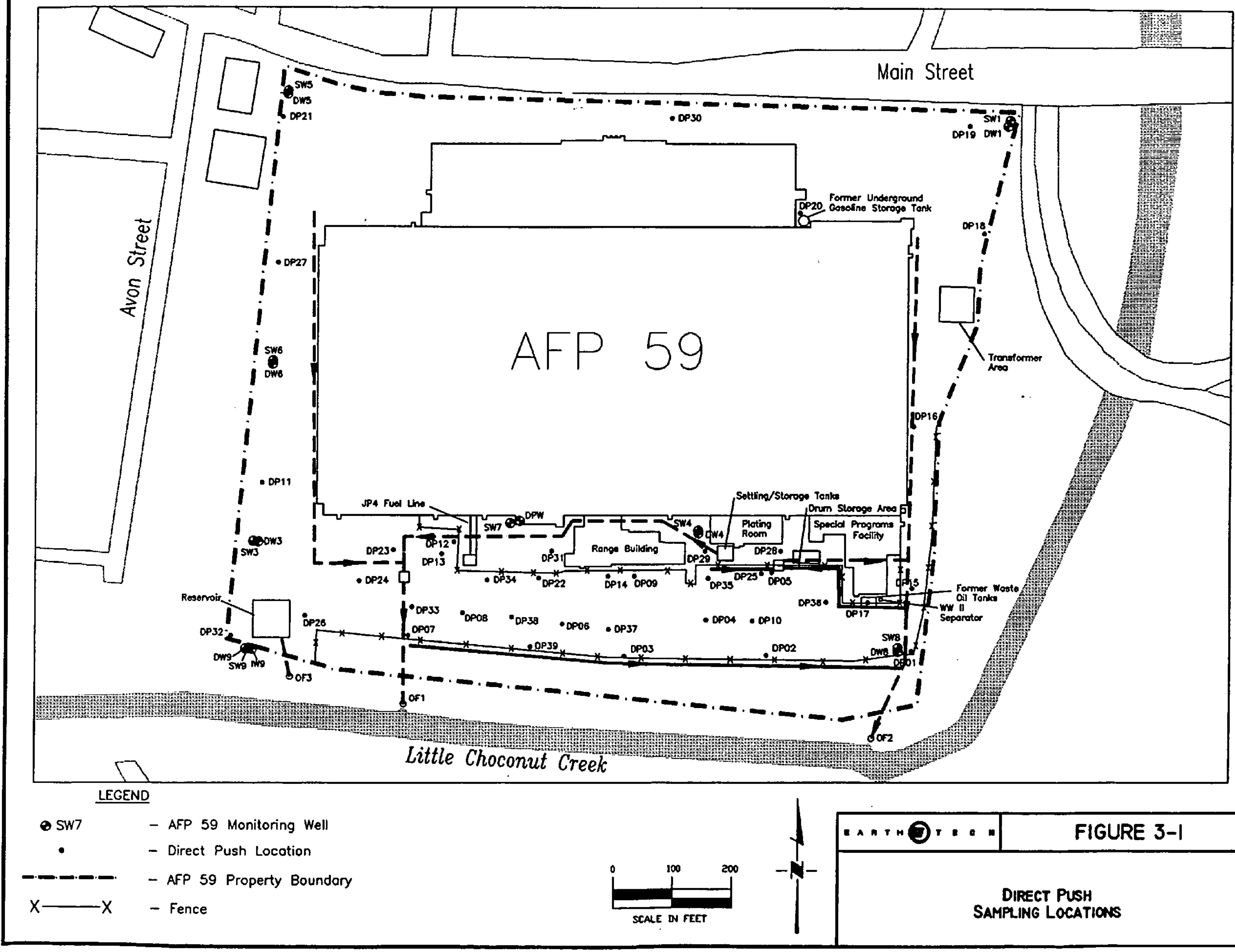
3.2.1.2 Direct Push Soil and Groundwater Sampling. As part of the first phase of the field investigation, Target Environmental Services Inc. will perform soil and groundwater sampling at AFP 59 using a direct push method. Samples will be analyzed onsite for VOCs using a mobile laboratory equipped with a GC. Direct push soil and groundwater sampling is designed to allow real time characterization of the site by defining any contaminant plumes and potential sources. Direct push soil and groundwater sampling will be a cost-effective reconnaissance tool to assist in the placement of monitoring wells during the second phase of the field program. The objectives of the direct push sampling survey are to investigate potential source areas and migration pathways, delineate the extent of soil and groundwater contamination, and define background concentrations of VOCs and metals in soil. Procedures for the direct push soil and groundwater sampling are described in Section 2.1.3 of the SAP.

Soil and groundwater samples will be collected at the approximate locations shown in Figure 3-1. The sampling locations were selected to generally characterize the site. Direct push sampling locations are along drains, outside of the plating room, near the reservoir, and along the perimeter of the plant. These locations were chosen to further define contamination in the vicinity of the plating room and investigate potential migration pathways which contaminants may have followed, such as subsurface drains. Locations along the perimeter of the plant were chosen to provide background concentrations and determine if contamination is moving onsite from offsite, upgradient locations.

3.2.1.3 Subsurface Soil Sampling. Subsurface soil samples will be collected to:

- Determine the presence of any contamination;
- Confirm the types of contaminants present (if any);
- Spatially evaluate the horizontal and vertical extent of any detected contamination; and
- Define the subsurface lithology, including the presence and/or extent of fine-grained lakebed deposits.

Subsurface soil samples will be collected continuously and logged for lithology during deep monitoring well installation using continuous tube samplers until the lakebed deposits have been encountered. While drilling the shallow monitoring well boreholes and soil boreholes, soil samples will be collected every 5 feet until groundwater is encountered using split-spoon samplers for potential chemical analysis. Up to three soil samples from each borehole and shallow monitoring well borehole will be selected for chemical analysis based on field headspace measurements (using a PID), soil discoloration, or odor indicating the presence of contamination. If the headspace field measurements are uniform and within 5 ppm of the



LEGEND

- SW7 – AFP 59 Monitoring Well
- • – Direct Push Location
- –·–·–·– – AFP 59 Property Boundary
- X——X – Fence

FIGURE 3-1

DIRECT PUSH SAMPLING LOCATIONS

background measurements, and there is no physical evidence or indication that contaminants may be present, the soil samples selected for analysis will be collected at evenly spaced intervals from the surface to the top of the water table. A maximum of approximately 48 soil samples will be collected for analysis from approximately 12 borings and 4 shallow monitoring wells during the investigation.

The selected soil samples will be analyzed for the parameters listed in Table 3-2 and summarized in Section 3.2.2. Details regarding drilling methods and soil sampling procedures are provided in Sections 2.1.4 and 2.2.1.2 of the SAP, respectively. Proposed sampling locations are shown on Figure 3-2; actual locations may be changed in the field. All subsurface sampling locations will be surveyed following completion of the drilling program (see Section 2.1.9 of the SAP).

3.2.1.4 Monitoring Well Installation and Development. Monitoring wells will be installed during the second phase of the field program to obtain representative and reproducible groundwater samples at AFP 59. The groundwater monitoring well locations and depths were chosen to meet the following data needs.

- Assess background water quality to determine if contaminants are moving onsite from upgradient areas.
- Determine the extent of any contaminant plumes (i.e., metals, chlorinated hydrocarbons, benzene, toluene, ethylbenzene, and xylenes) and confirm Reconnaissance Survey results.
- Characterize the subsurface lithology and continuity of stratigraphic units.
- Characterize the hydrogeology of the area, including the potentiometric surface and groundwater flow directions.
- Delineate potential source areas.

Monitoring wells will be installed using either hollow-stem auger or drive and wash drilling methods. Approximately 8 to 12 monitoring wells at four locations will be installed. Wells will be installed as well clusters consisting of a shallow well screened in the outwash deposits (the shallow zone of the aquifer) and a deep well screened in the ice-contact deposits (the deep zone of the aquifer). Where fine-grained deposits separate the two units, a third, intermediate-depth well will be installed directly above the lakebed deposits. The shallow wells will be constructed to monitor approximately the upper 10 feet of saturated sediments; intermediate wells screened in the shallow zone immediately above a potentially semi-confining layer will monitor the presence of any dense non-aqueous phase liquids; and deep wells will monitor the deep zone of the aquifer. Proposed monitoring well locations are shown in Figure 3-2. All monitoring well locations and elevations will be surveyed upon completion of the well installation program.

The monitoring well installation procedures are described in detail in Section 2.1.5.1 of the SAP and will follow the guidelines outlined in the Handbook (USAF, 1993b). Casing/screen will be placed inside hollow-stem augers or driven casing and suspended such that it does not rest on

TABLE 3-2
SUMMARY OF PHASE II SAMPLE ANALYSES

Analytical Method	Reporting Units	Environmental Samples	Trip Blanks	Ambient Condition Blanks	Equipment Blanks	Duplicate/ Replicate Samples	Total Analyses
SOIL ANALYSES							
SW8260 Volatile Organics	mg/kg	48	10	1	10	5	74
SW8270 Semivolatile Organics	mg/kg	48	---	---	10	5	63
SW6010 Metals	mg/kg	48	---	---	10	5	63
SW7060 Arsenic	mg/kg	48	---	---	10	5	63
SW7421 Lead	mg/kg	48	---	---	10	5	63
SW7471 Mercury	mg/kg	48	---	---	10	5	63
SW7740 Selenium	mg/kg	48	---	---	10	5	63
SW7841 Thallium	mg/kg	48	---	---	10	5	63
SW8080 Pesticides/PCBs	mg/kg	48	---	---	10	5	63
SW9010 Cyanide	mg/kg	48	---	---	10	5	63
ASTM D2216 Moisture	Percent (%)	48	---	---	---	5	53
SW9060 TOC	mg/kg	48	---	---	10	5	63

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TABLE 3-2
SUMMARY OF PHASE II SAMPLE ANALYSES

Continued

Analytical Method	Reporting Units	Environmental Samples	Trip Blanks	Ambient Condition Blanks	Equipment Blanks	Duplicate/ Replicate Samples	Total Analyses
GROUNDWATER ANALYSES							
SW8260 Volatile Organics	µg/L	29	10	1	10	3	53
SW8270 Semivolatile Organics	µg/L	29	---	---	10	3	42
SW6010 Metals	mg/L	29	---	---	10	3	42
SW7060 Arsenic	mg/L	29	---	---	10	3	42
SW7420 Lead	mg/L	29	---	---	10	3	42
SW7470 Mercury	mg/L	29	---	---	10	3	42
SW7740 Selenium	mg/L	29	---	---	10	3	42
SW7841 Thallium	mg/L	29	---	---	10	3	42
SW8080 Pesticides/PCBs	µg/L	29	---	---	10	3	42
SW9010 Cyanide	mg/L	29	---	---	10	3	42
E130.1 Hardness	mg/L	29	---	---	--	3	32

TABLE 3-2
SUMMARY OF PHASE II SAMPLE ANALYSES

Continued

Analytical Method	Reporting Units	Environmental Samples	Trip Blanks	Ambient Condition Blanks	Equipment Blanks	Duplicate/ Replicate Samples	Total Analyses
SEDIMENT ANALYSES							
SW8260 Volatile Organics	mg/kg	5	1	1	1	1	9
SW8270 Semivolatile Organics	mg/kg	5	---	---	1	1	7
SW6010 Metals	mg/kg	5	---	---	1	1	7
SW7060 Arsenic	mg/kg	5	---	---	1	1	7
SW7421 Lead	mg/kg	5	---	---	1	1	7
SW7471 Mercury	mg/kg	5	---	---	1	1	7
SW7740 Selenium	mg/kg	5	---	---	1	1	7
SW7841 Thallium	mg/kg	5	---	---	1	1	7
SW8080 Pesticides/PCBs	mg/kg	5	---	---	1	1	7
SW9010 Cyanide	mg/kg	5	---	---	1	1	7
SW9060 TOC	mg/kg	5	---	---	1	1	7
ASTM D2216 Moisture	Percent (%)	5	---	---	---	1	6

TABLE 3-2
SUMMARY OF PHASE II SAMPLE ANALYSES

Continued

Analytical Method	Reporting Units	Environmental Samples	Trip Blanks	Ambient Condition Blanks	Equipment Blanks	Duplicate/ Replicate Samples	Total Analyses
SURFACE WATER ANALYSES							
SW8260 Volatile Organics	μg/L	5	1	1	1	1	9
SW8270 Semivolatile Organics	μg/L	5	---	---	1	1	7
SW6010 Metals	mg/L	5	---	---	1	1	7
SW7060 Arsenic	mg/L	5	---	---	1	1	7
SW7420 Lead	mg/L	5	---	---	1	1	7
SW7470 Mercury	mg/L	5	---	---	1	1	7
SW7740 Selenium	mg/L	5	---	---	1	1	7
SW7841 Thallium	mg/L	5	---	---	1	1	7
SW8080 Pesticides/PCBs	μg/L	5	---	---	1	1	7
SW9010 Cyanide	mg/L	5	---	---	1	1	7
E130.1 Hardness	mg/L	5	---	---	--	1	6

Note: Number of sample analyses is based on the maximum number of samples expected to be collected during Phase II of the investigation.

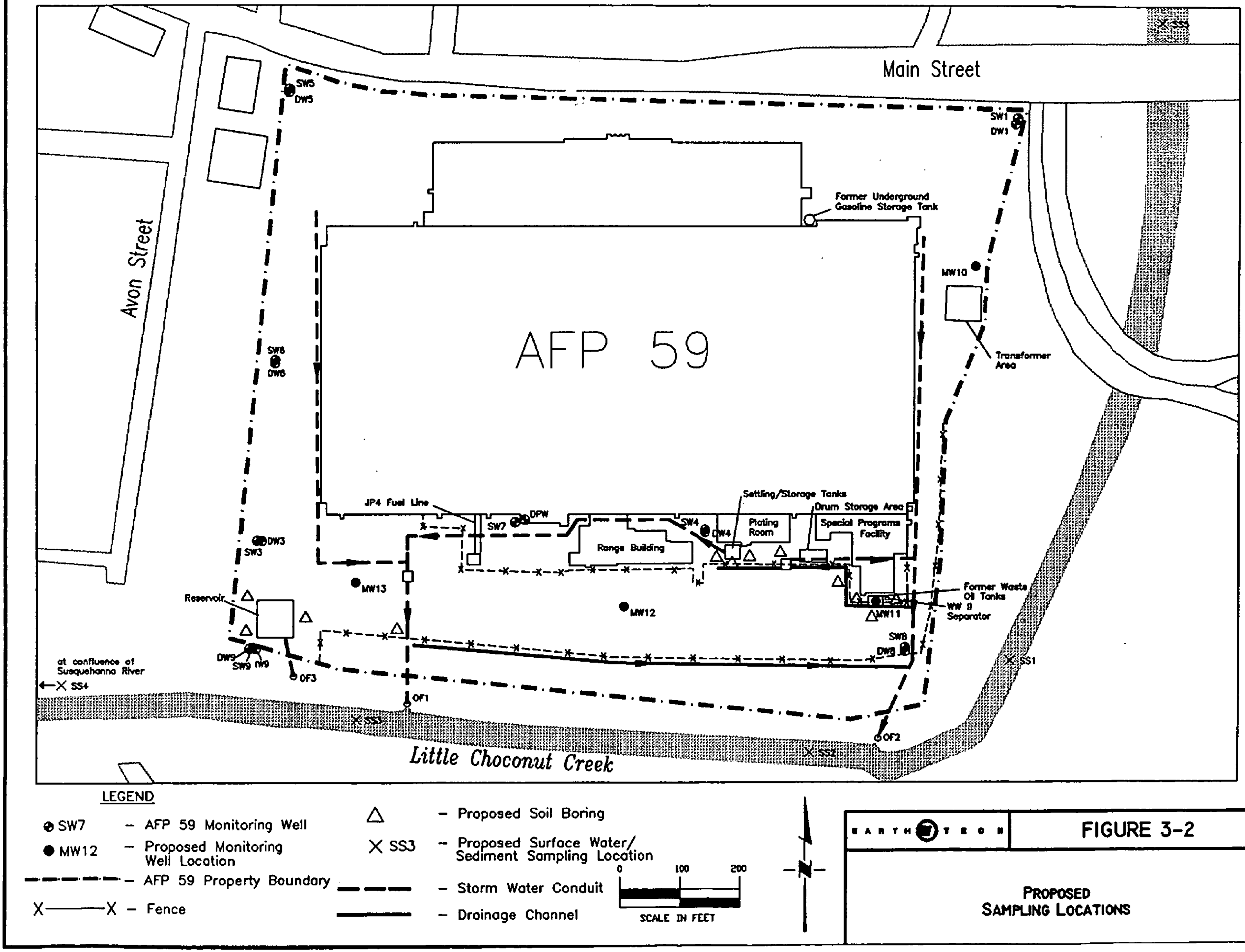


FIGURE 3-2

PROPOSED SAMPLING LOCATIONS

the bottom of the borehole. The casing will be straight and plumb within 3 degrees of vertical. The inner diameter of the hollow-stem augers or driven casing will be at least 4 inches larger than the outer diameter of the casing and well screen. Filter pack, bentonite seal, and Type I Portland cement/bentonite grout will then be emplaced in the annulus between the borehole wall and casing/screen. The filter pack material will be carefully selected for each well based on field sieve analyses of the aquifer material in an attempt to reduce the turbidity of groundwater samples. Deep wells installed where lakebed deposits are present will be double cased to prevent cross-contamination between the upper and lower zones of the aquifer.

Monitoring well development will be performed in order to restore the aquifer's hydraulic conductivity by removing solids and/or other mobile particulate matter from the monitoring well. The method of development will be surging and overpumping. At least three well bore volumes will be removed during purging. Monitoring well development procedures are described in Section 2.1.5.2 of the SAP.

3.2.1.5 Groundwater Sampling. Groundwater samples will be collected for analysis at a fixed laboratory during the second phase of the field program from all new and existing monitoring wells at AFP 59. Groundwater sampling will be conducted to meet the following objectives.

- Evaluate background concentrations of analytes in groundwater to provide a baseline for comparison with onsite samples.
- Identify potential source areas or areas with elevated concentrations of contaminants.
- Evaluate the vertical distribution of contaminants in groundwater.
- Determine the relationship between any onsite contamination and contamination at the Camden Street Wellfield.

Groundwater samples will be collected using the procedures described in Section 2.2.1.3 of the SAP. Samples to be analyzed for metals will be collected using variable rate pumps immediately following well purging in order to obtain low turbidity groundwater samples. Groundwater samples will be analyzed by the methods listed in Table 3-2 and summarized in Section 3.2.2.

3.2.1.6 Surface Water Sampling. Five surface water samples from Little Choconut Creek will be collected during the second phase of the field investigation. The surface water samples will be paired with sediment samples collected at the same location (see Section 3.2.1.7). The samples will be collected to determine the background water quality of the creek and the impact of installation activities on the creek. Samples will be collected upstream of the plant and downstream of each of the plant's outfalls. The proposed sampling locations are shown in Figure 3-2; actual sampling locations may vary depending on access or field conditions. All sampling locations will be surveyed upon completion of the field program. Surface water sampling procedures are described in Section 2.2.1.4 of the SAP. The samples will be analyzed using the methods indicated in Table 3-2.

3.2.1.7 Sediment Sampling. Five sediment samples will be collected from Little Choconut Creek during the second phase of the field investigation. The sediment sampling locations will be paired with the surface water sampling locations (see Section 3.2.1.6). Two upgradient and three downgradient samples will be collected at the locations proposed on Figure 3-2. Actual sampling locations may vary depending on access and field conditions. All sampling locations will be surveyed upon completion of the field program. The samples will be collected to assess background conditions and determine the impacts to creek sediments from plant activities. Section 2.2.1.5 of the SAP describes the sediment sampling procedures.

3.2.1.8 Groundwater Level Measurements. Groundwater level measurements will be taken at all accessible monitoring wells onsite and offsite during both the first and second phases of the field program. The synoptic groundwater level measurements will be taken to generate potentiometric surface maps and determine groundwater flow directions under the most common pumping conditions. This data will be used to evaluate the potential for offsite migration of any contamination originating at AFP 59.

Groundwater level measurements will be recorded as feet below the measuring point on the casing which has been permanently marked and surveyed. Procedures for obtaining groundwater level measurements are described in Section 2.1.6 of the SAP.

3.2.1.9 Aquifer Testing. A limited-duration (24 hour) pumping test will be conducted using the existing onsite production well as the pumping well and existing monitoring wells as observation wells. The test will be conducted to determine the interconnection between the shallow and deep zones of the aquifer. This data will be used to evaluate aquifer characteristics (hydraulic conductivity, storativity, and transmissivity) and to assess the potential for vertical migration of any onsite contamination. During the pump test Little Choconut Creek will also be gaged to determine the interconnection between the creek and the aquifer.

The procedures for conducting the pump test are provided in Section 2.1.7 of the SAP. Water levels in both the pumping and observation wells will be recorded at pre-determined intervals throughout the test.

3.2.1.10 Fish and Wildlife Impact Analysis. A Fish and Wildlife Impact Analysis, as defined by the NYSDEC Division of Fish and Wildlife, will be conducted at least through Step IIB during the second phase of the investigation. The analysis will be conducted to evaluate the impacts of AFP 59 on fish and wildlife resources. The analysis will identify fish and wildlife resources that may be affected by any contaminants related to AFP 59, and determine the impacts of these contaminants on the fish and wildlife resources. Maps, descriptions of resources, regulatory criteria, pathway analysis, and criteria-specific analysis will be generated in accordance with the state's guidance (NYSDEC, 1991b). Details of the analysis are provided in Section 2.1.9 of the SAP.

3.2.1.11 Geodetic Survey. A third order geodetic survey will be performed by a certified land surveyor upon completion of the sampling and well installation programs. These data will be collected in order to generate accurate potentiometric surface maps to assess contaminant migration. All newly installed monitoring wells, soil borings, and surface water/sediment sampling locations will be surveyed. Each sampling location will be surveyed to the nearest 0.1 foot and referenced to the State Plane Coordinate system. Elevation measurements will be referenced to MSL. Elevations of the ground surface adjacent to monitoring wells will be measured to the nearest 0.1 foot, and elevations of the top of the well casing will be measured to the nearest 0.01 foot. Survey procedures are described in more detail in Section 2.1.10 of the SAP.

3.2.1.12 Waste Handling. Wastes generated during the field investigation may include soil cuttings from drilling, waste groundwater generated during monitoring well development and purging, decontamination fluids, and disposable personal protective equipment and supplies. Soil cuttings will be containerized and segregated as they are produced. Development and purge water will be discharged to a grassy area to infiltrate and will not be allowed to flow into the storm drains or creek. If the ground is frozen and the water cannot infiltrate, it will be containerized in Baker tanks. The contents of all tanks will be recorded. Disposable protective equipment and supplies will be containerized in labelled, 55-gallon drums. All wastes generated during the course of the field investigation will be disposed in accordance with applicable state and federal regulations. Further description of the waste handling is provided in Section 2.1.12 of the SAP.

3.2.2 Sampling and Analysis Activities

The sampling and analysis procedures are described in detail in the SAP. A summary of the number of samples, analytical methods, and field QA/QC samples for each matrix is provided in Table 3-2.

3.3 Literature Search

Documents reviewed during preparation of the planning documents include previous IRP investigations, closure investigations, and offsite source investigations. Additionally, existing USGS reports were consulted. A complete list of references is provided in Section 6.0.

3.4 Recordkeeping

The field crew and field team leader will maintain records throughout the field investigation in project logbooks. All logbooks will be waterproof and permanently bound with sequentially numbered pages. Entries in the logbook will be made with indelible ink. No pages shall be removed and unused pages or portions of pages will be lined out to prevent entry of additional data at a later date. Corrections to a logbook will be made by drawing a single line through the incorrect entry in such a way that the incorrect entry may still be read, and then entering the correct information. Any subsequent error discovered should be corrected, initialed, and dated by the person who made the entry. The field records will include sufficient information to recreate all sampling and measurement activities and to meet all IRP Information Management Systems (IRPIMS) data loading requirements. The following information will be recorded for all activities.

- Location
- Date and time
- Identity of people performing activity

- Weather conditions

The following information will be recorded for all field measurements.

- The numerical value and units of each measurement
- The identity of and calibration results for each field instrument.

The following additional information will be recorded for all sampling activities.

- Sample type and sampling method
- The identity of each sample and depth(s), where applicable, from which it was collected
- The amount of each sample
- Sample description (e.g., color, odor, clarity)
- Identification of sampling devices
- Identification of conditions that might affect the representativeness of a sample (e.g., refueling operations, damaged casing).

3.4.1 Site Logbook

The site logbook is the master field investigation record, chronicling all field investigation activities at a lower level of detail than the field logbooks. Its primary purpose is to summarize within one document the daily field activities accomplished and reference the field documents that contain specific descriptions of each activity.

All entries into the site logbook will be signed and dated by the Field Team Leader. The following information typically will be recorded in the site logbook.

- Name and title of author, and date and time of entry
- Name and address of field contact (in cover of logbook)
- Names, titles, and affiliations of onsite personnel
- Names and titles of all site visitors
- General description of each day's field activities
- Documentation of health and safety activities
- Purpose of sampling activity
- Physical/environmental conditions during the field activity
- Sample locations and identification
- Type of sampled media (i.e., soil, groundwater)
- Sample collection method (i.e., split-spoon, grab)
- Number and volume of samples taken
- Identification of sampling devices
- Decontamination procedures or references to a procedure
- References for all maps and photographs of the sampling sites
- Records of telephone conversations
- Weather conditions.

3.4.2 Field Logbook

The personnel responsible for sampling and support activities will maintain separate field logbooks. In general, these logbooks will contain more specific details describing the tasks performed by the person maintaining the field logbook. All information included in the site logbook will be required for the field logbook as well as the following information.

- Description of sampling points
- Date and time of collection of each sample
- Preservatives used and intended analyses for each sample
- Sample description (e.g., color, odor, clarity)
- Identity of each sample and depths, where applicable, from which it was collected
- Sample distribution (i.e., laboratory)
- Field observations
- Field measurements made (i.e., pH, temperature) and units of each measurement
- Instrument calibration
- Identification of conditions that might affect the representativeness of a sample (e.g., refueling operations, damaged casing).

3.4.3 Field Equipment Logbook

The purpose of the field equipment logbook is to document the proper use, maintenance, and calibration of the field testing equipment. All equipment will be inspected and approved by the field team leader before use. A calibration logsheet will be maintained for each instrument used onsite and will be kept in the project records. The field equipment logbook shall include the following data.

- Name and identifying number of the instrument
- Date calibrated
- Calibration points
- Identification of the calibrator
- Manufacturer
- Expiration date of calibration standards
- Results of the calibration.

3.5 Data Assessment

Data collected during the investigation will generally consist of field and analytical data. Data assessment methods will vary depending on the type of data collected. Data will be analyzed to assure that accurate and valid data have been generated. The data will then be used to refine the conceptual site model and prepare technical reports.

Field data, such as borehole logs and groundwater level measurements, will be used to generate geologic and hydrologic maps and cross-sections for the site. The data will be transferred to electronic format to allow computer analysis and graphic representation of the data.

Analytical data will be received from the laboratory in both hard copy and electronic formats. The laboratory QA methods for data assessment are discussed in the QA Project Plan. The electronic data will be in the IRPIMS format and will have been checked using the most recent version of the QCTool (Version 1.31, July 15, 1994) prior to delivery to Earth Tech. Upon receipt of the electronic data, Earth Tech will electronically check for duplicate records, data entry errors (i.e., dates, sample IDs), holding times, percent recoveries, and relative percent differences. Summary tables can then be generated directly from the database.

3.6 Characterization of Background Conditions

Limited background sampling was conducted during the SSI (ANL, 1994). As discussed in the conceptual site model (Section 2.3), samples representative of background conditions for groundwater, soil, surface water, and sediment are available from only one location for each media. The distribution of metals in background is therefore not fully characterized.

During the RI additional samples will be collected to evaluate background conditions. Background soil samples for VOC and metals analysis will be collected during the first phase of the investigation from several subsurface locations believed to be unaffected by past site activities. Background soil samples will also be collected as part of the second phase of the program during monitoring well installation. These soil samples will be analyzed for VOCs, SVOCs, pesticides/PCBs, metals, cyanide, and TOC. One well pair (SW1/DW1) is currently located in an upgradient, background location. During the second phase of the investigation, an additional background monitoring well will be installed. Both the existing and new background wells will be sampled and analyzed for VOCs, SVOCs, pesticides/PCBs, metals, cyanide, and hardness. Two surface water/sediment sample pairs will be collected from locations upgradient of the AFP 59 outfalls to characterize background conditions. These samples will be analyzed for VOCs, SVOCs, pesticides/PCBs, metals, and cyanide. Additionally, the sediment samples will be analyzed for TOC and the surface water samples will be analyzed for hardness.

3.7 Human Health Risk Assessment

Growing public awareness of the potential risks to humans from toxic chemicals in the environment has led to concern over permissible exposure limits. This awareness has generated a demand for a rational means of estimating risk and for limiting exposure in cases where risk is judged to be excessive. One outcome of such growing public awareness is the emergence of the field of risk assessment, which evaluates available data on exposure and toxicity of chemicals to estimate associated risks to humans. The National Contingency Plan (NCP) requires that a quantitative baseline risk assessment be done to evaluate the potential risks to human health and the environment associated with current and future land use conditions in the absence of remedial activity.

Results of soil, sediment, groundwater, and surface water sample analyses performed during the remedial investigation, as well as potential transport and exposure pathways and potential human receptors at AFP 59 will be used in the baseline risk assessment. It will be based on procedures outlined in the following documents.

- *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (HHEM) Part A, (Interim Final)*, EPA/540/1-89/002, December 1989.

- *Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)*, (Air Force Center for Environmental Excellence (AFCEE), September 1993b.

- *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors (Interim Final)*, USEPA OSWER, 1991.

- Available guidance promulgated by state and local jurisdictions.

The purpose of the baseline human health risk assessment is to assess the potential for adverse human health effects. Estimating the health risks associated with exposure to chemicals involves the following steps.

- Selecting chemicals of potential concern
- Exposure assessment
- Toxicity assessment
- Risk characterization
- Evaluation of risk.

Sections 3.7.1 through 3.7.5 present the step-wise approach used to estimate human health risk associated with exposure to chemicals from the site.

3.7.1 Selection of Chemicals of Potential Concern

The procedure for selection of chemicals of potential concern by medium considers: (1) background concentrations of analytes; (2) the concentration of analytes present in various environmental media (as determined from environmental monitoring results and chemical source information); (3) the predicted mobility, persistence, and potential transformation of chemicals in the environment (as determined from their physicochemical properties); and (4) the observed toxicological hazards of chemicals.

The screening of chemicals of potential concern shall be conducted using the procedures in *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (HHEM), Part A, (Interim Final)*, Section 5.8, "Development of a Set of Chemical Data and Information for Use in the Risk Assessment", and procedures outlined in *Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)*, Section 2.3, "Data Quality Assessment". The affected media, the measured or predicted environmental concentrations for each chemical, and the rationale and methods used to select each chemical of concern will be reported.

For organic analytes, chemicals detected in less than 5 percent of the samples from any one medium, may be eliminated from further assessment. However, if a chemical is detected in less than 5 percent of samples, but is highly toxic (e.g., an A carcinogen) and persistent in media, the chemical will be retained for further assessment.

For inorganic chemicals, a comparison of area sample concentrations with area background concentrations will be conducted. Inorganic analytes that are not detected in any site samples for any sampled depth will be deleted from further consideration for the site. Inorganic analytes that are detected in one or more site samples, but which were not detected in background samples will be retained as chemicals of potential concern for the particular site.

For inorganic analytes with four or more analytical results, the Students' t test and the Wilcoxon Rank Sum test will be used to determine if site analyte concentrations statistically exceed background concentrations. These tests statistically compare the mean concentration of the site-specific analyte with the mean concentration of background. The Student's t test is a parametric test which assumes the data being compared are normally distributed. Because false conclusions can result if this assumption is violated, the Student's t test will be applied only when the site inorganic concentrations and the background concentrations are both normally distributed. The Wilcoxon Rank Sum test is a non-parametric test which does not assume a distributional model for the data being compared. As such, this test will only be performed when either the site inorganic concentrations or the background concentrations are lognormally or nonnormally distributed. Both the Student's t and the Wilcoxon Rank Sum tests will be conducted as upper one-sided tests at the 0.05 significance level (i.e., 95% confidence interval).

For site inorganic analytes with less than four analytical results, the Students' t-test and the Wilcoxon Rank Sum test will not be used to determine whether inorganics exceed background levels. Instead, the site inorganic's maximum detected concentration will be compared to the 95% upper confidence limit (UCL) of the arithmetic mean at background. The site inorganic will be retained as exceeding background if the site inorganic maximum concentration is greater than the 95% UCL of the arithmetic mean at background.

If an analyte is detected in some, but not all samples from an area of concern, the value of one-half the detection limit will be assigned to the nondetected sample and will be used to calculate the mean concentration for the group of samples evaluated. In cases where samples are determined to originate from a "hotspot", it will be assumed that non-detects are equal to the full value of the detection limit.

3.7.2 Exposure Assessment

An important step in the risk assessment process is determining the probability that exposure to chemicals of potential concern will increase the incidence of adverse health effects in exposed populations. The objectives of the exposure assessment are to estimate the magnitude, frequency, duration, and route of human exposure to chemicals of potential concern. The magnitude of exposure, both current and future, is determined by measuring or estimating the amount of chemical to which individuals are exposed through inhalation, ingestion, or skin (dermal) contact during a specified time period. The frequency and duration of exposure are influenced by how long the facility will operate, use of the site if operations cease, and the activities of individuals living nearby.

Exposure will be determined for present and future exposure scenarios. Development for these scenarios will include consideration of continued use of the facility, applicable zoning laws, regional master development plans, and any other applicable development regulations. Accomplishing this task will involve completing the following steps.

- Characterizing potential migration pathways
- Receptor assessment
- Characterizing critical exposure pathways
- Estimating potential intakes by receptors.

The objectives of an exposure assessment are to identify the relevant pathways of human exposure and to determine the total amount of chemicals of potential concern taken in that are attributable to site contamination. Migration of chemicals from a site due to air transport through volatilization of chemicals or resuspension of contaminated soils and transport of chemicals in groundwater may result in human exposure to site-generated contaminants.

3.7.2.1 Characterizing Potential Migration Pathways. Environmental fate and transport analyses are sometimes necessary to determine the concentration of chemicals of potential concern at points of human exposure. To monitor the future environmental fate of contaminants present at the site, it is necessary to evaluate the rate at which chemicals enter a given environmental medium and the pathway processes that affect chemical concentrations in that medium. The basic processes that control the environmental fate of compounds are transport, transformation, and cross-media transfer.

Transport is the movement of chemicals within a particular environmental medium due to natural forces. For example, chemicals found in surface and groundwater can be carried by water movements, currents, or by suspended sediment. Transformation is any process that changes the physical or chemical structure of a compound. A chemical may be physically transformed (e.g., volatilize from a solid to a gaseous form) or may undergo chemical transformation (e.g., hydrolysis, oxidation, or reduction) or biotransformation (e.g., biodegradation). Cross-media transfer is the movement of pollutants between the environmental media: air, water, soil, and biota. Cross-media transfer can result in a wide distribution of pollutants throughout the environment and can, consequently, enhance the potential for human exposure from multiple sources.

Many chemical, physical, and environmental parameters, such as water solubility, vapor pressure, octanol-water partitioning, organic carbon partitioning, and bioaccumulation, influence the behavior and fate of organics released into the environment. A variety of physiochemical properties will be assessed for chemicals where appropriate and possible. The determination of these properties is necessary if fate and transport modeling is conducted.

If necessary, appropriate fate and transport models, in addition to data collected during field investigation studies, will be used to characterize the potential movement of chemicals through air, water, soil, and sediment. It is not anticipated that fate and transport modeling will be used to characterize movement of site contamination in groundwater towards receptors.

If air modeling is determined to be necessary, several models may be used to determine the effects from exposure to VOCs and fugitive dust. The models used to calculate VOC emission rates may include the Farmer Model, Shen Model, and Hwang-Falco Model. The model that will be used to calculate VOC emissions from construction activities is found in the "Estimation of Air Impacts for the Excavation of Contaminated Soil" (USEPA, 1992a). The model that will be used to calculate the PM_{10} emissions as fugitive dust is found in the "Estimation of Air Impacts from Area Sources of Particulate Matter Emissions at Superfund Sites" (USEPA, 1993a). Emission rates will be converted to the total mass of VOCs and fugitive dust emitted per second (total mass flux rate).

After total mass flux rates have been determined for VOCs and fugitive dust, a model will be used to predict air concentrations at receptors; the air quality model being considered is the Industrial Source Complex - Short Term (ISCST) Model. The ISCST accounts for horizontal and vertical chemical dispersion, contaminant degradation, adsorption, and settleout.

*3.7.2.2 **Receptor Assessment.*** Potential current and future human receptors, including plant workers, residents located outside of AFP 59, recreational users of Little Choconut Creek, and construction workers, will be identified. Sensitive subpopulations, such as children, will be identified who may contact chemicals migrating from the site. Particular emphasis will be placed on populations living downgradient of the site who may contact contaminated groundwater.

Populations (i.e., potential groups of human receptors) that are on or near the site will be characterized with respect to the following:

- Location relative to the site
- Activity patterns
- Presence of sensitive subpopulations.

Current and future land use will be defined to characterize activities and activity patterns of potential receptors. A determination of possible changes in the future area or near-area land uses will be based on available information (e.g., proposed construction projects within or outside of the site, land zoning, Bureau of Census projections, and professional judgment).

*3.7.2.3 **Characterizing Critical Exposure Pathways.*** The objectives of an exposure assessment are to identify the relevant pathways of human exposure and to determine the total amount of contaminants taken in that are attributable to site contamination. Offsite migration of contaminants due to groundwater movement or through volatilization or suspension of contaminated soils may result in human exposure to site-related contamination.

The previously discussed environmental fate and transport models will be used, if necessary, to estimate the concentration of contaminants to which receptor populations are likely to be exposed. Potential exposures from all relevant pathways that will be evaluated for populations defined by the receptor survey include: (1) ingestion or dermal absorption of chemicals in soil or sediment by all identified receptors; (2) ingestion, dermal adsorption, or inhalation of chemicals in groundwater or surface water by offsite residents; (3) direct inhalation of chemical vapors or particulate-bound chemicals by future construction workers; and (4) consumption of contaminated home-grown produce or fish by offsite residents.

3.7.2.4 Estimating Potential Intakes by Receptors. Site-specific exposure scenarios will be developed to integrate the location of individuals relative to the site, the frequency and duration of exposure, and the pathways of exposure. The reasonable maximum exposure (RME) scenario will be evaluated for all relevant pathways of exposure. The RME is the maximum exposure that is reasonably expected to occur at a site. The rationale for evaluating the RME scenario is that the estimated risks represent the highest risk exposed individuals are likely to experience due to site contamination. Standard default exposure factors will be used to estimate exposure, where applicable; reasonable assumptions will be made to quantify site-specific exposure factors. Site-specific scenario development will consider:

- Dermal absorption from contact with chemicals in soil, sediment, and water
- Ingestion of chemicals in soil, sediment, and water
- Inhalation of volatile organics and chemicals in suspended soil
- Consumption of chemicals in home-grown produce or fish.

Receptor exposure (intake) for ingestion of contaminated soil will be evaluated using standard default ingestion rates recommended by the USEPA.

Dermal exposure can result from contact with soil. Chemical concentrations on the skin are based on the rate of dust accumulation per skin surface area and the amount of exposed skin. The area of skin surface available for contact will be based on the 50th percentile value for exposure scenarios (USEPA, 1992b). Dermal contact with chemicals during showering will also be evaluated.

The amount of chemical taken in from the consumption of contaminated drinking water will be estimated from the concentration of chemical in the water supply, the amount of water consumed daily, and the percent of chemical absorbed through the gastrointestinal tract.

The amount of chemical taken in during inhalation depends upon: (1) the concentration of a chemical in inspired air; (2) the amount of air inspired per unit time; and (3) the percent of chemical in inspired air that is absorbed through the lung. The risk associated with inhalation of VOCs will be calculated for both outdoor and indoor (i.e., showering) exposures. An average adult respiration rate of 20 m^3 per day will be assumed for outdoor exposure scenarios and 15 m^3 per day for indoor showering. The risk associated with inhaling ambient concentrations of compounds sorbed to particulates will be determined assuming that inhaled particles are completely absorbed through the lung.

Intakes from the consumption of contaminated food items, if relevant, will be evaluated using region-specific crop and livestock data collected by Shor *et al.* (1982). Since specific daily consumption values have not been estimated, national values report by Pao *et al.* (1982), the USDA (1985) and USEPA (1980) will be applied.

3.7.3 Toxicity Assessment

Toxicity assessment evaluates the nature and extent of health and environmental hazards from exposure to site-related chemicals. A toxicity assessment will be performed for all the chemicals of potential concern at the site. The assessment consists of a hazard evaluation and a dose-response assessment. The hazard evaluation involves a comprehensive review of toxicity data from epidemiological, clinical, animal, and *in vitro* studies to identify the severity of toxic properties associated with chemicals of concern. Once the potential toxicity of a chemical has been established, the next step is to calculate the amount of chemical exposure by humans that may result in an adverse effect (i.e., to establish the dose-response relationship for each chemical of concern). Where possible, an estimate will be provided of the relationship between the extent of exposure to a contaminant and the increased likelihood and/or severity of adverse effects. These toxicity values are used in the risk characterization step to estimate the possibility of adverse effects occurring in humans at different exposure levels.

Both carcinogenic and noncarcinogenic toxicological endpoints will be considered for all chemicals of potential concern. The exposure time for carcinogenicity is a lifetime (i.e., 70 years); the exposure time for chronic toxicity, (i.e., long term exposure) is greater than 7 years. The exposure time for subchronic toxicity is between 2 weeks and 7 years. The following paragraphs briefly describe the procedures for evaluating potential adverse health effects of human exposure to carcinogenic and noncarcinogenic compounds.

Evidence of chemical carcinogenicity originates primarily from two sources: (1) lifetime studies with laboratory animals; and (2) human (epidemiological) studies. For most chemical carcinogens, animal data from laboratory experiments represent the primary basis for the extrapolation of results of carcinogenicity studies to humans. Major assumptions arise from the necessity of extrapolating experimental results: (1) across species (from laboratory animals to humans); (2) from high-dose levels (to which laboratory animals are exposed) to low-dose levels (levels to which humans are likely to be exposed in the environment); and (3) across routes of administration (inhalation versus ingestion).

Federal regulatory agencies have traditionally estimated cancer risks associated with human exposure to chemical carcinogens by assuming that: (1) the dose-response relationship obtained for animals is the same for humans; and (2) if a carcinogenic response occurs at the exposure level studied, a carcinogenic response will occur at all doses (i.e., that there is a direct, linear relationship between dose and cancer incidence). Thus, exposure to any level of a carcinogen is considered to have a finite risk of inducing cancer (i.e., carcinogens do not have thresholds). Excess lifetime cancer risks are defined as the incremental increase in risk that occurs over a 70-year lifetime due to exposure to a chemical carcinogen. The cancer toxicity value is known as the slope factor (SF). USEPA-verified SFs identified in USEPA's Integrated Risk Information System (IRIS) as a primary reference or the Health Effects Assessment Summary Tables (HEAST) will be used.

Substances that cause systemic toxicity (i.e., toxic effects other than cancer) appear to do so through mechanisms that include physiological thresholds. Thus, a certain dose of a compound must be present before toxic effects will be observed. Potential health effects of chronic exposure to noncarcinogenic compounds will be assessed using an USEPA verified IRIS or interim HEAST reference dose (RfD) that represents the limit for daily exposure not expected to cause deleterious health effects during a 70-year lifetime.

Occasionally, toxicity values used to characterize risk are only available for certain chemicals within a chemical class. In such cases, a single chemical will be selected to represent a group of related chemicals. This will be done only for chemicals with similar toxicological and physicochemical properties.

3.7.4 Risk Characterization

Risk characterization involves estimating the magnitude of potential adverse effects and making summary judgements about the nature of the health risk threat to the public. It combines the results of the toxicity and exposure assessments to provide numerical estimates of health risk and summarizes the nature and weight of the evidence supporting the numerical estimates. The uncertainties in the evidence and how these uncertainties influence the results will also be discussed in this portion of the risk assessment. The approach adopted for this task will be to use reasonable health-protective assumptions that are likely to overestimate potential risks. This strategy typically is adopted because it is assumed that it compensates for uncertainties inherent to the risk assessment process and provides an adequate margin of safety. Identification of immediately apparent unacceptable risks will be a priority in the baseline risk assessment.

Excess lifetime cancer risk estimates (a unitless probability of an individual developing cancer) associated with exposure to low levels of potential carcinogens will be calculated for all carcinogenic chemicals of concern using cancer SFs. A pathway-specific risk estimate will be derived by summing the contribution from each chemical of concern; risk will be developed using the RME scenarios for all relevant pathways. An aggregate risk estimate will be calculated by summing the contribution from each relevant pathway. Risk estimates will be compared to an acceptable benchmark value of 10^{-6}.

A hazard quotient (HQ), which equals estimated daily intake divided by a chemical-specific RfD, will be calculated for each chemical of concern at each receptor location. The HQ for all chemicals associated with a specific exposure pathway will be summed to determine cumulative noncarcinogenic effects, known as a total exposure hazard index (HI). A separate HI will be calculated as necessary for chronic and subchronic exposure periods. An HI greater than 1 indicates that the contaminants on a site are likely to cause adverse health effects in exposed populations. If the HI exceeds 1 for the sum of all chemical HQs, chemicals will be segregated by critical effect and mechanism of action to derive HIs for each group.

3.7.5 Evaluation of Risk

Preparing a baseline risk assessment for any site necessitates that numerous assumptions be made. As the baseline risk assessment is being prepared, technical issues arise, such as data selection, formulation of assumptions, and selection of appropriate exposure scenarios and modeling efforts. As a result, difference in risk estimates result from variability associated with the assumptions made and data input values used. Reporting single-value estimates of risk may be misleading, since single-value estimates tend to give the impression that estimated risks are known precisely. Health risk assessments should not only characterize the potential risks to human health and the environment, they should also express risk estimates in such a way that the assumptions made to drive those estimates and the uncertainties associated with such estimates are evident to the decision maker.

A semi-quantitative uncertainty analysis will be performed to characterize the likelihood that an exposed individual would actually experience the risk levels estimated. A sensitivity analysis will be used, where appropriate, to identify the variability in human exposure due to uncertainties associated with input parameters, model design, etc.

3.8 Bench Scale/Treatability Studies

Bench scale/treatability studies may be recommended upon completion of the investigation described in this Work Plan. Prior to initiation of any such studies, appropriate planning documents will be prepared and submitted for review.

SECTION 4.0

REPORTING REQUIREMENTS

The scope and content of reports to be submitted during the RI are discussed in this section. The following reports may be submitted during or after the conclusion of these investigations.

- Research and Development (R&D) Monthly Status Reports
- Informal Technical Information Reports (ITIRs)
- Technical Reports.

In addition to these documents, IRPIMS data files will be generated in conformance with the latest version of the IRPIMS Data Loading Handbook.

4.1 R&D Monthly Status Reports

Monthly reports will be prepared by the Project Manager and will describe the technical and financial progress of the AFP 59 investigation. These reports will be prepared to inform the Air Force Center for Environmental Excellence Remedial Team Chief of the progress of the project, and to justify man-hours billed during the reporting period. The R&D monthly status reports will discuss the following items.

- Identification of activities in progress.
- Status of work at each area and progress to date.
- Percentage of completion and schedule status.
- Difficulties or problems encountered during the reporting period.
- Actions being taken to rectify problems.
- Changes in personnel.
- Target and actual completion dates for each element of activity, including project completion.
- Explanation of deviations from milestones presented in the Work Plan.

Activities such as field work, data analysis, and report writing which require major manpower commitments will be addressed in the monthly reports.

4.2 Informal Technical Information Reports

ITIRs will be prepared and submitted to document technical information generated during the investigation. They will conform to the format requirements given by the USAF. The analytical data ITIR will contain all laboratory test results obtained during this investigation. Data will include sample analyses, QC results, and cross-reference tables for soil, sediment, and water samples. Risk assessment and conceptual site model ITIRs will also be prepared. Recipients of the ITIRs include the following organizations:

Air Force Center for Environmental Excellence (AFCEE)
Aeronautical Systems Center (ASC)
New York State Department of Environmental Conservation (NYSDEC).

4.3 Technical Report

A draft and final technical report will be prepared to summarize information obtained from the investigation at AFP 59. Cumulative information and data obtained from this and all previous studies will be used to evaluate trends and to develop conclusions and recommendations. Environmental sample results will be analyzed with respect to QA/QC data unique to this project. Specific topics that will be discussed in the Technical Report include:

- USAF IRP
- Environmental setting
- Site descriptions
- Field investigation program
- Soil borehole and monitoring well data and lithologic logs
- Groundwater data
- Raw field data
- Sampling location survey data
- Chain-of-custody forms
- Analytical laboratory data, including QA/QC data
- Data related to previous IRP investigations
- Results and significance of findings
- Biographies of key personnel.

The Technical Report will be distributed to the following organizations:

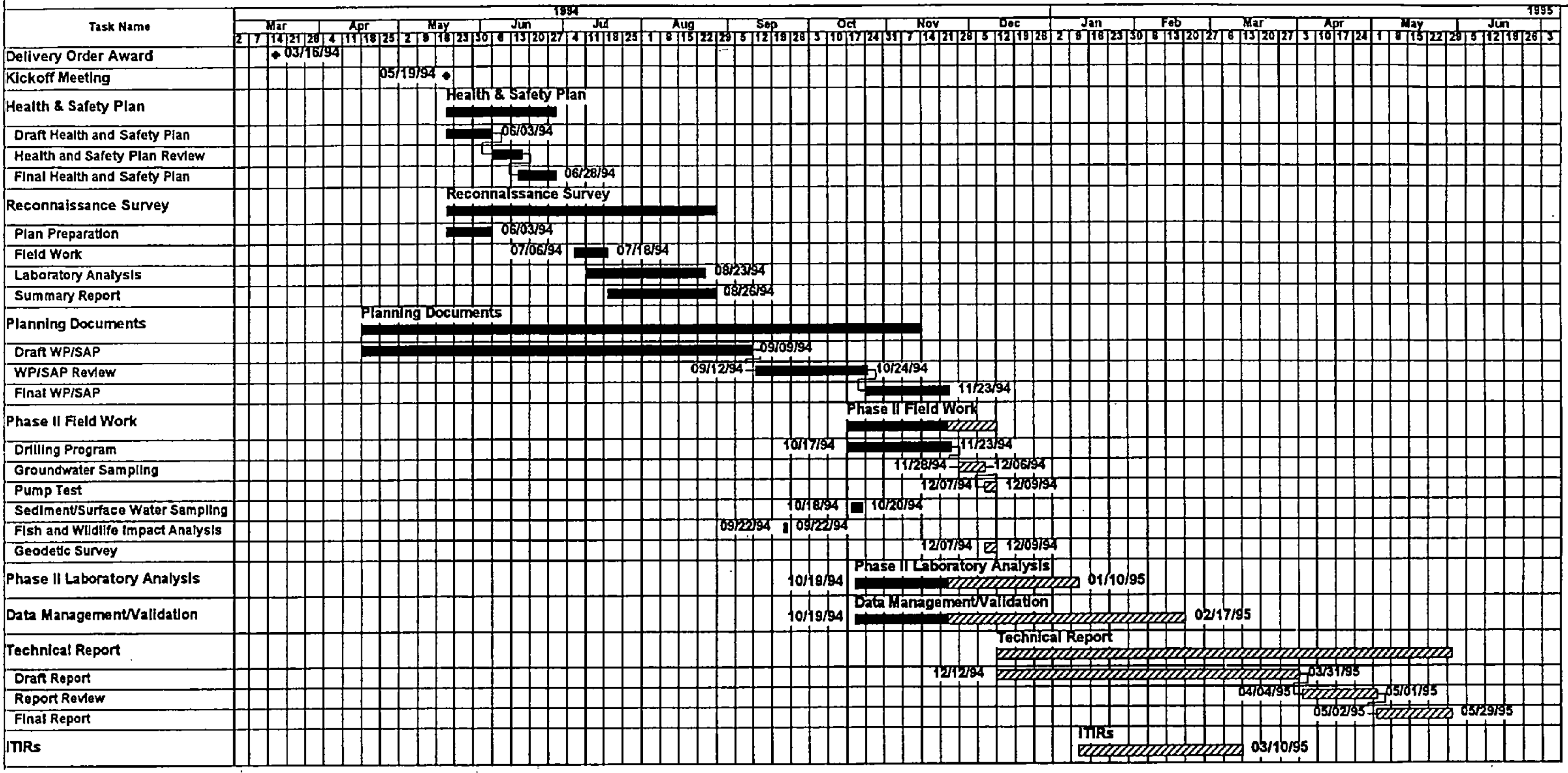
Air Force Center for Environmental Excellence (AFCEE)
Aeronautical Systems Center (ASC)
New York State Department of Environmental Conservation (NYSDEC).

SECTION 5.0

PROJECT SCHEDULE

Figure 5-1 presents the project schedule for the investigation of AFP 59. The schedule includes the field activities planned for both phases of the investigation, laboratory analysis, data management/validation, and report preparation.

AFP 59 RI Project Schedule



E A R T H T E C H

FIGURE 5-1

AFP 59 RI
Project Schedule

GF/AFP 59/RI/FS/FIG 5-1

SECTION 6.0

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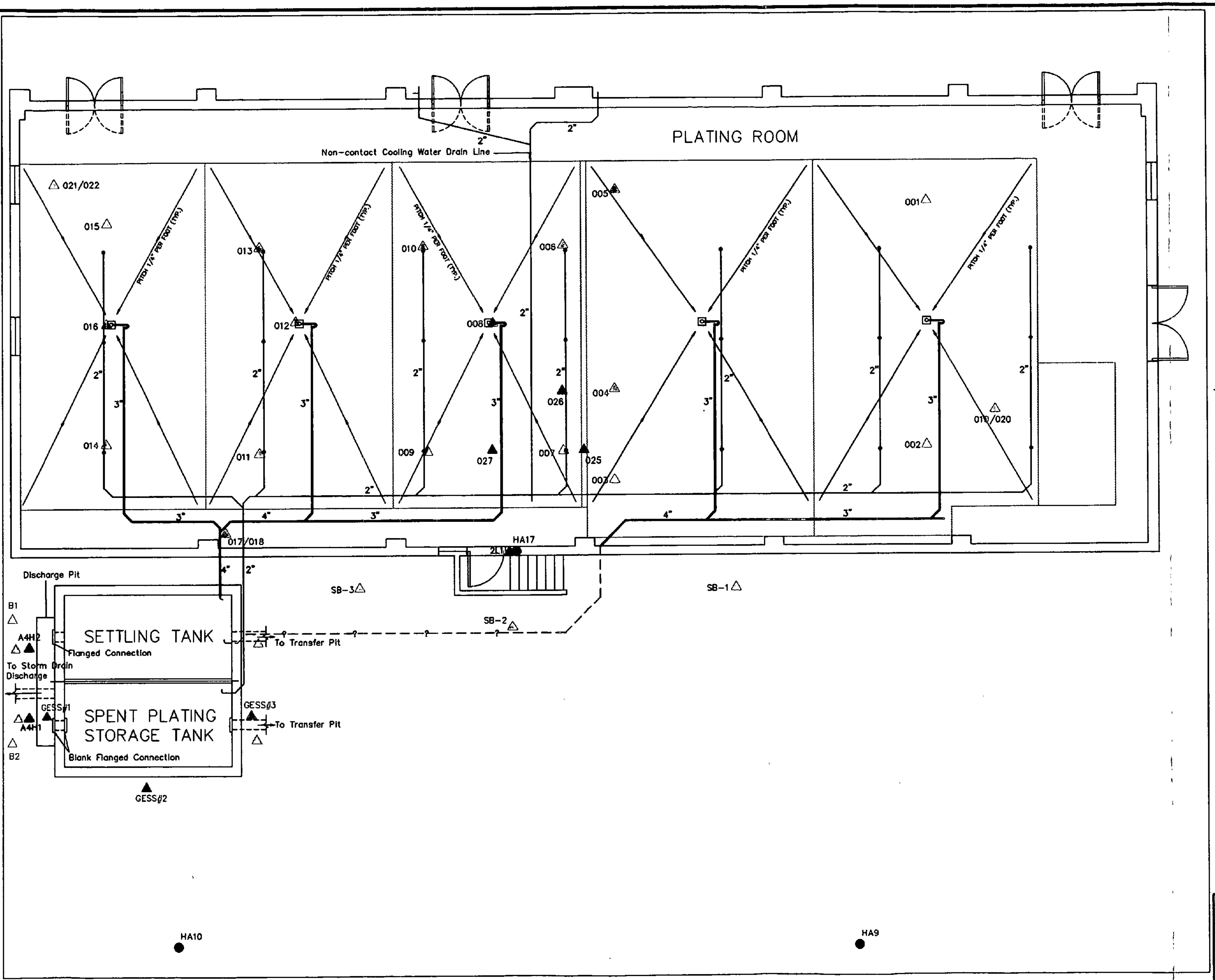

LEGEND

▲ – Hart, March 1987 Stage 1 Soil Boring Locations

△ – MARCOR, May 1991 Soil Boring Locations

▲ – OHM, July 1992 Soil Boring Locations

△ – OHM, September 1993 Soil Boring Locations

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● – Argonne National Laboratory, January 1994 Supplemental Site Inspection Hand Auger Sample Locations

△ – OHM, November 1993 Soil Boring Locations

▲ – OHM, June 1994 Soil Boring Locations

— – Drain Line

▣ – Floor Drain

∘ – Floor Drain Opening

NOTE: Locations are approximate.

0 5 10
SCALE IN FEET

EARTH TECH

FIGURE I-7

PLATING ROOM AND SETTLING/STORAGE TANK SAMPLING LOCATIONS

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