MUNITIONS MAINTENANCE SQUADRON (SS-013)

SUPPLEMENTAL REMEDIAL INVESTIGATION REPORT

PLATTSBURGH AIR FORCE BASE
NEW YORK

CONTRACT NO. F41624-97-D-8016
DELIVERY ORDER 0046

PREPARED FOR
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BROOKS AIR FORCE BASE, TEXAS

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FINAL
JANUARY 2003

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APPENDICES

ACRONYMS

ABB	ABB Environmental Services, Inc.
AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
amsl	above mean sea level
ARAR	Applicable or Relevant and Appropriate Requirements
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
ATV	All Terrain Vehicle
AWQC	Ambient Water Quality Criteria
BCF	bioconcentration factor
BEHP	Bis(2-ethylhexyl)phthalate
BTEX	benzene, toluene, ethylbenzene, xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
CRDL	Contract Required Detection Limit
1,2-DCE	1,2-dichloroethene
ECAO	Environmental Criteria and Assessment Office
ECL	Environmental Conservation Law
ERA	Ecological Risk Assessment
FEMA	Federal Emergency Management Agency
FFA	Federal Facilities Agreement
FS	Feasibility Study
FWAA	Former Waste Accumulation Area
gpm	gallon per minute
HARM	Hazard Assessment Ranking Methodology
HDPE	high density polyethylene
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient

ACRONYMS (Con't)

HR	hour
HRA	health risk assessment
HSA	hollow stem augers
IA	Industrial Area
I.D.	internal diameter
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
K	conductivity
kg	kilogram
K_{ow}	octanol-water partition coefficient
L	liter
m^3	cubic meter
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
µg	microgram
MMS	Munitions Maintenance Squadron
MW	monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Unit
NYCRR	New York Code of Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
OD	outer diameter
OHM	OHM Remedial Services, Inc.
ORP	Oxidation-Reduction Potential
OU	operable unit
PA	Preliminary Assessment

ACRONYMS (Con't)

PAFB	Plattsburgh Air Force Base
PAH	polycyclic aromatic hydrocarbon
PARC	Plattsburgh Airbase Redevelopment Corporation
PCB	Polychlorinated Biphenyls
PCE	tetrachloroethene
PHC	Petroleum Hydrocarbon
PID	photoionization detector
ppb	part per billion
ppm	part per million
PVC	polyvinyl chloride
PZ	piezometer
Q	total discharge
RAB	Restoration Advisory Board
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RDBMS	Relational Database Management System
RFC	reference concentration
RfD	reference dose
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
s	stream stage
sec	second
SF	slope factor
SI	Site Investigation
SMCL	Secondary Maximum Contaminant Level
SOV	Soil Organic Vapor
SVOC	semivolatile organic compound
TAL	target analyte list

ACRONYMS (Con't)

TBC	to be considered
TCE	trichloroethene
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon
TOGS	Technical and Operational Guidance Series
URS	URS Consultants, Inc.
USACE	United States Army Corp of Engineers
USAF	United States Air Force
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	underground storage tank
VC	vinyl chloride
VF	volatilization factor
VOC	volatile organic compound
WSA	Weapons Storage Area

1.0 INTRODUCTION

Plattsburgh Air Force Base (PAFB) is located in northeastern New York State just east of Interstate 87 and south of the City of Plattsburgh (Figure 1-1). It is bordered by Lake Champlain to the east, lake shore communities to the southeast, the Salmon River and agricultural land to the south, and the Adirondack Mountains to the west. The base, formerly the home of the 380th Air Refueling Wing, was officially closed by the United States Air Force (USAF) on September 30, 1995.

Remedial investigations and site remediation are being conducted at PAFB as part of the Department of Defense's Installation Restoration Program (IRP). The IRP was developed as a component of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

On November 21, 1989, PAFB was placed on the National Priorities List (NPL) by the United States Environmental Protection Agency (USEPA). On July 10, 1991, USAF entered into an interagency Federal Facilities Agreement (FFA) (Docket No.: II-CERCLA – FFA – 10201) with USEPA and the New York State Department of Environmental Conservation (NYSDEC) in order to implement the IRP at PAFB.

The IRP at PAFB has included execution of Preliminary Assessments (PAs), Site Investigations (SIs), Remedial Investigations (RIs), and Feasibility Studies (FSs), and the implementation of site-specific remedial action. This Supplemental Remedial Investigation report focuses upon the Munitions Maintenance Squadron (MMS) site, referred to herein as spill site SS-013.

1.1 Purpose of Report

The purpose of this Supplemental RI report is to present, summarize, and provide interpretations and conclusions regarding data from environmental activities at site SS-013, particularly those occurring after the RI (the RI was undertaken from 1993 – 1995 [URS 1996a]).

Investigation/remediation activities conducted at site SS-013 have occurred for a period of over fifteen years and have been performed by several different contractors (Table 1-1). Important data from these activities has been consolidated and incorporated into this report and includes:

- Analytical data from the three post-RI Air Force removal actions in 1996 and 1997
- Groundwater data relevant to SS-013 from the Fire Training Area (FT-002)/Industrial Area Groundwater Operable Unit Remedial Investigation/Feasibility Study (URS 2000a)
- Results of the year 2000 time-critical soil removal action in the vicinity of Buildings 3578 and 3569
- Results of the Supplemental RI field investigations, conducted in late 2000, that included the installation of three new groundwater monitoring wells downgradient from the former northern and southern leach fields and collection and analysis of groundwater samples from all site SS-013 monitoring wells
- A revised and updated human health risk assessment utilizing all available SS-013 analytical data and evaluating a potential future residential reuse exposure scenario

1.2 Site Description and History

The former MMS industrial complex is located in a fairly undeveloped portion of the base immediately north of the Weapons Storage Area and west of the runway (Figure 1-1). The site occupies approximately 50 acres and is located within one of the largest drainage areas at PAFB. Relief is variable across the site with terrain ranging from hilly to swampy. Drainages enter the site from the north and west and flow southward prior to discharging into the nearby Salmon River (NYSDEC considers this complex of streams to be tributary C-21-1 of the Salmon River). The industrial complex consists of several buildings that were used from 1954 to 1991 for the maintenance, storage, and handling of munitions-related items (Figure 1-2).

The Integrated Munitions Maintenance and Storage Branch (Building 3578) of the MMS generated wastes in significant quantities (Radian 1985). Activities carried out by this branch of the squadron were warehousing, inspecting, cleaning, and painting of munitions and munitions support equipment. Materials used or generated included methyl ethyl ketone (50 gallons/year), thinners (30 gallons/year), paints (120 gallons/year), and oil and lubricants (55 gallons/year). Some solvents were staged in drums in a small area approximately 50 feet east of Building 3578, which became known as the Former Waste Accumulation Area (FWAA).

The MMS complex was not connected to the PAFB sanitary sewer system, but instead was served by septic systems with leach fields. Leach fields were located north of Building 3578, adjacent to the north side of Building 3569, and northeast of Building 3569 (Figure 1-2). In the RI report (URS 1996a), these leach fields were called the northern former leach field, the southern former leach field, and the active leach field, respectively. These designations are no longer accurate or appropriate. In this report, the "northern former leach field" will be referred to as "leach field N", the "southern former leach field" will be referred to as "leach field S", and the former "active leach field" will be referred to as "leach field A".

Leach field A was a replacement for leach field N. These leach fields serviced Buildings 3578, 3580, 3582, and 3592. Leach field S only serviced a bathroom in Building 3569. The septic tank, lift station, and most of the piping associated with former leach fields N and A have been removed. The septic system north of Building 3569 (including leach field S) is still in place.

The MMS complex also was not connected to the PAFB central heating system. Instead, oil-fired boilers/heaters were located in each building. Many buildings had associated aboveground storage tanks (ASTs) and underground storage tanks (USTs) for fuel-oil storage. A few diesel fuel tanks and one unleaded gasoline tank were also present in the MMS complex. All ASTs (with the exception of AST-3583, which is an integral part of the emergency generator) and USTs have been removed from the MMS complex. UST-3578-A-1 (and its replacement UST-3578-A-2) was the only tank location with significant contaminant problems. Storage tank information is summarized in Table 1-2.

There are several other IRP sites in the vicinity of SS-013 (Figure 1-3). These include the Flightline (SS-004) to the east and north; the former Fire Training Area (FT-002), the former Liquid Oxygen Plant (SS-027), and a former landfill (LF-023) to the north-northwest; the Explosive Ordnance Demolition Range (SS-026) to the west; and another former landfill (LF-024) to the southwest. SS-013 is situated downgradient of groundwater contaminant plumes emanating from site FT-002 and associated with site LF-023. Upgradient wells at SS-013 appear to be impacted by the FT-002 groundwater contaminant plume. Contaminated groundwater from the FT-002 site also discharges into surface water northeast of SS-013 and is carried through the SS-013 drainage.

1.3 Previous Investigations

The following subsections chronologically list and summarize the previous investigative and remedial activities that have been conducted at site SS-013. Data from these activities has been integrated into Sections 3.0, 5.0, and 6.0 of this report.

1.3.1 Phase I Records Search

In 1985, Radian Corporation completed a Phase I records search to identify sites basewide with possible environmental contamination resulting from past waste disposal practices, and to assess the probability of contaminant migration. Radian assigned a Hazard Assessment Ranking Methodology (HARM) score of 70/100 to the MMS industrial complex. There was direct evidence for migration of hazardous contaminants at the MMS site based on surface water samples collected by the Bioenvironmental Engineering Office at PAFB. These samples contained low part per billion (ppb) levels of methylene chloride, benzene, toluene, dichloroethene, trichloroethene, and trichlorethane.

Radian (1985) recommended that future investigative work include:

- Two surface water samples
- Five monitoring wells

- One 5-foot deep soil boring advanced near Building 3578 to collect soil samples at 1-foot intervals

1.3.2 Site Investigation

In 1987, E. C. Jordan conducted a series of SIs at various PAFB sites, including SS-013 (E.C. Jordan 1989). As part of the SS-013 SI, E.C. Jordan performed the following: (1) a limited soil organic vapor (SOV) survey around the leach field east of Building 3569 to investigate the potential for volatile organic compounds (VOCs) in soil gas; (2) installation and sampling of 5 monitoring wells; and (3) collection of 1 surface water and 1 sediment sample in tributary C-21-1 to assess the quality of surface water and sediment downstream of the industrial complex (Figure 1-4). Due to security restrictions, all SI field activities were conducted outside of the SS-013 security fence. Because of organic and inorganic compound detections in the sediment, surface water, and groundwater samples, E.C. Jordan recommended additional investigation of the drainageways and groundwater at SS-013.

1.3.3 Drainage Flow Study

ABB Environmental Services, Inc. (formerly E.C. Jordan Co.) completed a base-wide drainage flow study in September 1991 (ABB 1991). The purpose of the study was to establish baseline water quality data and to characterize the surface water network at PAFB. As part of this study, 7 locations were monitored for one year in the vicinity of SS-013. Results of this investigation are discussed in Section 5.0.

1.3.4 Remedial Investigation

Additional hydrogeologic and chemical data were obtained during the RI performed by URS Consultants, Inc. (URS 1996a). This study followed through with the recommendations of the SI and included investigations inside the secure portion of the MMS. Field activities were conducted in two phases. The first phase, conducted between July 1993 and February 1994, included: a soil gas survey (Figure 1-5); collection and chemical analysis of 19 surface soil samples, 26 subsurface soil samples, 20 groundwater screening samples, and 12 surface water and

12 sediment samples; installation and development of 3 monitoring wells; and sampling of groundwater at the 3 newly installed monitoring wells and at 3 existing monitoring wells (2 rounds). The second phase, conducted from August through October 1995, included: installation of 4 monitoring wells and 8 piezometers; groundwater sampling from the 12 SS-013 wells and 8 existing wells at sites FT-002 and LF-023; collection of 11 sediment samples for total organic carbon (TOC) analysis; and collection and analysis of 2 soil samples. RI sampling locations are shown in Figures 1-6 and 1-7. Results of the RI are incorporated in Sections 3.0, 5.0, and 6.0.

The RI concluded that site contamination is potentially attributed to five potential onsite source areas which are shown in Figure 1-2 and include: (1) leach field N; (2) leach field S; (3) leach field A; (4) the former waste accumulation area; and (5) the UST that was located southwest of Building 3578. Contamination in the leach fields is likely a result of small spills that may have reached the leach fields through floor drains and the sewer network. The waste accumulation area was used for drum storage and staging. A solvent storage pad, located about 30 feet north of the waste accumulation area, was used to stage drums of solvents, primarily toluene. Spills appear to have occurred in these areas. The UST and associated piping appear to have leaked an unknown quantity of #2 fuel oil.

In general, contamination migrates from the five potential source areas into groundwater. Contamination in groundwater may then discharge into surface drainage near the site. Surface drainages are also impacted by upgradient sources. Results of the groundwater sampling showed that the fire training area plume was migrating and beginning to encroach on the MMS area, since 1,2-dichloroethene (1,2-DCE) and trichloroethene (TCE) were detected at MW-13-001. However, this contamination had not impacted wells in the MMS industrial complex area.

Human health risks associated with exposure to potentially contaminated media were assessed under three exposure scenarios:

- Current conditions under which trespassers could be exposed to surface soil contaminants
- Hypothetical future conditions under which construction workers could be exposed to surface and subsurface soil contaminants during intrusive activities

- Hypothetical future conditions under which industrial workers could be exposed to groundwater (through ingestion or inhalation of vapors) or soil (through incidental ingestion or dermal contact)

The results of the risk analysis, showed:

- Risks to trespassers, under the current use scenario, were within acceptable levels
- Risks to construction workers, under hypothetical future conditions, were within acceptable levels
- Risks to industrial workers, under hypothetical future conditions, from exposure to soil contaminants only were within acceptable levels
- Risks to industrial workers from exposure to groundwater contaminants were above acceptable levels

Risks from exposure to groundwater were largely due to vinyl chloride and arsenic.

Risks to wildlife were assessed by evaluating potential impacts of soil and sediment contaminants on four terrestrial indicator species. Results showed that there are no potential risks to terrestrial species from soil contamination. There is a potential impact on one of the four species (the meadow mouse) from sediment contamination. However, the magnitude of impact on this species is expected to be small, (i.e., only 5 mice in the population could experience chronic effects at a given time).

Risks to aquatic life were assessed by comparing representative surface water concentrations to federal and state water quality criteria and guidelines. Concentrations of all chemicals, except silver, were below established values. Silver was detected at concentrations of 2.0 μg/l (SW-13-07) and 2.5 μg/l (SW-13-01) in two samples upstream of SS-013 and on opposite sides of the MMS (Figure 1-7). These detections were well below the calculated New York State Class D surface water standard of 20.72 μg/l, but above a federal scientific assessment chronic exposure value of 0.12 μg/l (USEPA 1979b). The source of the silver detections is unknown and is not believed to be attributable to the SS-013 site.

In general, site-related contaminants did not appear to represent a significant threat to ecological receptors.

RI Recommendations

Soil, surface water, and sediment data, and the risk evaluation all indicated that no action was warranted to address contamination in these media.

The localized groundwater contamination around MW-13-008 represented a potential future health threat. This threat could have been mitigated by implementation of deed restrictions on future groundwater use. Such restrictions could be instituted since municipal water is available in this area of the base. However, source mitigation, in addition to deed restrictions, appeared prudent to further ensure protection.

Groundwater quality was expected to improve significantly after closure actions at source areas which were scheduled to begin in 1996. The closure actions were projected to include the following:

- Contract No. 41625-94-D8106 was to include removal of the UST near Building 3578 and associated contaminated soil.

- Project No. 95-6010 Phase II was to include removal of the leach fields.

In addition to the above actions, it was recommended that a removal action be performed at the former waste accumulation area (the only source area not addressed by the above actions) to further improve groundwater quality. The primary area of concern was at the former solvent storage pad. It was expected that groundwater quality would significantly improve and eventually be restored to acceptable quality after the contaminant sources were removed.

1.3.5 1996 Equipment Removals

In 1996, OHM Remediation Services Corporation (OHM) removed the underground fuel-oil storage tank located southwest of Building 3578 and the majority of the septic system equipment at SS-013 (Figure 1-8). The piping, septic tank, sand filter, and leach field S north of Building 3569 were not removed. The removal activities are summarized in the following two sections. The complete Closure Reports are included as Appendices B and C.

1.3.5.1 UST-3578-A-2 Removal

On March 26, 1996, OHM excavated and removed the 6,000 gallon underground fuel oil storage tank located southwest of Building 3578. Soil around the UST was excavated to a depth of approximately 10 feet and temporarily stockpiled adjacent to the excavation on plastic sheeting. Groundwater was encountered at a depth of approximately 3 feet. Staining and hydrocarbon odors were present at the time of the removal.

On June 5, 1996, a groundwater sample was collected from monitoring well MW-13-008, which is located in a concrete parking area surrounding Building 3578 and is about 75 feet northwest of the former tank (Figure 1-9). The concentrations of benzene (6.7 ppb), toluene (9.5 ppb), ethylbenzene (9.5 ppb), xylenes (42.7 ppb), naphthalene (41,059 ppb), acenaphthene (1,596 ppb), fluorene (394 ppb), and phenanthrene (90.3 ppb) in the groundwater sample exceeded New York State (NYS) Class GA Groundwater Standards.

On June 25, 1996, a five-point composite soil sample was collected from the middle of each of the five major sidewalls of the tank removal excavation and a grab sample was collected from the groundwater in the excavation (Figure 1-9 and Photo 1). The samples were analyzed for VOCs and polycyclic aromatic hydrocarbons (PAHs). The VOC fraction of the soil sample was resampled on July 10, 1996 due to a holding time exceedance. The water grab sample contained benzene (1.6 ppb) at a concentration that exceeded its respective NYS groundwater standard. The composite soil sample contained very low concentrations of benzene, ethylbenzene, and xylenes, but at levels below regulatory agency guidance values. The soil stockpile had been transported to the on base treatment cell; therefore, no soil stockpile analytical samples were collected.

Because of the high fuel-related compound concentrations in the groundwater sample from MW-13-008, it was thought that the piping connecting the UST to Building 3578 might have been leaky. On October 8 and 9, 1996, the UST excavation was extended northward and all remaining fuel supply piping to Building 3578 was removed (Figure 1-10). Soil was excavated to a depth of 4 feet and transported directly to the on-site treatment cell. Groundwater was encountered at approximately 4 feet depth. Staining and hydrocarbon odors were present and soil headspace samples collected within the trench had photoionization detector (PID) readings above 20 parts per million (ppm).

On October 9, 1996, two five-point composite soil samples were collected from the bottom and sidewalls of the trench (Figure 1-10). A water grab sample was also collected from an area where water had accumulated in the bottom of the trench. The samples were analyzed for VOCs and PAHs. The water grab sample contained xylenes (9.0 ppb) at a concentration that exceeded its respective NYS groundwater standard. The composite soil samples contained ethylbenzene, xylenes, naphthalene, acenaphthalene, phenanthrene, and pyrene at concentrations that exceeded their respective Stars Memo #1 Toxicity Characteristic Leaching Procedure (TCLP) Alternative Guidance Values.

Additional soil was removed from the trench on October 10, 1996 (Figure 1-11). On December 30, 1996, four three-point composite soil samples were collected from three sidewalls of the enlarged trench and analyzed for VOCs and PAHs. One VOC and several PAHs were detected in the soil samples at concentrations exceeding their respective Stars Memo #1 TCLP Alternative Guidance Values. The excavated soil stockpile was transported to the on base treatment cell and the excavation was backfilled to grade with clean imported fill. The portion of the excavation that had previously been a concrete parking area was later paved with asphalt (Photo 2).

1.3.5.2 Septic System Removal

On September 16, 1996, OHM excavated and removed a 7,500 gallon septic tank from the north side of Building 3578 (Figure 1-2 and Photo 3). The contents of the tank had been sampled on August 29, 1996 and analyzed for VOCs in accordance with the requirements of the disposal facility (the Plattsburgh Water Pollution Control Plant). No VOCs were detected in the sample and the tank contents were pumped out on September 14, 1996.

Soil at the septic tank location was excavated to a depth of 5 feet and temporarily stockpiled adjacent to the excavation on plastic sheeting (Figure 1-12). Groundwater was encountered at a depth of 4 feet during removal activities. No signs of contamination (staining or odors) were noted. On October 3, 1996, a four-point composite soil sample was collected from the sidewalls of the excavation and a water sample was collected from the bottom of the excavation. Both samples were analyzed for VOCs and PAHs and no compounds were detected in the samples. The excavation was backfilled to grade with the originally excavated soil.

Other parts of the septic system were also removed in September 1996; however, documentation of these removals appears to be limited to site photographs. The lift station and its sump were removed, as were the piping leading from the lift station to leach field A (Photos 4 through 6). The drainage piping within leach field A also was removed. Vitrified clay piping leading from the septic tank to Building 3580 was removed up to the paved access road (Photos 3 and 7). Other piping removal may have occurred but could not be verified with available documentation. No environmental samples were collected during the removal of the piping or lift station.

1.3.6 1997 Removal Action at the Former Waste Accumulation Area

The RI had identified the presence of VOCs in soils surrounding a concrete pad, located east of Building 3578, that had been used to store solvent containers (Photo 8). Spills on or around this pad were suspected of being a source of groundwater contamination. On April 16, 1997, OHM and Parsons Engineering Science, Inc. (Parsons) collected 8 grab soil samples around the perimeter of the pad to help delineate the extent of soil requiring removal (Parsons-OHM 1999). On November 3, 1997, the 6-foot by 13.5-foot concrete pad was broken up and staged on plastic sheeting next to the excavation. Excavated soil was loaded directly into dump trucks for transportation to the on-site treatment facility. The final excavation dimensions were 19 feet wide by 23.5 feet long by 6 feet deep (approximately 100 cubic yards of soil was excavated) (Figure 1-13). The top 2.5 feet of soil was a thin layer of topsoil underlain by fine to medium sand. Some of the sand was slightly stained. Beneath the sand layer was gray clay which continued to the bottom of the excavation.

Confirmatory soil samples were collected from the bottom and sidewalls of the excavation and were analyzed for VOCs and semivolatile organic compounds (SVOCs) (Figure 1-13). Several VOCs and SVOCs were detected at low concentrations in the soil samples, but the detected concentrations were well below their respective NYSDEC soil cleanup objective guidance concentrations (NYSDEC 1994). NYSDEC and USEPA concurred with the recommendation that no further soil removal was warranted at the excavation location (Appendix D). The excavation was backfilled with clean fill on May 11, 1998, a layer of topsoil was spread over the backfill material, and the site was seeded.

A sample of the concrete pad was submitted for TCLP VOC, SVOC, and metals analyses. The results showed the concrete was not classifiable as a Resource Conservation and Recovery Act (RCRA) hazardous material and it was therefore disposed of as construction debris.

1.3.7 Fire Training Area (FT-002)/Industrial Area Groundwater Operable Unit Remedial Investigation/Feasibility Study

From 1995 through 1999, a large volume of groundwater and surface water data was compiled as part of the Fire Training Area (FT-002)/Industrial Area Groundwater Remedial Investigation/Feasibility Study (URS 2000a). These data supported the conclusions of the SS-013 RI, indicating that the leading edge of the chlorinated hydrocarbon contaminated groundwater plume from site FT-002 is impacting the most upgradient SS-013 monitoring wells (MW-13-001 and MW-13-002) and will likely impact the MMS industrial complex in the future. Surface water sampling results also indicated that contaminated groundwater from the FT-002 plume discharges to surface water in the drainage basin between the runway and flightline north of SS-013. The storm drainage system carries this water to a tributary that flows through site SS-013 and eventually to the Salmon River. Relevant data from the FT-002 study has been incorporated into Sections 3.0 and 5.0 of this report.

1.3.8 2000/2001 Removal Action at Buildings 3578 and 3569

An additional "time-critical" removal action was implemented by the Air Force to address soil contamination remaining in the vicinity of the former Building 3578 UST (Photos 9 and 10) and also to address a small area of PAH contaminated soils near Building 3569 (Photos 11 and 12). The Action Memorandum for this "time-critical" removal was reviewed by the USEPA and NYSDEC and presented for public commentary during the June 8, 2000 Restoration Advisory Board meeting in Plattsburgh. The soil removals began in August 2000 and continued through May 2001. Confirmatory soil samples were collected at both removal locations. Validated confirmatory sample data was submitted in August 2001 for review by the regulatory agencies. Following regulatory agency approvals, the Air Force (November 2001) removed and disposed of the contaminated soil and backfilled the excavations with soil from the stockpiles that showed no exceedances of NYSDEC recommended soil cleanup objectives (NYSDEC 1994) and imported clean fill material from an offbase source. A Draft Closure Report was submitted for regulatory agency review and concurrence in March 2002 (Versar 2002). Analytical data from the confirmatory samples has been incorporated in the Human Health Risk Assessment, Section 6.0.

1.4 Report Organization

This report has been organized in a format consistent with Chapter 3 of *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA 1988a). Report organization is as follows.

Site background information, including a discussion of previous investigations, is provided in Section 1.0. In Section 2.0, the scope of work is outlined, and the methods and procedures used during the Supplemental RI field investigation are summarized. The physical characteristics of the site are described in Section 3.0. In Section 4.0, Applicable or Relevant and Appropriate Requirements (ARARs) are discussed. Section 5.0 provides a detailed discussion of analytical testing results, both from this study and from previous investigations. A discussion of risk assessment results is presented in Section 6.0. A summary and conclusions are presented in Section 7.0, and recommendations for future action are made in Section 8.0.

The report is divided into two volumes. The first volume consists of the text, tables, figures, and photographs. The second volume consists of supporting appendices.

2.0 SUPPLEMENTAL REMEDIAL INVESTIGATION FIELD ACTIVITIES

Supplemental RI field activities were conducted between July and December 2000 and consisted of:

- Collecting groundwater samples for laboratory analysis from 2 SS-013 monitoring wells in July 2000

- Installing and developing 3 new shallow groundwater monitoring wells at SS-013 in November/December 2000

- Collecting groundwater samples for laboratory analysis from 12 SS-013 monitoring wells in December 2000

As was done for the RI, field sampling was conducted in a manner consistent with the *Final Work Plan* (Malcolm Pirnie 1992a) and the *Final Site Safety and Health Plan* (Malcolm Pirnie 1992b). The following modifications to the *Final Work Plan* were used for the RI and were also used for this sampling program:

- Stipulating a frequency of trip blanks of one per cooler in which a volatile organics sample was shipped.

- Each well was purged using a Waterra hydro-lift pump or an Isco peristaltic pump equipped with dedicated and disposable high-density polyethylene tubing and foot-valve (i.e., new tubing and foot-valves were used in each well). Submersible pumps were not used. Six well volumes were purged from each well prior to sample collection (with the exception of wells that purged to dryness before the target volume of water was removed). The factor used to calculate purge volumes for 2-inch diameter wells was increased from 0.17 gallons/foot to 2.5 gallons/foot for the portion of the well that has a filter pack to ensure that the filter pack surrounding the well was also purged of any stagnant water. The sixth well volume was purged with a dedicated/disposable bailer to ensure that any stagnant water was also removed from the top of the water column.

- Pre-cleaned, factory sealed, disposable Teflon bailers were used to collect groundwater samples. Equipment blanks were taken from this apparatus at a frequency of one per batch lot.

Deviations from the *Revised Work Plan for Supplemental Remedial Investigation at Spill Site SS-013* (URS 2000b) included:

- The bentonite seals on the three newly installed monitoring wells were only 1 to 1.5 feet thick instead of the minimum of 2 feet specified in the Work Plan (due to the shallow water table).

- New wells MW-13-013 through MW-13-015 did not have 3 times the volume of municipal water added to the borehole during well construction removed during development (see Section 2.2).

- Monitoring wells MW-13-005, MW-13-008, and MW-13-012 could not be sampled in December 2000 because groundwater in these wells was frozen.

2.1 Monitoring Well Installation

This section describes the procedures that were utilized for the installation of the three new shallow groundwater monitoring wells at SS-013. One well (MW-13-013) was installed downgradient of the former leach field N and two wells (MW-13-014 and MW-13-015) were installed downgradient of leach field S (Figure 2-1). Drilling services were provided by Northern Technical Services of Malone, New York using a CME 550 all terrain vehicle (ATV) mounted drill rig.

MW-13-013 through MW-13-015 were installed with 10-foot long screens straddling the water table surface. Boreholes for well installation were advanced with 6¼-inch inner diameter

(I.D.) hollow stem augers (HSA). Soil samples for geologic classification were collected with 2-inch split spoon samplers in accordance with ASTM D1586-84. Sampling frequency was at a minimum of 5-foot intervals, or more frequently as directed by the URS supervising geologist. Because of the shallow depth to the water table in the new well borings (generally approximately 1 foot below ground surface), it was necessary to keep a head of potable water in the HSA to keep mobile overburden soils from flowing into the HSA (approximately to the level of the water table). As indicated on the Well Development Logs (Appendix G), approximately 150, 400, and 150 total gallons of potable water were added to the MW-13-013, MW-13-014, and MW-13-015 boreholes, respectively, during drilling. Boring logs for the well borings are provided in Appendix E.

All well riser and screen was steam-cleaned prior to installation. Wells were constructed of 2-inch I.D. Schedule 40 threaded flush-joint PVC riser pipe and 0.010-inch slot screen. End caps for the screens were threaded. The sand pack consisted of clean well-rounded sand (Filpro #1 Well Gravel) with a grain size distribution and uniformity coefficient compatible with the formation material and screen. Because of the shallow depth to the water table, only a 1- to 1.5-foot thick bentonite seal could be placed above the sandpacks. Steel stickup protective casings with concrete aprons were used to complete the wells at the surface. Steel guard posts were installed around the well heads to protect the wells from mowing activities. Well construction details are provided in Appendix F.

2.2 Well Development

The three newly installed monitoring wells were to be developed by pumping prior to sampling using a Waterra hydrolift pump with dedicated and disposable high-density polyethylene (HDPE) tubing and footvalve. However, only MW-13-014 yielded sufficient water to be developed with a Waterra pump. MW-13-013 and MW-13-015 typically pumped dry after only a few gallons had been removed. These slow recharging wells were developed by pumping with a Isco peristaltic pump with dedicated HDPE tubing and footvalves and hand-bailing with disposable teflon bailers.

Development was to continue until pH, temperature, specific conductance, and oxidation-reduction potential (ORP) readings on discharge water had stabilized and turbidity readings were less than 50 nephelometric turbidity units (NTU). Also, a minimum of 3 times the volume of municipal water (drilling water) added to the borehole during well construction was to be removed during development. Parameter stabilization and turbidity requirements were generally achieved for all three wells, but difficulties were encountered trying to remove 3 times the volume of drilling water added during well installation because of the poor recharge characteristics of the wells. The Well Development Logs in Appendix G indicate that only 69.5, 360, and 160.5 total gallons were removed from MW-13-013, MW-13-014, and MW-13-015, respectively as compared to the 150, 400, and 150 total gallons of potable water added to each well boring, respectively, during drilling.

Because of the onset of winter and the shallow depth to the water table in the new wells, it was feared that the development and subsequent sampling of the wells would not be completed before the wells froze. Therefore, development of the wells was discontinued in early December so the wells could equilibrate for approximately 2 weeks prior to being sampled.

2.3 Water Level Measurements

A complete round of water level measurements was collected from all SS-013 monitoring wells, piezometers, and stream gauging stations on December 13, 2000. Surface water/groundwater at many locations was frozen and the top of ice surfaces were utilized as default water levels. These data were used to evaluate current groundwater flow conditions and the interrelationship between groundwater and surface water in the vicinity of SS-013. Results are presented in Section 3.0.

2.4 Groundwater Sampling

The Work Plan specified that one round of groundwater samples would be collected from the fifteen SS-013 monitoring wells (MW-13-001 through MW-13-015; see Figure 2-1). All groundwater samples were to be analyzed for target compound list (TCL) VOCs and TCL SVOCs. The samples from newly installed monitoring wells MW-13-013 through MW-13-015 and existing monitoring wells MW-13-003, MW-13-004, MW-13-006, MW-13-007 and MW-13-008 also were to be analyzed for total (unfiltered) and dissolved (filtered) target analyte list (TAL) metals to evaluate the downgradient impacts at suspected source areas.

Sampling was conducted from December 14 through 21, 2000. Only twelve wells could be sampled. Wells MW-13-005, MW-13-008, and MW-13-012 were frozen and could not be sampled. Each well was purged before sampling following procedures specified in the Work Plan. Six wells were pumped dry during purging (MW-13-004, -007, -010, -013, -014, and -015). Well purging logs are provided in Appendix H. After purging, the wells were sampled using dedicated, disposable Teflon 1⅝-inch outer diameter bailers with Teflon-coated stainless-steel leader lines. Wells that had pumped dry during purging were sampled after they had recovered to a sufficient level to acquire necessary volumes for sample analysis.

Previously, groundwater samples were collected from MW-13-008 and MW-13-012 on July 13, 2000 and were analyzed for TCL VOCs and TCL SVOCs. These samples were collected in advance of the Building 3578 soil removal to evaluate the impact of the soil removal on groundwater quality and because it was anticipated that the removal might necessitate the abandonment of MW-13-008. The purge logs for this sampling event are also in Appendix H. The analytical results for the Supplemental RI groundwater samples collected at SS-013 are presented in Appendix A and are discussed in Section 5.0.

Based on comments from USEPA and NYSDEC, additional groundwater sampling events were conducted in 2002. MW-13-008 was sampled on August 15, 2002, MW-13-005 and MW-13-012 were sampled on August 27, 2002, and MW-13-013, -014, and –015 were sampled on November 7, 2002. These later three wells were sampled to remove concerns regarding water added to the wells during construction that was not removed during development for the 2000 sampling event (NYSDEC agreed that enough time had passed to alleviate these concerns for the 2002 event). The analytical results from the 2002 event are presented in Appendix O. Purge logs are given in Appendix H.

2.5 Laboratory Methods and Validation Procedures

Samples collected for chemical analysis were preserved, packaged, and shipped according to procedures specified in the *Final Work Plan* (Malcolm Pirnie 1992a) and *Chemical Data Acquisition Plan* (Malcolm Pirnie 1992c). Samples were analyzed by O'Brien & Gere Laboratories of Syracuse, New York. TCL VOCs were analyzed following USEPA Method 8260B; TCL SVOCs were analyzed following USEPA Method 8270C; and TAL metals were analyzed by USEPA Methods 6010B/7470A. The data were reviewed for compliance with the referenced methods, the URS subcontract agreement with the laboratory, and the requirements of the *Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP) Version 3.0* (AFCEE 1998), including project-approved variances. Appendix A contains the Data Assessment Summary, chain-of-custody forms, data flagged with validation qualifiers, and raw laboratory data forms. Results are discussed in Section 5.0.

2.6 Site Surveying

Following drilling activities, the three new monitoring well sites were surveyed for horizontal location and elevation. Horizontal coordinates are based on the New York State Plane Coordinate System, Transverse Mercator Projection, East Zone, North American Datum of 1927. Vertical coordinates (elevations) are based on the National Geodetic Vertical Datum of 1929 (mean sea level – msl). Surveyed locations and elevations are provided in Appendix I. All surveying was conducted under the supervision of a New York State-licensed land surveyor.

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

The physical characteristics of the SS-013 area were described in the Draft Final RI report in great detail (URS 1996a). Portions of that information have been included in this section as has information collected subsequent to the RI.

3.1 Surface Features

The major physical features in the vicinity of the SS-013 site are the industrial complex and the weapons storage bunkers (Figure 3-1). The industrial complex consists of a series of buildings accessible by a paved road. A major drainageway enters near the northeast corner of the site, flows through the facility, and intersects lower-order drainage ditches and swales that originate within and west of the site. These drainageways carry runoff, which eventually discharges into the Salmon River, away from the facility. Most of the area within and immediately surrounding the site is grass-covered.

In general, the land at SS-013 slopes to the south and southwest, although locally it may slope in various directions towards intermediate surface drainages. Topography ranges from hilly to flat and surface elevation ranges from approximately 200 feet above mean sea level (amsl) to approximately 150 feet amsl. The majority of the site has little relief. Because of this topographic variability coupled with the pattern of the drainageways, several surface water drainage divides occur at the site.

3.2 Land Use

Land uses near PAFB include industrial, residential, commercial, and business. A zoning map for PAFB and vicinity is presented in Figure 3-2. The Plattsburgh Airbase Redevelopment Corporation (PARC) currently is administering the redevelopment of PAFB in conjunction with the USAF. Proposed reuses for the SS-013 site, outlined in the *Final Environmental Impact Statement for the Disposal and Reuse of PAFB, NY* (USAF 1995) and the *Draft Environmental Assessment – Alternative Land Uses, Plattsburgh Air Force Base* (USAF 2000), include aviation support, industrial, commercial, and public/recreational.

PAFB obtains its potable water from the City of Plattsburgh municipal water system. Municipal water sources are the Patterson and Mead Reservoirs, and West Brook, located approximately 5 miles northwest of the City of Plattsburgh. Some residences adjacent to PAFB rely on private wells for drinking water. These residences include the homes along Kemp Lane (near the base's north gate), the residential development on old NY Route 22 (near the NY Route 22 and I-87 interchange), and residences southeast of the base along Route 9 (Figure 3-3).

3.3 Soils

Soils mapped in the vicinity of SS-013 include Udorthents, Udipsamments and Psammequents, Fluvaquents-Udifluvents complex, Raynham silt loam, Pipestone loamy sand, Junius loamy fine sand, Plainfield loamy sand, Croghan loamy fine sand, and urban land - Plainfield complex (USDA-Soil Conservation Service undated). Soil units are described in Table 3-1 and depicted in Figure 3-4. Site geology is discussed in Section 3.7.2.

3.4 Ecology

A Step I Habitat Assessment (URS 1994a) and wetlands delineation (USACE 1992; URS 1994b) were used to evaluate and characterize the ecology of the area around SS-013.

3.4.1 Covertypes

Vegetative covertypes, both aquatic and terrestrial, were mapped during the Step I Habitat Assessment (URS 1994a). Fourteen covertypes identified in the vicinity of the SS-013 site are illustrated in Figure 3-5 and described below. Plots of covertypes over the entire base at a scale of 1" = 200' may be found in the Step I Habitat Assessment Report (URS 1994a).

- **Riverine System Covertypes**

(MS) - Midreach Stream - A midreach stream is moderate to large-sized, with a mainstream dominated by riffle/run/pool associations. Stream bottom substrates are generally bedrock, boulders, cobbles, gravel, or sand. There may be small backwaters, seeps, wetlands, or waterfalls associated with the mainstream habitats. There also may be temporary slackwater regions associated with snags, debris, or beaver dams. The Salmon River is a midreach stream downgradient from SS-013. Some of the expected fish species in a midreach stream include:

Rainbow trout *(Oncorhynchus mykiss)*
Brown trout *(Salmo trutta)*
White sucker *(Catostomus commersoni)*
Silver redhorse *(Moxostoma anisurum)*
Common shiner *(Notropis cornutus)*

(HW) - Marsh Headwater Stream - A marsh headwater stream is a small stream that has its source in a lowlands swamp or marsh wetlands. A headwater stream is differentiated from an intermittent stream by the presence of permanent aquatic habitat. Permanent aquatic habitats are pools that remain even during periods of low stream flow when portions of the stream bed may be dry. These pools provide refuge for fish and macroinvertebrate communities that will re-populate the stream when flow resumes.

Typical marsh headwater stream aquatic habitats are riffle, run, and pool associations. Additional instream habitats include undercut banks, overhanging vegetation, logs, snags, and other debris. Beaver dams with associated ponds are common and may promote the presence of permanent aquatic habitats. Marsh headwater streams may have extensive wetland areas associated within their floodplain, similar to the marsh headwater stream of Reschke (1990). The stream that runs through and past the Weapon Storage Area (WSA), eventually emptying to the Salmon River, is a good example of a marsh headwater stream. Typical fishes include:

Brook trout (*Salvelinus fontinalis)*
Creek chub (*Semotilus atromaculatus)*
Johnny darter (*Etheostoma nigrum)*
Common shiner (*Notropis cornutus)*
Bluntnose minnow (*Pimephales notatus)*
Blacknose dace (*Rhinicthys atratulus)*

In addition, marsh headwater streams are often utilized as spawning and nursery areas by other fish species such as:

White sucker (*Catostomus commersoni*)
Rainbow trout (*Oncorhynchus mykiss*)
Brown trout (*Salmo trutta*)
Northern brook lamprey (*Icthyomyzon fossor*)
Longnose dace (*Rhinicthys cataractae*)

(DS) - Ditch/Intermittent Stream - This type occurs along small drainageways, either channelized or natural. These drainageways are often lined with plant species from the wet meadow or shrub swamp communities listed below and are similar to the ditch/artificial intermittent stream of Reschke (1990). These are various intermittent streams/ditches in the grass area to the west of the PAFB runway. Fish species in intermittent streams may include:

Bluntnose minnow (*Pimephales notatus*)
Creek chub (*Semotilus atromaculatus*)
Johnny darter (*Etheostoma nigrum*)

- **Terrestrial System - Forested Covertypes**

(PH) - Pine-Hardwoods - This covertype is the most xeric of the forested types. It occurs on well-drained sandy soils. It is similar to the Appalachian oak-pine forest and pine-northern hardwoods forest of Reschke (1990). Pines together make up more than 50 percent of the stand. Some stands are plantations. There are many occurrences of this covertype throughout the base (e.g., the areas west, south, and east of the WSA). Dominant plant species include:

Trees
    Pines (*Pinus strobus, P. rigida, P. resinosa*)
    Oaks (*Quercus rubra, Q. alba, Q. velutina*)
    Aspens (*Populus grandidentata, P. tremuloides*)
    Paper Birch (*Betula papyrifera*)

Black Cherry (*Prunus serotina*)

Shrubs

Blueberries (*Vaccinium angustifolium, V. pallidum*)
Black Huckleberry (*Gaylussacia baccata*)
Sheep Laurel (*Kalmia angustifolia*)

Herbs

Bracken Fern (*Pteridium aquilinum*)
Sarsaparilla (*Aralia nudicaulis*)
Indian Cucumber-root (*Medeola virginiana*)

(HH) - Hemlock-Hardwoods - This covertype is more mesic than the pine-hardwoods described above. It often occurs on cool north- to east-facing slopes, but also occurs on moist flats. It is similar to the hemlock-northern hardwood forest of Reschke (1990). Hemlock makes up more than 50 percent of the stand. This covertype is rare on the base. Hemlock-hardwoods tend to be small areas surrounded by mixed hardwood or pine hardwood forests. An example of this covertype may be found near the southern perimeter of the WSA. Dominant plant species include:

Trees

Hemlock (*Tsuga canadensis*)
Beech (*Fagus grandifolia*)
Yellow Birch (*Betula alleghaniensis*)
White Pine (*Pinus strobus*)
Sugar Maple (*Acer saccharum*)
Black Cherry (*Prunus serotina*)
Northern White Cedar (*Thuja occidentalis*)

(MH) - Mixed Hardwoods - This covertype occurs on mesic sites. It is most similar to successional northern hardwoods, but with elements of the beech-maple mesic forest of Reschke (1990). Some conifers may be present (e.g., white pine, hemlock, and northern white cedar), but these together make up less than 50 percent of the stand. This covertype is found throughout the base. Dominant plant species include:

Trees

- Red Maple (*Acer rubrum*)
- Aspens (*Populus grandidentata, P. tremuloides*)
- Paper Birch (*Betula papyrifera*)
- Beech (*Fagus grandifolia*)
- Sugar Maple (*Acer saccharum*)
- White Ash (*Fraxinus americana*)
- Oaks (*Quercus rubra, Q. alba, Q. macrocarpa*)

Shrubs

- Hop Hornbeam (*Ostrya virginiana*)
- Ironwood (*Carpinus caroliniana*)
- Spicebush (*Lindera benzoin*)

Herbs

- Cinnamon Fern (*Osmunda cinnamomea*)
- Sensitive Fern (*Onoclea sensibilis*)
- Spinulose Wood Fern (*Dryopteris spinulosa*)

- **Terrestrial System - Non-Forested Covertypes (Moderately Disturbed)**

(DM) - Dry Meadow - This covertype is maintained by periodic mowing or brush-hogging at least annually and is dominated by various non-hydrophytic forbs and grasses. Young shrubs and seedlings/saplings may be present, but are only minor components of the community and are cut back periodically. This covertype contains various elements of the successional old field, cropland/field crops, and pastureland of Reschke (1990). Examples of this covertype may be found just west of SS-013. Dominant plant species include:

Herbs

- Goldenrods (*Solidago nemoralis, S. altissima, S. canadensis*)
- Bluegrasses (*Poa pratensis, P. compressa*)
- Kentucky Fescue (*Festuca arundinacea*)
- Quackgrass (*Agropyron repens*)
- Timothy (*Phleum pratense*)
- Orchard Grass (*Dactylis glomerata*)
- New England Aster (*Aster novae-angliae*)
- Common Evening Primrose (*Oenothera biennis*)
- Wild Carrot (*Daucus carota*)
- Ragweed (*Ambrosia artemisiifolia*)

Young Shrubs

- Northern Arrowwood (*Viburnum recognitum*)
- Common Blackberry (*Rubus allegheniensis*)
- Multiflora Rose (*Rosa multiflora*)

Trees (Saplings/Seedlings)

- White Ash (*Fraxinus americana*)
- Aspens (*Populus tremuloides, P. grandidentata*)
- Red Maple (*Acer rubrum*)

(SU) - Successional Shrubland - This covertype is similar to the successional old field, but is usually somewhat farther removed in time from maintenance. Shrubs and young trees/saplings make up more than 50 percent of the cover. This covertype is found throughout the base, but is relatively rare near the SS-013 site. Examples may be found in the wet meadows just west of the site and along the Salmon River south of the site. Dominant plant species include:

Shrubs

- Black Chokeberry (*Pyrus Melanocarpa*)
- Dogwoods (*Cornus amomum, C. racemosa*)

Northern Arrowwood (*Viburnum recognitum*)
Common Blackberry (*Rubus allegheniensis*)
Roses (*Rosa carolina, R. multiflora*)
Glossy Buckthorn (*Rhamnus frangula*)
Sumacs (*Rhus typhina, R. glabra*)

Trees

White Ash (*Fraxinus americana*)
Aspens (*Populus tremuloides, P. grandidentata*)
Soft Maples (*Acer rubrum, A. negundo*)
Paper Birch (*Betula papyrifera*)

Herbs

Goldenrods (*Solidago nemoralis, S. altissma, S. canadensis*)
Kentucky Bluegrass (*Poa pratensis*)
Kentucky Fescue (*Festuca arundinacea*)
Quackgrass (*Agropyron repens*)
Timothy (*Phleum pratense*)
Orchard Grass (*Dactylis glomerata*)
New England Aster (*Aster novae-angliae*)
Common Evening Primrose (*Oenothera biennis*)
Wild Carrot (*Daucus carota*)
Ragweed (*Ambrosia artemisiifolia*)

- **Terrestrial System - Non-Forested Covertypes (Highly Disturbed)**

(ML) - Mowed Lawn - This covertype is mapped in areas of lawn grasses maintained by regular mowing. Trees and shrubs may be present, but make up less than 30 percent of the cover. This covertype may be found throughout the base. It includes most areas immediately adjacent to buildings and alongside the runway.

(PS) - Unvegetated Permeable Surfaces - This covertype includes areas where vegetation has been removed, but the surface has not been paved or sealed. Examples include abandoned sand pits and railroad beds. Vascular plants are only minor, incidental components of this covertype. Examples of this covertype may be found about 500 feet west of the WSA, and also approximately 1,000 feet east of this area.

(UP) - Unpaved Road/Roadside/Pathway - This covertype includes a multitude of situations in which vegetation is maintained (mowed, brush-hogged, or controlled by herbicide use) in linear corridors, such as utility rights-of-way and along unpaved roads and paths. Vegetation may consist of a number of elements from the dry meadow and mowed lawn covertypes described above. This covertype is a combination of the unpaved road/path, mowed roadside/pathway, and herbicided roadside/pathway of Reschke (1990). Examples of this covertype may be found just west of SS-013.

- **Palustrine System (Wetlands) - Forested Covertypes**

(HS) - Mixed Hardwoods (Red Maple) Swamp - This covertype generally occurs in wetlands, but it also occurs on seasonally to regularly wet sites. It is similar to the red maple-hardwood swamp of Reschke (1990). Some conifers may be present (e.g., white pine, hemlock, and northern white cedar), but various hardwoods make up more than 50 percent of the stand. There are several hardwood swamp areas scattered throughout the base. A good example of this covertype may be seen just west of the SS-013. Dominant plant species include:

Trees

- Red maple (*Acer rubrum*)
- American Elm (*Ulmus americana*)
- Gray Birch (*Betula populifolia*)
- Ashes (*Fraxinus pennsylvanica, F. nigra*)
- Black Willow (*Salix nigra*)
- Cottonwood (*Populus deltoides*)

Shrubs

Alders (*Alnus rugosa, A. serrulata*)
Winterberry (*Ilex verticillata*)
Black Chokeberry (*Pyrus melanocarpa*)
Silky Dogwood (*Cornus amomum*)
Northern Arrowwood (*Viburnum recognitum*)
Highbush Blueberry (*Vaccinium corymbosum*)
Glossy Buckthorn (*Rhamnus frangula*)
Pussy Willow (*Salix discolor*)
Meadowsweet (Spiraea alba)

Herbs/Ground Cover

Sedges (*Carex crinita, C. lupulina*)
Jewelweed (*Impatiens capensis*)
False Nettle (*Boehmeria cylindrica*)
Poison Ivy (*Rhus radicans*)
Moneywort (*Lysimachia nummularia*)
Cinnamon Fern (*Osmunda cinnamomea*)
Royal Fern (*Osmunda regalis*)
Sensitive Fern (*Onoclea sensibilis*)

- **Palustrine System (Wetlands) - Non-forested Covertypes**

(SH) - Shrub Swamp - This type is indicated where various shrubs make up more than 50 percent of the cover and the area is wetland. It is similar to the shrub swamp of Reschke (1990). An example of this covertype may be seen approximately 200 feet west of SS-013, within the Wet Meadow covertype. Dominant plant species include:

Shrubs

Alders (*Alnus rugosa, A. serrulata*)
Winterberry (*Ilex verticillata*)
Black chokeberry (*Aronia melanocarpa*)

Dogwoods (*Cornus amomum, C. racemosa*)
Northern Arrowwood (*Viburnum recognitum*)
Highbush Blueberry (*Vaccinium corymbosum*)
Glossy Buckthorn (*Rhamnus frangula*)
Shrub Willow (*Salix discolor, S. sericea*)
Meadow Sweet (*Spiraea alba*)
Steeplebush (*Spiraea tomentosa*)

Small Trees/Saplings

Soft maple (*Acer rubrum, A. negundo*)
American Elm (*Ulmus americana*)
Gray Birch (*Betula populifolia*)
Black Ash (*Fraxinus nigra*)
Black Willow (*Salix nigra*)
Cottonwood (*Populus deltoides*)

Herbs

Sedges (*Carex crinita, C. lupulina*)
Jewelweed (*Impatiens capen*sis)

(WM) - Wet Meadow - This covertype is indicated where various open-habitat grasses, sedges, rushes, bulrushes, and forbs make up more than 50 percent of the cover and the area is wetland. Young shrubs and seedlings/saplings may be present, but make up less than 50 percent of the cover. This covertype contains various elements of the ditch/artificial intermittent stream, shallow emergent marsh, sedge meadow, and redgrass/purple loosestrife marsh covertypes of Reschke (1990). A good example of this covertype may be found at the western edge of the site. Dominant plant species include:

Herbs

Cattails (*Typha angustifolia, T. latifolia*)
Bulrushes (*Scirpus atrovirens, S. cyperinus, S. validus*)
Sedges (*Carex crinita, C. vulpinoidea, C. lupulina*)

Rushes (*Juncus effusus, J. bufonius*)
Reed Canary Grass (*Phalaris arundinacea*)
Rice Cut Grass (*Leersia oryzoides*)
Water Millet (*Echinochloa muricata*)
Jewelweed (*Impatiens capensis*)
Blue Vervain (*Verbena hastata*)
Dwarf St. John's-wort (*Hypericum mutilum*)
Giant Goldenrod (*Solidago gigantea*)
Calico Aster (*Aster lateriflorus*)
Boneset (*Eupatorium perfoliatum*)
Beggar-ticks (*Bidens cernua*)
Water-horehound (*Lycopus americanus*)
Purple Willow-herb (*Epilobium coloratum*)
Sensitive Fern (*Onoclea sensibilis*)

3.4.2 Protected Wetlands

Federally- and NYSDEC-regulated wetlands identified in the vicinity of SS-013 are shown in Figure 3-6. Other wetlands on the base are described in the *Final Wetland Delineation Report* (URS 1994b).

A number of federally-delineated wetlands lie on or near the site, as delineated by the USACE in 1992. One NYSDEC-regulated wetland (PB-14) lies just west of the site, overlapping to a great extent the largest portion of the federally-delineated wetlands. Dominant covertypes within these wetlands are Wet Meadow (WM), Successional Shrubland (SU), Marsh Headwater Stream (HW), and Ditch/Intermittent Stream (DS).

3.4.3 Wildlife Species Present

A wide variety of animal species may be encountered in site habitats at PAFB. Fish and wildlife species commonly associated with the covertypes present at the site are listed in Appendix J.

3.4.4 Special Resources

Apart from wetlands, additional special resources were discovered in the vicinity of PAFB. The New York Natural Heritage Program was contracted by the USAF to carry out an inventory of threatened and endangered species in the area. No federally-listed threatened or endangered species were found. However, the survey identified 5 species of fauna and flora occurring on PAFB listed as either endangered, threatened, rare, or of special concern by New York State. The Northern Harrier (*Circus cyaneus*), also known as the marsh hawk, is listed as threatened and was seen in the vicinity of the Flightline. Two songbirds, the Grasshopper Sparrow (*Ammodramus savannarum*) and the Vesper Sparrow (*Pooecetes gramineus*), listed as of special concern, were seen near the flightline as well. Two plants, a flat-sedge (*Carex houghtonii*) and the Houghton umbrella-sedge (*Cyperus houghtonii*), are listed as rare, the latter being found in the vicinity of SS-013.

3.4.5 Resource Characterization

SS-013 is located in an area that can generally be described as a valuable natural resource based on the number of species observed, the variety of covertypes and habitats present, and the proximity of two jurisdictional wetlands. The immediately impacted area of SS-13 is developed land in the industrial complex and is not considered a valuable natural resource.

3.5 Surface Water Hydrology

PAFB lies within the Lake Champlain drainage basin. The dominant surface water features in the vicinity of PAFB are the Saranac River to the north, the Salmon River to the south, and Lake Champlain to the east. The Saranac and Salmon Rivers, which discharge into Lake Champlain, originate west of PAFB in the Adirondack Mountains. A network of drainage ways carries surface water runoff from the base into sewers and streams that lead to off base areas.

3.5.1 Site Drainage

SS-013 is located within the largest drainage area on base (Figure 3-7). This drainage area carries water from the north/northwest to the south and discharges to the Salmon River. A significant part of the upper reaches of this drainage area lies off-base to the west of Route I-87. Drainage from the runway and areas south of landfill LF-023 also flow through this drainage area. The sources of drainage within this system are precipitation, discharge from the FT-002 Water Treatment Plant, and groundwater discharge. The contribution from precipitation can be divided into direct overland flow and collected runoff discharged to the stream via storm sewers.

SS-013 is situated in a topographic basin, where the unconfined aquifer thins. Groundwater discharges directly to the ground surface or into drainage channels. Groundwater discharged into the topographic basin between the runway and flightline ramp is carried by a storm sewer line directly into a tributary that flows through site SS-013. This stream also receives treated groundwater from the FT-002 Water Treatment Plant. The smaller drainage channels and seeps coalesce into a larger stream, classified by NYSDEC as tributary C-21-1 to the Salmon River, that enters the Salmon River about 1,000 feet southeast of the Weapons Storage Area. Tributary C-21-1 and the lower-order drainage ditches and swales that discharge into C-21-1 are classified as Class D water bodies by NYSDEC (see Section 4.3.2).

The topographic basin between the runway and flightline ramp is probably the feature that has the greatest impact on water quality in the SS-013 drainage. This basin is a large depression in the sand unit with six storm sewer drop inlets at its base (Figure 3-7). The original intent of this structure was probably to collect surface water flow and direct it southward to tributary C-21-1. However, portions of the basin are up to 27 feet lower than the flanking runway and flightline ramp which induces groundwater flow into the basin. Groundwater discharge can be readily observed in the lower portions of the basin. Groundwater seeps flow directly into the storm sewer drop inlets and also form areas of ponded water. The inverts of the storm sewer pipes in the bottom of the basin are 4 to 8 feet below ground surface. Since the water table at the bottom of the basin is at or near the ground surface (as evidenced by groundwater seeps and ponded water), much of the storm sewer piping in the basin is located below the water table. These corrugated metal pipes range in size from 15- to 30-inches in diameter and were installed approximately 40 years ago. It is likely that some groundwater leaks directly into these pipes and is transported southward, via surface drainage, through SS-013.

Surface water samples collected in the basin between the runway and flightline ramp in July 1996 contained the same chlorinated hydrocarbon compounds (i.e., trichloroethene, 1,2-dichloroethene, and vinyl chloride) found in the FT-002 groundwater contaminant plume. Therefore, SS-013 is currently being impacted by groundwater from the FT-002 contaminant plume that is intercepted by the basin and rapidly transported (as compared to normal groundwater flow) via the storm sewer system to tributary C-21-1.

A smaller drainage channel is located between the FT-002 site and the runway, running southward roughly adjacent to the perimeter road. This channel receives storm sewer discharge that also may be intercepting contaminated groundwater from the FT-002 site. The channel discharges into the SS-013 drainage system just upstream of the discharge point of the water collected in the basin between the runway and flightline.

3.5.2 Stream Hydrology

ABB (1991) measured the discharge of the main drainage channel (Tributary C-21-1) where it enters SS-013, and where it discharges into the Salmon River. These two locations, designated SW-13-016 and SW-13-015 respectively, are shown in Figure 3-1. The discharge equation for SW-13-16 is $Q=2.4(s)^{1.4}$, and the discharge equation for SW-13-015 (which estimates the total discharge leaving the drainage basin) is $Q=3.1(s)^{0.6}$; where Q = total discharge and s = stream stage. Groundwater was reported to be the major source of recharge for SS-013 streams. This is based on the relatively constant water stage and temperature throughout the year, and the numerous seeps along the drainageway slopes (ABB 1991).

The Salmon River in the vicinity of PAFB is classified as a Class C(T) stream. The symbol (T) indicates that the designated waters are trout waters and that a dissolved oxygen content specification is applicable. The river originates approximately 20 miles west of the base in the Adirondack Mountains. No discharge measurements are available for this river.

3.5.3 Lake Champlain Hydrology

Present-day Lake Champlain represents the remnant of glacial Lake Vermont, which occupied the Champlain Valley during the most recent glacial retreat in the Pleistocene Epoch, about 10,000 years ago. The Lake Champlain drainage basin occupies an area of approximately 8,277 square miles. Lake Champlain drains northward into the Richelieu River, which continues northward for approximately 75 miles before discharging into the St. Lawrence River.

Lake Champlain, which has a mean surface elevation of about 95 feet amsl, is approximately 125 miles long and covers about 490 square miles. Maximum and minimum recorded lake water levels are approximately 102 feet and 93 feet amsl, respectively. Lake Champlain's maximum depth is approximately 400 feet (Fisher 1968).

The lake receives water from precipitation and from the numerous streams that drain the Adirondack Mountains in New York and the Green Mountains in Vermont. The lake also receives groundwater flow in the Plattsburgh area from a confined bedrock aquifer (Giese and Hobba 1970). Lake Champlain is classified by the NYSDEC as a Class A water body, designated for drinking water supplies, culinary or food processing uses, and any other uses.

3.6 Hydrogeology and Geology

A preliminary investigation of the geology and hydrogeology of SS-013 was conducted by E.C. Jordan (1989), and included information obtained from soil borings, monitoring wells, and a geophysical survey. Additional information on site stratigraphy and hydrogeology is provided in the *Draft Remedial Investigation Report Attachment I Sites (SS-005, SS-006, SS-017, and SS-018)* (Malcolm Pirnie 1996), the *Draft Final Fire Training Area (FT-002)/Industrial Area Groundwater Operable Unit Remedial Investigation/Feasibility Study* (URS 2000a), and the Draft Final SS-013 RI (URS 1996a). The following subsections summarize the regional and site-specific hydrogeology and geology.

3.6.1 Regional Hydrogeology

PAFB is located in the St. Lawrence-Champlain Lowlands physiographic province of New York State (Van Diver 1985). The base lies within the Lake Champlain Valley, which trends north-south between the Adirondack Mountains to the west and the Green Mountains to the east.

During the most recent Pleistocene glacial retreat approximately 10,000 years ago, the Laurentide ice mass retreated northward through the Champlain Valley, leaving behind huge glacial deposits and large quantities of glacial meltwater, the latter of which formed glacial lakes. Lake Champlain, once a proglacial lake, underwent a series of stages or temporary water levels during the glacial retreat. These stages are recognizable from the different beach levels found in the area. The lake stages were influenced primarily by the amount of meltwater generated by the waning glacial mass, and by isostatic uplift in the area which regionally is estimated to have been approximately 500 feet (Fisher 1968). Isostatic uplift and drainage eventually outpaced the melting ice, and Lake Champlain gradually arrived at its present-day surface elevation of 95 feet amsl.

The unconsolidated surficial deposits in the vicinity of PAFB have been mapped as alluvial sediments, kame deposits, glaciomarine and glaciolacustrine sand, silt and clay, and glacial till (Cadwell et al. 1991). Figure 3-8 depicts the surficial geology in the vicinity of PAFB. These deposits are described below:

- Alluvial sediments - recent deposits occurring primarily in valleys (e.g., Salmon and Saranac Rivers). Composed of sand and gravel, with varying amounts of silt on floodplains. These deposits occur surficially in the extreme northwest corner of the base along the Saranac River.

- Kame deposits - generally coarse to fine gravel and/or sand with lateral variability in texture and permeability. These deposits occur surficially near the northwest portion of PAFB.

- Glaciomarine and glaciolacustrine sand - stratified, fine to medium sand, permeable, with variable thickness. This unit represents the most laterally extensive surficial deposit at PAFB.

- Glaciomarine and glaciolacustrine silt and clay - generally laminated to massive silt and clay of low permeability, deposited in deep water. These deposits at PAFB occur surficially at the south end of the flightline apron, in the Golf Course Drainage Area, and at the mouth of the Salmon River.

- Glacial till - variably textured (boulders to silt and clay) deposit that is typically well-graded and generally deposited beneath glacial ice. Permeability varies with degree of compaction. Surficially, these deposits occur southeast of PAFB.

Underlying the unconsolidated overburden deposits is bedrock of Ordovician age, which consists of a series of thinly to thickly bedded limestones and dolostones with medium to micritic textures (Fisher 1968). These consolidated rocks underlie the Champlain Valley and dip to the east, forming an artesian aquifer (Giese and Hobba 1970).

Groundwater in the Plattsburgh area occurs in both the overburden deposits and the bedrock. Groundwater movement in these media is controlled by aquifer characteristics, infiltration, and runoff. The Adirondack Mountains to the west of Plattsburgh represent the major recharge area for the region, and Lake Champlain represents the regional discharge area (Giese and Hobba 1970). Other locally significant discharge areas include the Saranac and Salmon Rivers, located just north and south of PAFB, respectively.

Water yields from wells screened in unconsolidated deposits vary from approximately several hundred gallons per minute (gpm) to only a few gpm (Giese and Hobba 1970). In general, alluvial sediments and kame deposits provide the highest water yields. The silt and clay deposits, being of low permeability (10^{-6} to 10^{-4} centimeters/second), are poor aquifers. In general, the till produces only low (1 to 20 gpm) water yields.

Groundwater movement in the bedrock is controlled by physical characteristics of the rock. These include primary porosity, secondary fractures, faults, bedding planes, joints, and solution cavities. Average well yields from rock wells in the vicinity of PAFB range from 2 to 200 gpm (Giese and Hobba 1970).

3.6.2 Site Stratigraphy

Stratigraphy in the site SS-013 area generally consists of five units (from top to bottom): sandy fill and regraded surficial deposits; silty sand; silt and clay; glacial till; and bedrock. Figure 3-9 depicts the locations of cross-sections A-A', B-B', and C-C', which are shown in Figures 3-10, 3-11, and 3-12, respectively. Site stratigraphy is graphically portrayed in these cross-sections. Each of the stratigraphic units is described below.

3.6.2.1 Fill and Regraded Material

Although areas of apparent fill and regraded material were identified in RI soil borings (see Appendix E Soil Boring Logs), the fill and regraded material was not discussed as a separate stratigraphic unit. A recent examination of pre- and post-base construction topographic maps (Figures 3-13 and 3-14) revealed significant differences in topography which are believed to be due to base construction activities. Figure 3-15 shows estimated elevation changes in the vicinity of SS-013 calculated by subtracting the 1956 topographic contours from current topographic contours.

The analysis shown in Figure 3-15 indicates that significant elevation increases appear to have occurred on the eastern side of SS-013 during base construction, probably due to the introduction of fill material. The fill material has been typically described in soil boring logs as well-graded fine to coarse sand with a trace of gravel (Table 3-2). Figure 3-15 indicates that surface elevations on the eastern side of SS-013 could have increased up to 25 feet and at boring SB-13-011 (located near the 25 foot elevation increase contour) 40 feet of sandy fill was reportedly encountered. Elevation increases within the SS-013 industrial complex appear to be on the order of 5 feet or less. However, soil boring data indicates that soils were regraded to depths greater than the apparent elevation increases (Appendix E).

The western portion of the site and the area west of SS-013 shows little elevation change or minor areas of elevation decrease. This area appears to have been changed less by base construction as compared to the eastern portion of the site. However, comparison of pre- and post-base construction drainage features indicates that most drainage features in the vicinity of SS-013 were constructed or reworked during base construction.

3.6.2.2 Silty Sand Unit

The predominant surficial deposit encountered at PAFB is a poorly-graded fine sand with minor amounts of medium and coarse sand and silt. The sand is light brown above the water table, but is typically gray beneath the water table due to reducing conditions. This unit typically becomes finer-grained with depth, grading texturally into the underlying silt and clay unit.

Within the boundaries of site SS-013, the naturally occurring surficial unit encountered is gray silty sand with occasional interstratified layers of fine sand, silts, and clays. This strata probably represents the basal portions of the fine sand unit seen basewide. Within the SS-013 industrial complex, the silty sand unit is often covered by several feet of regraded material or sandy fill. The silty sand unit thickness was fairly consistent in site borings and ranged from 7 to 15 feet.

3.6.2.3 Silt and Clay Unit

The silt and clay unit is characterized as a gray, very soft to stiff, clayey silt and silty clay. The plasticity index of the unit generally increases with depth, as does clay content. Site boring data indicates that the silt and clay unit is continuous beneath SS-013. Only one site boring has penetrated through the silt and clay unit: the silt and clay unit was found to be 30.5 feet thick at well location MW-13-002. The clay thickness in a basewide piezometer boring (PZ-4D) approximately 2,500 feet southwest of SS-013 was 17 feet. Therefore, it is believed that the silt and clay unit serves as a thick, continuous confining layer beneath the water table aquifer, which is present in the silty sand unit.

3.6.2.4 Glacial Till Unit

The glacial till unit has only been encountered in site boring MW-13-002 at a depth of approximately 57.5 feet and was at least 5 feet thick. It was described as a dense gray sandy silt with angular rock fragments. The till has been described in other basewide borings as a heterogeneous mix of sand, silt, clay, gravel, cobbles, and boulders. Based on the high percentage of fine sand in the till and its highly compact nature, the till is most likely a lodgement till (URS 2000a). Few borings at the base have penetrated through the till unit to bedrock, but based upon available data the till thickness beneath SS-013 is estimated to be between 7 and 20 feet (URS 2000a).

3.6.2.5 Bedrock

The nearest boring (PZ-4D) to SS-013 that has reached bedrock is 2,500 feet southwest of SS-013. Bedrock beneath SS-013 has been mapped as Lower Ordovician age Providence Island Dolostone, which is described as a buff-weathering, medium-thick bedded, fine- to medium-grained, blue-gray dolostone (Fisher 1968). An east-west trending normal fault has been inferred just to the north of SS-013 (Fisher 1968; URS 2000a).

3.7.3 Site Hydrogeology

Groundwater in the vicinity of SS-013 occurs in both the overburden deposits and the bedrock. Hydrologically, the stratigraphic column can be divided into the following units: the vadose (unsaturated) zone, present in the fill/regraded material and the silty sand unit; the unconfined water table aquifer, also present in the fill/regraded material and the silty sand unit; a confining layer (aquitard) formed by the silt and clay unit; the confined till water-bearing zone; and the confined bedrock aquifer. These hydrogeologic units are discussed in the following sections.

3.7.3.1 Vadose Zone

The vadose zone lies between the ground surface and the water table. Figure 3-16 depicts vadose zone thickness (or depth to the water table) contours in the vicinity of the SS-013 industrial complex in October 1995. Vadose zone thickness ranged from approximately 19 feet near former leach field A to less than 1 foot west of the industrial complex. Vadose zone thickness (depth to the water table) in the industrial complex area ranged from 0 to 5 feet. The vadose zone is absent at gaining stream/drainage locations, at groundwater seeps northwest of leach field S, and often in areas west of the industrial complex access road.

3.7.3.2 Water Table Aquifer

Figures 3-17 and 3-18 depict the potentiometric surface of the unconfined water table aquifer as interpreted from water elevation data collected on October 5, 1995 and December 13, 2000, respectively. Water elevation measurements are provided in Table 3-3. The morphology of the water table surface is similar in both figures and closely reassembles the surface topography. Groundwater around the SS-013 site flows radially inward from all directions into the WSA drainage basin and converges along the main stream that meanders through the site (tributary C-21-1 of the Salmon River). Due to irregular surface topography and smaller drainage features (i.e., ditches and small streams), groundwater flow direction can vary on a local scale. Groundwater at SS-013 discharges to surface water within the basin and is eventually carried southward to the Salmon River by tributary C-21-1.

3.7.3.3 Confining Layer

The silt and clay unit forms a confining layer (aquitard) that separates the water table aquifer from the underlying till water-bearing zone and bedrock aquifer. Based on all available boring information at and around site SS-013, the silt and clay unit is continuous beneath and in the vicinity of SS-013 and is on the order of 15 to 30 feet thick. This unit effectively confines the underlying units and restricts groundwater movement between the water table aquifer and the till water-bearing zone/bedrock aquifer.

3.7.3.4 Confined Till Water-bearing Zone

The SS-013 RI report identified the till unit as a confining or semi-confining layer, but information gathered during the FT-002/Industrial Area (IA) Groundwater Operable Unit (OU) RI indicates that the till is a conductive, water-bearing zone. The till water-bearing zone is confined by the overlying clay unit. It is isolated from the water table aquifer above, but is in immediate contact with the underlying bedrock aquifer. During the FT-002/IA Groundwater OU RI drilling program, artesian water flow frequently occurred when the drilling tools encountered the till. Several proposed bedrock wells were completed in the till because it yielded more water than the underlying bedrock. Six wells were installed in the till unit during this study, primarily in the southeastern portion of the base. Because of the limited number of wells in this unit (six), the hydrologic properties of the till water-bearing zone are not well known. Water elevation measurements taken in the till wells indicate an eastward to southeastward horizontal groundwater flow direction in the southeastern portion of the base. Vertical gradients between the till water-bearing zone and the unconfined aquifer appear to be upward west of the base and in the vicinity of the golf course and the southern end of the runway and downward in the flightline industrial corridor.

3.7.3.5 Confined Bedrock Aquifer

The bedrock aquifer is isolated from the unconfined sand aquifer by the overlying silt and clay unit. Groundwater movement in the bedrock is controlled by physical characteristics of the rock such as porosity, fractures, faults, bedding planes, joints, and solution cavities. Regionally, fractured bedrock groundwater flow is controlled by the potentiometric surface, which slopes east-southeastward toward Lake Champlain. At large-scales, bedrock flow approximates flow through a porous medium (Freeze and Cherry 1979). However, flow velocities can be much greater in fractured rock. Locally, flow may be anisotropic with flow direction influenced strongly by the orientation of open fractures. Vertical flow gradients within the bedrock aquifer have not been determined at the base, but it is reported that flow gradients within the bedrock aquifer are upward (Giese and Hobba 1970).

3.7.3.6 Hydraulic Conductivity

In-situ hydraulic conductivity tests (slug tests) were performed in 2 shallow SS-013 monitoring wells (MW-13-007 and MW-13-008) during the RI. Horizontal hydraulic conductivity values calculated for the water table aquifer (fill/regraded material and silty sand unit) ranged from 1.02 x 10^{-4} centimeters/second (cm/sec) to 1.79 x 10^{-4} cm/sec.

Shelby tube samples of the silt and clay unit have been obtained from various locations on base and submitted for laboratory permeability tests. The vertical hydraulic conductivities determined for the samples have historically been on the order of 10^{-8} cm/sec. A Shelby sample of this unit was obtained during the SS-013 RI from boring SB-13-09 and the vertical hydraulic conductivity determined for the sample was 4.46 x 10^{-8} cm/sec (URS 1996). The hydraulic conductivity of the silt and clay confining layer is several orders of magnitude lower than the units lying above (unconfined silty sand aquifer) or below (till water-bearing zone) it.

Three of the monitoring wells installed in the southeastern portion of the base in the till unit as part of the FT-002/IA Groundwater OU RI were slug tested. The calculated arithmetic mean horizontal hydraulic conductivities were 2.06 x 10^{-4} cm/sec, 1.80 x 10^{-4} cm/sec, and 5.64 x 10^{-3} cm/sec (URS 2000a). These values are comparable to values obtained for the water table aquifer at SS-013.

The hydraulic properties of the bedrock are extremely variable. Slug tests performed by Malcolm Pirnie, Inc. on five bedrock piezometers and one bedrock monitoring well indicated horizontal hydraulic conductivities ranging from 1.91 x 10^{-6} cm/sec to 1.41 x 10^{-2} cm/sec (Malcolm Pirnie 1996). Packer tests performed on the eight bedrock wells installed during the FT-002/IA Groundwater OU RI yielded horizontal hydraulic conductivities ranging from 3.65 x 10^{-5} cm/sec to 7.90 x 10^{-4} cm/sec (URS 2000a). The hydraulic conductivity values calculated for the bedrock wells and piezometers may be more indicative of individual fracture zones than of the formation as a whole, pointing to the inherent antisotropy of the bedrock aquifer.

4.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The National Contingency Plan (NCP) (40 CFR 300) requires that the selection of remedial actions at CERCLA sites meet applicable or relevant and appropriate requirements (ARARs) of federal and state environmental laws and regulations (USEPA 1990a). The process of identifying ARARs begins during the scoping of the RI/FS and continues through the remedial design phase. ARARs identification is always site-specific.

4.1 Definition of ARARs and TBCs

A requirement of federal or state law may be either "applicable" or "relevant and appropriate."

Applicable requirements are those cleanup standards, standards of control, and other environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance or contaminant, a remedial action, location, or other circumstances at a CERCLA site.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance or contaminant, a remedial action, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well-suited to the particular site.

In addition to promulgated standards and controls, other requirements "to be considered (TBC)" are federal and state policies, advisories, and other non-promulgated health and environmental criteria, including numerical guidance values, that are not legally binding. TBCs are used for the protection of public health and the environment if no specific ARARs for a chemical or other site condition exist, or if ARARs are not deemed sufficiently protective.

The Air Force position on CERCLA-consistent response actions with respect to the requirements of NEPA is that the CERCLA response process can satisfy the requirements of NEPA by addressing potential impacts of remedial actions on human health and the environment (USAF 1992). Installations have the option to prepare separate NEPA- and CERCLA-consistent restoration documentation, but an attempt is made to:

- Integrate NEPA and CERCLA documentation whenever possible
- Use the community involvement element of the CERCLA process to address impacts of remedial actions
- Evaluate potential environmental impacts the response action may have on natural resources
- Reflect any potential impacts from anticipated CERCLA response actions in the disposal/reuse Environmental Impact Statement

32 CFR Part 989 also sets forth policy for compliance with Executive Orders #11988 and #11990 on floodplain management and wetlands protection. These require that a remedial alternative located in a floodplain or in a wetland not be selected unless a determination is made that no practicable alternative exists. If no practicable alternative exists, potential harm must be minimized and action taken to restore and preserve the natural and beneficial values of floodplains (e.g., reduction and control of flood hazard, replenishment of groundwater, soil conservation, and conservation and long-term productivity of existing flora and fauna).

Section 404 of the Clean Water Act and related regulations (40 CFR 230) protect waters of the United States, including wetlands, and prohibit the deposition of dredged or excavated materials. Protection of aquatic and wetland habitats is a primary goal of this program. Remedial activities that affect habitats may include capping, stream channelization, and dewatering of the site [See 33 CFR 320-330 for USACE permit regulations].

New York State Freshwater Wetlands Act, ECL Article 24, and the Freshwater Wetlands Classification and Permit Requirements (6NYCRR 663-664) identify and classify all wetlands in the state over 12.5 acres according to their value as natural water and wildlife habitat resources. Activities that take place in or near these wetlands must be permitted and must avoid or mitigate adverse impacts to the benefits provided by the wetland.

New York State Use and Protection of Waters (6NYCRR 608) established a permit program to protect certain classes of New York State waterways. Stream disturbances must be avoided, or adverse impacts must be mitigated through terms and conditions of the joint permitting process between the NYSDEC and USACE regulating waters of the United States. Protected streams include Classes a, B, and C(T).

New York State Fish and Wildlife Regulations (6NYCRR 182) and the federal Endangered Species Act (16 USC 1531) list and protect endangered or threatened species from actions that may threaten their existence or modify their habitats. Rare and endangered plant species also are protected in New York State by regulations in 6NYCRR 193. The species data bases with location-specific information are kept by the U.S. Fish and Wildlife Service and the New York State Heritage Program, managed by NYSDEC.

Fish and Wildlife Coordination Act (16 USC 661) requires protection of fish and wildlife from actions which would affect or modify wildlife habitat.

New York State Water Quality Classifications (6NYCRR 701-703) classifies groundwater, streams, and other water bodies. Classes a, B, C, and D fresh surface waters are pre-identified, and their best uses, ranging from fishing to drinking, are protected with ambient water quality criteria. These are addressed in Section 4.3.

New York State Floodplain Management Act and Regulations (ECL Article 36, and 6NYCRR 500) regulates activities taking place in floodplains. Although PAFB was not classified on Federal Emergency Management Agency (FEMA) flood insurance maps, nearby off-base FEMA mapping indicates SS-013 to be well above the 100-year floodplain boundary of the Salmon and Saranac Rivers (FEMA 1979).

4.2.2 Cultural Features

National Historic Preservation Act (16 USC 470). The National Historic Preservation Act is a federal law that establishes the responsibilities of federal agencies with respect to "historic properties" which include objects from both history and prehistory and which cover the range from standing structures to discrete artifacts recovered from archaeological excavations. This federal law also protects properties listed on, or eligible for inclusion on, the National Register of Historic Places (NRHP). Archaeological finds that are considered eligible for inclusion on the NRHP area also protected by this act. The New York State Historic Preservation Office lists all federal- and state-protected properties. This office has determined that investigation and general remedial activities at PAFB will not adversely affect existing historic properties.

An archaeological survey report for PAFB was completed in November 1994 by the United States Army Construction Engineering Research Laboratories/Technical Assistance Center (USACERL/TAC 1994). The purpose of the survey was to complete the inventory of prehistoric and historic archaeological sites on base, as required by the National Historic Preservation Act, Section 110. According to this survey, no archaeological sites were identified within 1,000 feet of SS-013.

Archaeological and Historic Preservation Act (16 USC Section 469). This act provides for the protection of archaeological data that might be lost as a result of a federal construction project. This law covers a broader range of resources than the National Historic Preservation Act, but allows for only the preservation of the data and not the site itself.

4.3 Chemical-specific ARARs

Numerical standards have been developed for each environmental medium at the SS-013 site through the evaluation of the ARARs and TBCs discussed below. Table 4-1 and Tables in Appendix A present these numerical standards, which are compared to analytical data in Section 5.0.

4.3.1 Groundwater

New York State regulates groundwater quality using numerical standards and guidance values established by the NYSDEC and the New York State Department of Health. These values have been consolidated into a single NYSDEC guidance document, the Division of Water's *Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* (1998a). In New York State, there is little practical difference between standards and guidance values since the procedure for determining these values is the same for each, and the state has the authority to enforce guidance values where there are no promulgated standards (6NYCRR 701.15(d)). 6NYCRR 700-705, *Water Quality Regulations-Surface Water and Groundwater Classifications and Standards*, and 10 NYCRR Part 5, Drinking Water Supplies, are also applicable ARARs for the site.

The Safe Drinking Water Act (SDWA) authorizes the National Primary and Secondary Drinking Water Regulations (40 CFR 141 and 143). The potable groundwater standards established by these regulations are called Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs). MCLs are legally enforceable federal drinking water standards, while MCLGs are nonenforceable health goals established by the USEPA. MCLs are commonly identified as ARARs for existing or potential future drinking water sources. MCLGs are used in cases where multiple contaminants or exposure pathways present extraordinary risks to human health. In such cases, USEPA makes a site-specific determination of the more stringent standards (USEPA 1993a).

Groundwater currently is not used as a potable water source on base and, therefore, MCLGs are not considered applicable for PAFB. However, MCLs are relevant and appropriate because groundwater may be considered a future water supply source. Secondary Maximum Contaminant Levels (SMCLs) are federally nonenforceable regulations that control contaminants in drinking water that affect the aesthetic qualities relating to the public acceptance of drinking water.

Human health-related ARAR values for groundwater at SS-013, which are primarily derived from *TOGS* 1.1.1, are presented in Table 4-1.

4.3.2 Surface Water

New York State regulates surface water according to stream/water body classifications. Surface drainage at the SS-013 site is controlled by a network of drainage channels that discharge to tributary C-21-1 of the Salmon River (Figure 1-2). This tributary represents the main drainage channel in the vicinity of SS-013. Lower order drainages intersect C-21-1 within the SS-013 compound. Tributary C-21-1 and the other drainages are classified by New York State as Class D surface water bodies. According to 6 NYCRR Part 701.9, "the best usage of Class D waters is fishing. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery, or stream bed conditions, the waters will not support fish propagation. These waters shall be suitable for fish survival. The water quality shall be suitable for primary or secondary contact recreation, although other factors may limit the use for these purposes."

Tributary C-21-1 drains into the Salmon River which then discharges into Lake Champlain. The Salmon River in the vicinity of PAFB is classified as a Class C(T) stream. According to 6 NYCRR Part 701.8, "the best usage of Class C waters is fishing. These water shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes." The symbol (T) indicates that the designated waters are trout waters and that a dissolved oxygen content specification is applicable. Lake Champlain is classified as a Class A water body. According to 6 NYCRR Part 701.6, "the best usages of Class A water are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish propagation and survival."

Chemical-specific surface water ARARs are included in NYSDEC *TOGS* 1.1.1 and 6NYCRR 700-705 (see Section 4.3.1). Where no state standards or guidance values have been established, water quality criteria from the federal Clean Water Act (Section 304) may apply. Most chemical-specific ARAR values derived from these documents for Class A, B, C, and D aquatic life concerns and Class A human health concerns are presented in Table 4-1. The values for cadmium, chromium, lead, and silver were calculated using Class D formula presented in *TOGS 1.1.1* and are presented in Table 4-2. The hardness value for SW-13-01 was used for calculating the ARAR values for all samples because this was the only sample analyzed for hardness.

4.3.3 Soils

Federal and state laws and regulations have not promulgated standards for soil contaminants, other than for hazardous waste characterization. However, the NYSDEC has established Recommended Soil Cleanup Objectives in *Determination of Soil Cleanup Objectives and Cleanup Levels* (NYSDEC 1994). These generic soil cleanup objectives were designed to eliminate significant threats to human health and/or the environment. The NYSDEC Recommended Soil Cleanup Objectives for organic compounds are based primarily on the soil to water partition theory model. The NYSDEC Recommended Soil Cleanup Objectives for metals are based upon published average concentrations detected in eastern U.S. soils. NYSDEC permits the use of "site background" data for metals, if this data is available. A base-wide surface soil and groundwater survey was performed in late 1994 primarily to establish background inorganic constituent concentrations in PAFB soils (URS 1996b). The 95% Upper Tolerance Limits calculated for each inorganic constituent detected in the background soil samples will be considered as "site background" metals concentrations and appropriate for use as soil TBCs. RCRA hazardous waste toxicity characteristic limits established by 40 CFR 261 are considered soil ARARs.

The chemical-specific TBCs and ARARs developed for SS-013 soils are presented in Table 4-1.

4.3.4 Sediment

As with soils, there are no promulgated standards regulating contaminant levels in stream sediments. Sediment cleanup TBC criteria were developed in accordance with the NYSDEC document *Technical Guidance for Screening Contaminated Sediments* (NYSDEC 1998b), which details the methodology for determining acceptable levels of non-polar organic contaminants and metals.

Criteria for non-polar organic compounds were established for four categories of health and environmental risk:

- Human health bioaccumulation
- Benthic aquatic life acute toxicity
- Benthic aquatic life chronic toxicity
- Wildlife bio-accumulation

For non-polar organic contaminants, sediment TBCs can be calculated on a sample-specific basis using the applicable surface water quality standards and the chemical properties for each chemical. The TOC content of a sample is then factored into the calculations for each chemical to arrive at the sample-specific guidance value. TBCs can only be calculated for parameters with known surface water ARARs and octanol-water partition coefficients (K_{ow}). K_{ow} is defined as a measure of the degree to which an organic chemical will preferentially dissolve in water or an organic solvent. The sample-specific organic compound TBC calculations are presented in Table 4-3 and 4-4. These tables also display the formulae for determining sediment TBCs from a known surface water ARAR value, K_{ow}, and TOC content for a sediment sample.

For metals contaminants, sediment screening criteria are based upon chemical effects data. New York State-established screening criteria for sediments following a combination of the Ministry of Ontario guidelines (Persaud et al. 1992) and chemical effects data developed by Long and Morgan (1990). The Ministry of Ontario guidelines span background, lowest effect level (indicates a level of sediment contamination that can be tolerated by the majority of benthic organisms, but still causes toxicity to a few species), and severe effect level (indicates the concentration at which pronounced disturbance of the sediment dwelling community can be expected). Long and Morgan categorized chemical effects data in sediments according to low and median toxic effects (i.e., Effects Range-Low [ER-L] and Effects Range-Median [ER-M]). The lowest concentration in each of the two effect levels was selected as the New York State sediment screening criterion (NYSDEC 1998b). Using this methodology, New York State has established criteria for twelve metals: antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc. The criteria will be used as a baseline for evaluating metals concentrations in sediment samples at SS-013. These values are listed in Table 4-5.

5.0 NATURE AND EXTENT OF CONTAMINATION

This section characterizes the nature and extent of contaminants in environmental media at site SS-013. The SS-013 RI identified five potential source areas within the industrial complex: former leach field N; former leach field A; leach field S; the former waste accumulation area (FWAA) and the former solvent storage pad located approximately 30 feet north of the FWAA; and the Building 3578 fuel oil UST. It was also believed that chlorinated hydrocarbon contamination from the site FT-002 dissolved groundwater contaminant plume was impacting surface water and upgradient groundwater at SS-013. Several removal activities and sampling events have occurred at SS-013 since the Draft Final SS-013 RI report was issued in February 1996. All available data will be discussed on a media-specific basis.

5.1 Soil

Soil samples were not collected at SS-013 until the RI. Soil gas surveys, concentrated primarily on the 3 leach fields, were performed during the SI and early RI and were used as guides in establishing soil sampling points (Figures 1-4 and 1-5). Twenty-one surface soil samples were collected during the RI and analyzed for TCL VOCs and SVOCs, and TAL or RCRA metals. Sampling locations are shown on Figures 1-6 and 1-7 and the analytical results are summarized in Table 5-1 and Figure 5-1. Twenty-one subsurface soil samples were collected from soil borings and analyzed for TCL VOCs, SVOCs, polychlorinated biphenyls (PCBs), pesticides, and TAL metals. Sampling locations are also shown on Figures 1-6 and 1-7 and the analytical results are summarized in Table 5-2 and Figure 5-2.

Soil samples collected during the RI indicated: acetone and metals contamination (antimony, chromium, and selenium) that appeared to be associated with subsurface soil in the vicinity of leach field S; carcinogenic PAH contamination in surface soils near the perimeter of Building 3569; VOC (solvents) and metals contamination in surface and subsurface soils around the former solvent storage pad; carcinogenic PAH contamination in surface and subsurface soils along the edge of the concrete pad east of Building 3578 where the former waste accumulation area was located; and carcinogenic PAH and metals contamination in subsurface soil within former leach field N. No compounds were detected at concentrations above TBC values in former leach field A soil samples. Although no soil samples were collected in the vicinity of the fuel oil UST south of Building 3578, communications with base personnel and physical observations at the site indicated that soil contamination was probably associated with the UST, which was programmed for removal.

In 1996, OHM removed the UST south of Building 3578 and some soil that had been contaminated by fuel oil leakage (see Section 1.3.5.1 and Appendix B). The extent of soil contamination associated with the UST and its piping was not completely delineated during this equipment removal. The excavated soil stockpile was transported to an on-site treatment cell and the excavation was backfilled to grade with clean imported fill. A "time-critical" removal action was implemented by the Air Force to address soil contamination remaining in the vicinity of the former Building 3578 UST. Soil removals began in August 2000 and continued through December 2000. Confirmatory soil samples were collected and the soil analytical data was submitted for regulatory agency review and comment. Following regulatory agency approvals, the excavation was backfilled in November 2001 and contaminated soil stockpiles were removed from the site for proper disposal. A Draft Closure Report was submitted for regulatory agency review and concurrence in March 2002 (Versar 2002).

In 1997, OHM and Parsons removed the former solvent storage concrete pad and VOC and metals contaminated soil surrounding the pad (see Section 1.3.6). The excavated soils and concrete pad were properly disposed and confirmatory soil samples indicated that any remaining compound concentrations were below NYSDEC soil cleanup guidance concentrations. NYSDEC and USEPA concurred with the recommendation that no further soil removal was warranted at the excavation location (Appendix D).

A soil removal action was also performed above the septic system equipment that leads from Building 3569 to leach field S. Soil removals began in August 2000 and continued through May 2001. Confirmatory samples were collected and the soil analytical data was submitted for regulatory agency review and comment. Following regulatory agency approval, the excavation was backfilled in November 2001 and contaminated soils were removed from the site for proper disposal. A Draft Closure Report describing the removal action was submitted for regulatory agency review and concurrence in March 2002 (Versar 2002).

5.2 Surface Water and Sediment

No additional investigations of surface water or sediment have occurred within the boundaries of site SS-013 since the RI. However, surface water samples upstream and downstream of SS-013 have been collected periodically since February 1998 to evaluate the loading of contaminants from the FT-002 site to the WSA Drainage stream. This section summarizes the previous surface water and sediment data collected for site SS-013 and presents analytical data collected for the FT-002 site that pertains to site SS-013.

5.2.1 Site Investigation

One paired surface water/sediment sample (SW-1/SD-1) was collected from the main drainage just west of the industrial complex (E.C. Jordan 1989). Figure 5-3 shows the sampling locations. Both the surface water and the sediment sample were analyzes for VOCs, SVOCs, and TAL inorganics. The analytical results are summarized in Table 5-3.

TCE was detected at an estimated concentration of 1 part per billion (ppb) in SW-1. Inorganics detected above Contract Required Detection Limits (CRDLs) included calcium, iron, magnesium, manganese, and sodium.

Low ppb levels of chloroform, methylene chloride, and acetone were detected in SD-1 but were attributed to laboratory contamination. Bis(2-ethylhexyl)phthalate (BEHP) was detected at an estimated concentration of 68 ppb. Metals detected above CRDLs were aluminum, arsenic, calcium, chromium, iron, lead, manganese, and zinc.

E.C. Jordan recommended that additional investigations of the drainageways be conducted at the site.

5.2.2 Drainage Flow Study

ABB Environmental Services, Inc. (formerly E.C. Jordan Co.) completed a base-wide drainage flow study in September 1991. The purpose of the study was to establish baseline water quality data and to characterize the surface water network at PAFB. As part of this study, 7 locations were monitored for one year in the vicinity of SS-013. These monitoring locations, designated SW-13-015 through SW-13-021, are shown in Figure 5-3.

Forty-two surface water samples were collected from the 7 locations. All were analyzed for VOCs, SVOCs, hardness, and glycols. Not all samples were analyzed for each chemical class during each round of sampling. Sampling took place at approximately monthly intervals between October 31, 1989, and October 11, 1990. Table 5-4 summarizes the analytical results.

Sampling point SW-13-015 was established at a location from which the total discharge from the study area could be measured as it enters the Salmon River. Twelve samples were taken at this point, at approximately monthly intervals. Only one VOC, 1,2-DCE at 5 ppb, was detected. No SVOCs were detected. Hardness was found to range from 180 to 300 parts per million (ppm). During sampling rounds 10 and 12, glycol was detected at 190 and 280 ppb, respectively.

Sampling point SW-13-016 was established in the drainage just above SS-013. Its purpose was to monitor the discharge from a 5-foot diameter steel culvert. Surface water samples were taken quarterly. In the first two sampling rounds, 1,2-DCE was detected at 6 and 11 ppb, respectively. TCE was detected during round 2 at 5 ppb. No SVOCs were detected. Hardness was found to range from 240 to 270 ppm. Due to the relatively low level of VOCs detected at this sampling point, two additional upstream sampling locations (SW-13-017 and SW-13-018) were established, and sampling at SW-13-016 was discontinued. SW-13-018 is situated at the outfall of a storm sewer system that drains the north end of the base infield. SW-13-017 monitors the outfall of a storm sewer system that drains the infield northeast of the WSA. ABB (1991) reported that based upon the temperature, flow, and chemical nature of water at these locations, the discharge was primarily groundwater.

1,2-DCE and TCE were detected at SW-13-017 throughout all sampling rounds at concentrations ranging from 21 to 110 ppb and 13 to 55 ppb, respectively. Phenol was detected once at 3 ppb. At SW-13-018, detected concentrations of these same VOCs ranged from 5 to 11 ppb and 5 to 9 ppb, respectively. ABB (1991) reported that the source of these contaminants appeared to be the dissolved groundwater plume from FT-002.

SW-13-019, SW-13-020, and SW-13-021 are located along the western boundary of the base, near Interstate 87 (Figure 5-3). These locations were sampled quarterly. No VOCs or SVOCs were detected. No glycol analyses were performed. Hardness values ranged from 220 to 510 ppm. ABB (1991) attributed the higher hardness values to the salting of Interstate 87 during the winter months.

5.2.3 Remedial Investigation

5.2.3.1 Surface Water

Twelve surface water samples were collected in October 1993 at the locations shown on Figures 5-4. All samples were analyzed for VOCs and SVOCs; four samples (SW-13-001, SW-13-004, SW-13-007, and SW-13-012) were analyzed for pesticides, PCBs, and RCRA metals. One sample, SW-13-001, was also tested for hardness. Analytical results are summarized in Table 5-5 and are shown on Figure 5-4.

The following VOCs were detected: 1,2-DCE in samples SW-13-002 (4 ppb) and SW-13-004 (4 ppb); TCE in samples SW-13-002 (4 ppb), SW-13-004 (3 ppb), and SW-13-006 (2 ppb); and xylenes in samples SW-13-006 (7 ppb) and SW-13-012 (4 ppb).

The only SVOCs detected in surface water samples were phthalates, which were detected in two samples (SW-13-001 and SW-13-002) at concentrations up to 12 ppb. No pesticides or PCBs were detected.

Three metals (barium, chromium, and silver) were detected. Barium was detected in all samples for which metals analysis was conducted. Chromium was detected in one sample, SW-13-012, at 10.6 ppb. Silver was detected in two samples: SW-13-001 (2.5 ppb) and SW-13-007 (2.0 ppb).

The analytical results for the surface water samples collected as part of the RI were compared to surface water standards and no detected concentrations exceeded surface water ARARs.

5.2.3.2 Sediment

Twelve sediment samples were collected in October 1993 at the locations shown in Figure 5-4. All samples were analyzed for VOCs and SVOCs. Four samples, SD-13-001, SD-13-004, SD-13-007, and SD-13-012, were analyzed for pesticides, PCBs, and TAL metals. Sample SD-13-001 was also analyzed for Total Organic Carbon (TOC) content. Locations SD-13-002 through SD-13-012 subsequently were resampled and also analyzed for TOC in August 1995. Analytical results are summarized in Table 5-6.

Four VOCs were detected in the sediment samples (methylene chloride, acetone, 2-butanone, and toluene) at concentrations up to 60 ppb. Among VOCs, acetone was detected most frequently (in 10 of 12 samples) and at the highest concentrations. Methylene chloride was detected in 5 of the 12 samples, and 2-butanone was detected in four samples. Sample SD-13-009 had the highest total VOC concentration (80 ppb).

SVOCs were detected in 9 samples. SVOCs detected were primarily PAHs. Phthalates were also detected. Individual PAH concentrations ranged from 10 ppb of dibenzofuran in SD-13-005 to 200 ppb of fluoranthene in SD-13-005. Concentrations of total PAHs ranged from 986 ppb in SD-13-005 to 21 ppb in SD-13-012.

Three pesticides, aldrin, 4,4'-DDE, and 4,4'-DDD, were detected. Aldrin was detected in samples SD-13-004 (0.85 ppb) and SD-13-007 (3.2 ppb). 4,4'-DDE was detected in samples SD-13-001 (0.29 ppb) and SD-13-004 (2.3 ppb). 4,4'-DDD was detected in one sample, SD-13-007, at 0.85 ppb. Aroclor-1248 was detected at a concentration of 53 ppb in SD-13-007.

Eighteen metals were detected in the sediment samples. Of the three metals detected in the surface water samples (barium, chromium, and silver), only silver was not detected in any sediment samples. Barium and chromium were detected in all the sediment samples.

Iron was detected in each of the four sediment samples analyzed, with the greatest concentration (41,100 ppm) occurring in SD-13-004. This concentration is one order of magnitude higher than the levels of iron detected in any other sample. Magnesium was detected in SD-13-004 (1,060 ppm) and SD-13-007 (1,390 ppm) at higher concentrations than in SD-13-001 (743 ppb) and SD-13-012 (509 ppm). Manganese was also detected in each of the sediment samples. Manganese was detected in SD-13-004 at 2,570 ppm, which is 1 to 2 orders of magnitude higher than other detected values. In general, concentrations of metals were greatest in SD-13-004 and SD-13-007.

Sediment TBC values are listed in Tables 4-4 and 4-5. Contaminants exceeding TBC values included PAHs, 4,4' DDE, 4,4' DDD, Aroclor 1248, and metals.

5.2.4 FT-002 Surface Water Sampling

Since February 1998, 14 rounds of surface water sampling have been conducted at key locations on base to evaluate loadings from the site FT-002 groundwater contaminant plume to surface water drainages on base. This sampling is ongoing and is being performed to evaluate contaminant concentrations compared to model predicted ranges over time and to ensure that contaminants are not migrating off base in surface water at concentrations above New York State surface water standards. Sampling points SW-MNA-6 and SW-MNA-8 are located upstream and downstream, respectively, of site SS-013 (Figure 5-5). SW-MNA-6 is located near the discharge point for treated water from the FT-002 water treatment plant and is also just downstream of the discharge point for storm sewer drains that intercept contaminated groundwater from the FT-002 groundwater contaminant plume. SW-MNA-8 is located approximately 1-mile downstream of SW-MNA-6 and about ½-mile upstream from the Salmon River.

Analytes detected in surface water samples collected at SW-MNA-6 and SW-MNA-8 are presented in Table 5-7. 1,2-DCE and TCE were the primary VOCs detected in the SS-013 RI surface water samples. These compounds have been detected in SW-MNA-6, upstream of SS-013, at concentrations an order of magnitude higher than those observed in the SS-013 RI surface water samples. Therefore, the 1,2-DCE and TCE observed in the SS-013 RI surface water samples was likely due to upstream FT-002 contamination and not to the SS-013 site. These contaminants appear to readily attenuate in surface water and appear only at very low concentrations at location SW-MNA-8.

As part of the FT-002/IA Groundwater OU remediation, a treatment basin will be constructed near location SW-MNA-6 to treat contaminated groundwater intercepted from the FT-002 contaminant plume.

5.3 Groundwater

Groundwater investigations at SS-013 were conducted during the SI and RI and more recently during the 2000 Supplemental Remedial Investigation. Groundwater data collected during the *FT-002/Industrial Area Groundwater Operable Unit Remedial Investigation/Feasibility Study* (URS 2000a) is also pertinent to SS-013. These data are presented and discussed in the following section.

5.3.1 Site Investigation

Five monitoring wells (currently designated MW-13-001 through MW-13-005) were installed during the SI (Figure 1-4) (E.C. Jordan 1989). Groundwater samples from these wells were analyzed for VOCs and TAL inorganics. Petroleum hydrocarbon (PHC) analyses were conducted on samples from MW-13-001 through MW-13-004. SVOC analysis was conducted on the sample from MW-13-005. Table 5-8 presents the results of these analyses. Since these data were not subjected to independent audit, analytical results will be used for data presentation only. The values were not used for health risk calculations.

2-Butanone was detected in samples MW-13-003 and MW-13-004 at concentrations of 59 and 170 ppb, respectively. All methylene chloride detections were attributed to laboratory contamination. Xylene had an estimated concentration of 3.1 ppb in MW-13-005. BEHP was the only SVOC detected in sample MW-13-005 (3.8 ppb), but the concentration was estimated. PHCs were not detected in any of the tested samples. Eighteen metals were detected in the 5 samples. Generally, for a given metal, the concentrations were about the same in all samples. Several samples, however, had concentrations of a single metal that appeared elevated compared to other samples. These were: aluminum in MW-13-005 (729 ppb); chromium in MW-13-004

(11 ppb); iron in MW-13-001 (18,400 ppb); manganese in MW-13-001 (3,110 ppb); lead in MW-13-005 (8.2 ppb); and sodium in MW-13-005 (30,300 ppb). E. C. Jordan recommended that groundwater quality downgradient of the leach fields be investigated.

5.3.2 Remedial Investigation

Groundwater investigations were undertaken in two phases. In Phase 1, groundwater samples were collected in two rounds from 4 existing monitoring wells and 3 newly installed monitoring wells. In Phase 2, 4 additional monitoring wells were installed at SS-013 and a third round of groundwater samples was then collected from the 12 SS-013 monitoring wells and 8 upgradient monitoring wells from IRP sites FT-002, SS-004, LF-023, and SS-027. These samples were collected to evaluate the impact of groundwater contaminant plumes from sites LF-023 and FT-002 on SS-013. The following subsections present a summary of field data and analytical results, and a discussion of the nature and extent of groundwater contamination in the unconfined, water-table aquifer.

5.3.2.1 Phase 1 Results

Six monitoring wells were sampled during each of the first two rounds. MW-13-005 could not be sampled because the water in it was frozen. MW-13-002 also was not sampled. Samples were analyzed for TCL organics and RCRA metals. Except for the sample taken from monitoring well MW-13-008, the volatiles fraction of each sample collected during the second-round sampling event was analyzed by USEPA Method 524.2, modified to quantify all TCL volatiles. Contaminants detected in the first and second round sampling events are shown in Figures 5-6 and 5-7, respectively. A summary of these results is also presented in Table 5-9.

First Round

Seven VOCs were detected in the first round groundwater samples. Concentrations of total VOCs ranged from 9 ppb in MW-13-006 to 115 ppb in MW-13-008. Chloromethane and 1,2-DCA were the most frequently detected VOCs. Vinyl chloride (53 ppb) and BTEX compounds (51 ppb) were also detected in MW-13-008.

SVOCs were detected in two wells, MW-13-004 and MW-13-008. Naphthalene was the only SVOC detected in MW-13-004 at a concentration of 5 ppb. The total concentration of SVOCs detected in MW-13-008 was 3,258 ppb, composed primarily of PAH compounds. Naphthalene was detected at a concentration of 2,700 ppb in MW-13-008. No pesticides or PCBs were detected in the first round groundwater samples.

Detected metals included arsenic, barium, chromium, lead, selenium, and mercury. Lead concentrations ranged from 1 ppb in MW-13-004 to 19.8 ppb in MW-13-008. Mercury (0.25 ppb) was detected only in MW-13-004.

The analytical results for the groundwater samples were compared to groundwater standards. These values, listed in Table 4-1, are also presented as ARAR values in the groundwater analyte detection table (Table 5-9). During first-round sampling, ARARs were exceeded for: chloromethane in MW-13-006, MW-13-007, and MW-13-008; and vinyl chloride, toluene, ethylbenzene, xylenes, naphthalene, 2-methylnaphthalene, acenaphthene, and carbazole in MW-13-008. The only metals detected at levels exceeding ARARs were: arsenic (MW-13-006); chromium (MW-13-006, MW-13-008, and MW-13-007); and lead (MW-13-006 and MW-13-007, MW-13-008).

Ethylene glycol was not detected in any sample collected in the first round.

Second Round

During second round sampling, 9 VOCs were detected. Concentrations of total VOCs ranged from 4.9 ppb in MW-13-003 to 61 ppb in MW-13-008. Most frequently detected VOCs were chloromethane, acetone, and 1,2-DCA. Other VOCs detected included vinyl chloride at 27 ppb, 1,2-DCE at 1 ppb, styrene at 1 ppb, and three BTEX compounds at 32 ppb, all in MW-13-008. The highest detected concentration of acetone occurred in the upgradient well, MW-13-001, at 34 ppb.

SVOC compounds were detected in only one sample, MW-13-008, at a total concentration of 1,576 ppb. Most SVOCs detections were PAHs. Individual SVOC detections ranged from 2 ppb of acenaphthylene to 860 ppb naphthalene. No pesticides or PCBs were detected in the second round groundwater samples.

Detected metals included arsenic, barium, cadmium, chromium, and lead. Lead concentrations ranged from 7.1 to 11.3 ppb in unfiltered samples. In general, metals were detected more frequently and at higher concentrations in the unfiltered samples than in the filtered samples.

During second-round sampling, ARARs were exceeded for: chloromethane in MW-13-004; and vinyl chloride, and toluene, ethylbenzene, xylenes, 2,4-dimethylphenol, naphthalene, 2-methylnaphthalene, and acenaphthene in MW-13-008. The only metal detected at a level that exceeded ARARs was lead in MW-13-006.

5.3.2.2 Phase 2 Results

A third round of groundwater sampling was conducted in October 1995 to evaluate the impact of the FT-002 groundwater contaminant plume on SS-013. The 12 SS-013 monitoring wells and 8 upgradient wells from adjacent IRP sites were sampled and analyzed for TCL VOCs at Method 524.2 (low level) detection limits. With the exception of well MW-13-008, all VOC detections were in wells located upgradient of SS-013.

Seven VOCs were detected in sample MW-13-008 (vinyl chloride, 1,2-dichlorethene, all BTEX compounds, and styrene). The detected concentrations of vinyl chloride (38 ppb), benzene (4.1 ppb), and xylenes (15 ppb) exceeded their respective ARAR values. The analytical results from the third round of sampling are displayed in Figure 5-8, and summarized in Table 5-9.

5.3.3 FT-002/Industrial Area Groundwater Operable Unit Remedial Investigation

As part of the FT-002/IA Groundwater OU RI, the chemical quality of groundwater in the vicinity of site FT-002, the flightline industrial corridor, and the former Weapon Storage Area was evaluated by compiling a database of existing groundwater analytical data from studies/investigations conducted at PAFB from 1987 to 1999, including the analytical results from 99 wells sampled in 1996 and 1997 as part of the FT-002 RI (URS 2000a). The database contained analytical data from approximately 307 wells and piezometers (968 sample records). The database compilation was limited to groundwater analytical data for the chlorinated hydrocarbon compounds PCE, TCE, DCE, and VC and the fuel-related hydrocarbon compounds benzene, toluene, ethylbenzene, and xylenes (BTEX compounds).

The distribution of maximum total BTEX and maximum total chlorinated hydrocarbon compounds in the unconfined aquifer, based upon groundwater analytical data from August 1995 through September 1999, is shown in Figures 5-9 and 5-10, respectively. This time period was chosen because it encompasses the largest number and greatest areal distribution of groundwater analyses performed at PAFB. Groundwater flow patterns are superimposed on the figures.

A small area of BTEX contaminated groundwater is associated with well MW-13-008 at SS-013 (Figure 5-9). This contamination is attributable to the fuel oil leakage associated with the former Building 3578 UST. Two larger BTEX groundwater contaminant plumes are located upgradient of SS-013. These plumes are associated with site FT-002 and an offbase source near LF-023. Given that BTEX compounds readily biodegrade and that these plumes are approximately 2000 feet upgradient from SS-013, it is unlikely that groundwater at SS-013 will be significantly affected by these upgradient BTEX contaminant sources.

Chlorinated hydrocarbon compounds do not biodegrade as readily as BTEX compounds and tend to be persistent in groundwater. Figure 5-10 shows estimated chlorinated hydrocarbon compound contamination in groundwater basewide. At SS-013, a small area of chlorinated hydrocarbon contamination is associated with MW-13-008. Chlorinated hydrocarbon plumes that appear to be emanating from sites FT-002/SS-004 are present upgradient of SS-013. The FT-002/SS-004 chlorinated hydrocarbon plume is believed to be currently impacting upgradient well pair MW-13-001/MW-13-002. As part of the FT-002/IA Groundwater OU remediation, a permeable treatment wall will be installed that will intercept the chlorinated hydrocarbon contaminated groundwater just west of MW-13-001/MW-13-002 and prevent its further migration (Figure 5-10).

5.3.4 2000 Supplemental Remedial Investigation

As detailed in Section 2.0, a supplemental groundwater sampling event was conducted at SS-013 in July and December 2000. The purposes of the sampling event were to evaluate current

VOC and SVOC concentrations in groundwater throughout SS-013 and metals concentrations in groundwater downgradient of the leach fields (new wells MW-13-013 through MW-13-015 were installed for this purpose). The compounds detected in the groundwater samples are presented in Table 5-10 and shown on Figure 5-11. Complete analytical results are provided in Appendix A.

Ten VOCs were detected in the groundwater samples. Minor acetone and methylene chloride detections occurred in several wells and may represent laboratory contamination. TCE and 1,2-DCE were detected in upgradient well pair MW-13-001/MW-13-002 and are believed to be attributable to the FT-002/SS-004 chlorinated hydrocarbon compound plume. This is the first time that TCE (at a concentration exceeding its ARAR value) and 1,2-DCE have been detected in MW-13-002, which monitors the deeper portion of the unconfined aquifer. Low concentrations of 1,1-DCA and 1,2-DCA were detected in MW-13-009; the 1.23 ppb 1,2-DCA detection exceeded the 0.6 ppb ARAR value. Vinyl chloride, methylene chloride, toluene, ethylbenzene, and xylenes were detected in MW-013-008 at concentrations that exceeded their respective ARAR values. The sample from MW-13-008 was collected in July 2000, prior to the removal action conducted by Versar to remove contaminated soils associated with the former Building 3578 UST.

Ten SVOCs were detected in the groundwater samples. Nine of the SVOC detections occurred in MW-13-008, with five compounds being detected at concentrations exceeding their respective ARAR values. These SVOCs included 2,4-dimethylphenol and fuel-related polynuclear aromatic hydrocarbon (PAH) compounds. The only other SVOC detected was bis(2-ethylhexyl) phthalate at low concentrations in several wells. Bis(2-ethylhexyl)phthalate is recognized as a common sampling/laboratory contaminant.

Eighteen of the 23 TAL metals were detected in the unfiltered (total metals) and filtered (dissolved metals) groundwater samples collected from seven wells in the vicinity of the leach fields. All unfiltered and most filtered sample iron detections were at concentrations that exceeded the iron ARAR value. Manganese and sodium were each detected in two wells at concentrations exceeding their respective ARAR values. Thallium was detected at a concentration of 4 ppb in MW-13-013, which is above the 0.5 ppb ARAR value. No other metals were detected at concentrations above their respective ARAR values. The leach fields do not appear to be significant sources of metals contamination based upon this group of groundwater samples. However, the groundwater analytical results may not reflect true groundwater quality due to the potential presence of remnant potable water (added to the boreholes during well installation) in the vicinity of the wells during sampling.

5.3.5 2002 Supplemental Groundwater Sampling

An additional groundwater sampling event was conducted in August and November 2002. MW-13-008 was sampled to evaluate contaminant concentrations following completion of soil removal activities in the immediate vicinity of the well, MW-13-005 and MW-13-012 were sampled because they were not sampled in the 2000 sampling event (they were frozen), and MW-13-013, -014, and –015 were sampled to alleviate concerns regarding the potential affect of water used during drilling on the 2000 results. Results are presented in Appendix O.

Groundwater collected from MW-13-005 and MW-13-012 was analyzed for TCL VOCs and SVOCs; no compounds were detected in these samples. The sample from MW-13-008 also was analyzed for TCL VOCs and SVOCs. Seven VOCs and ten SVOCs were detected at MW-13-008. Benzene, ethylbenzene, vinyl chloride, xylenes, 2,4-dimethylphenol, 2-methylnaphthalene, acenaphthene, carbazole, and naphthalene were detected at concentrations above their respective ARAR values. Groundwater samples from MW-13-013, -014, and –015 were analyzed for TCL VOCs, TCL SVOCs, and TAL metals. VOCs and SVOCs were not detected in these wells above ARARs. Five metals were detected in the samples at concentrations above ARARs: antimony, iron, manganese, sodium, and thallium. The antimony detections in these samples could neither be confirmed or eliminated based on a review of the data; antimony was detected in the blank samples (see Appendix O). Although similar, the 2002 results for these three wells were slightly higher than the 2000 results.

5.4 Contaminant Summary

In the RI report, five potential source areas were identified within the SS-013 industrial complex. These areas are: (1) former leach field N; (2) former leach field A; (3) leach field S;

(4) the former waste accumulation area and the former solvent storage pad; and (5) the former Building 3578 fuel oil UST. Each of these areas is discussed below.

5.4.1 Former Leach Field N

Septic system equipment associated with this leach field was removed in 1996. The soils within leach field N appear to have been somewhat impacted by former waste practices at the site. A few BTEX and PAH compounds were detected in soil samples from this leach field, with the concentrations of some carcinogenic PAHs exceeded soil TBC values. PAH compounds have low water solubilities and would not be expected to migrate into groundwater. Soil TBC exceedances also occurred for detections of aluminum, arsenic, calcium, copper, lead, magnesium, nickel, potassium, and zinc. These metals were not detected at concentrations above ARAR values in downgradient wells during the 2000 or 2002 events. Acetone (3.55 ppb) was the only VOC or SVOC detected in downgradient wells during the 2000 sampling event; this compound was not detected in the 2002 event. Former leachfield N does not appear to be a source for groundwater contamination.

5.4.2 Former Leach Field A

Septic equipment associated with this leach field also was removed in 1996. No organic compounds or metals were detected at concentrations above TBC values in soil samples from this leach field. 1,2-DCA, arsenic, chromium, and lead were detected in downgradient wells at concentrations above their respective ARAR values in 1994 groundwater samples. No VOCs were detected in downgradient groundwater samples collected in 1995 after base closure. The 2000 groundwater samples did not indicate any significant VOC, SVOC, or metal impacts downgradient of this leach field. Former leach field A does not appear to be a source for groundwater contamination.

5.4.3 Leach Field S

Leach field S is the only SS-013 leach field where the septic equipment was not removed. Acetone, aluminum, antimony, chromium, and selenium were present at concentrations above their respective TBC values in samples from one boring near leach field S. In the 2000 groundwater samples collected downgradient of leach field S, low concentrations of acetone and bis(2-ethylhexyl)phthalate were the only VOCs and SVOCs detected. In 2002, iron was the only analyte detected at a concentration exceeding its ARAR value in the downgradient groundwater samples; iron, manganese, thallium, and antimony were detected above ARARs in 2002 groundwater samples. Leach field S does not appear to be a source for groundwater contamination.

5.4.4 Former Waste Accumulation Area and Former Solvent Storage Pad

Soil samples from the former waste accumulation area contained high molecular-weight PAH compounds at concentrations that exceeded TBC values. The PAH compounds whose concentrations exceeded TBC values have not been detected in any SS-013 groundwater samples. However, PAH compounds detected above ARAR values in MW-13-008 were also present in soil samples collected at the former waste accumulation area, although at concentrations below TBC values. PAH compounds are relatively immobile in groundwater. The former waste accumulation area is probably not the PAH source for groundwater contamination observed in MW-13-008. Leakage from the former building 3578 fuel-oil UST piping is the most likely source for the PAH contamination observed in MW-13-008. Contaminated soils associated with the leaking pipes have been removed.

At the nearby former solvent storage pad, toluene and 1,2-DCE were detected in soil samples at concentrations above their respective TBC values. These compounds have been detected in MW-13-008, although the 1,2-DCE appears to be reductively dechlorinating to vinyl chloride within the fuel oil contaminant plume from the former Building 3578 UST. In 1997, solvent contaminated soils in the vicinity of the former solvent storage pad were removed and properly disposed (Parsons – OHM 1999). Following the analysis of confirmatory soil samples, NYSDEC and USEPA concurred with the recommendation that no further soil removal was warranted at the excavation location (Appendix D). The former solvent storage pad area is no longer a source for groundwater contamination. Vinyl chloride concentrations detected in downgradient well MW-13-008 have been decreasing with time (Figure 5-12).

5.4.5 Former Building 3578 UST and Vicinity

Soils in the vicinity of the former Building 3578 UST and its associated piping have been found to be contaminated with fuel oil (Appendix B). Samples from MW-13-008 also indicate that groundwater has been impacted by the fuel oil. Some contaminated soils were excavated when UST-3578-A-2 was removed in 1996. A soil removal action was initiated in 2000 to address the remaining contaminated soils. Following regulatory agency approvals, the excavation was backfilled in November 2001 and contaminated soil stockpiles were removed from the site for proper disposal. A Draft Closure Report was submitted for regulatory agency review and approval in March 2002. It is expected that groundwater quality will improve following the soil contaminant source removal. The contaminant of most concern resulting from this spill is naphthalene; naphthalene concentrations have decreased at MW-13-008 by about 35% from before the removal (2000) to after the removal (2002). Historical naphthalene results at MW-13-008 are shown on Figure 5-12.

5.4.6 Upgradient Source Areas

The primary upgradient source area of concern for SS-013 is the FT-002/SS-004 chlorinated hydrocarbon compound groundwater contaminant plume. This plume currently appears to be impacting upgradient well pair MW-13-001/MW-13-002. As part of the FT-002/IA Groundwater OU remediation, a permeable treatment wall is proposed to be installed between well pair MW-13-001/MW-13-002 and the SS-013 industrial complex to intercept and treat the FT-002/SS-004 groundwater contaminant plume, preventing impacts to SS-013 and areas downgradient.

6.0 HUMAN HEALTH RISK EVALUATION

6.1 Introduction

6.1.1 Methodology and Organization

This human health risk assessment (HRA) evaluates the potential adverse health effects that could result from contaminated soil and groundwater at the former Munitions Maintenance Squadron (Site SS-013). The HRA follows procedures set forth in the USEPA's *Risk Assessment Guidance for Superfund* (RAGS) dated 1989.

The HRA follows the format set forth in RAGS and includes the following:

- Identification of Chemicals of Potential Concern
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization
- Uncertainty Analysis

6.1.2 Scope of Risk Assessment

A HRA was performed as part of the Remedial Investigation that evaluated potential human exposure to soil and groundwater contamination under trespassing, construction, and industrial development scenarios (URS 1996a). This HRA showed that there was no significant human health risk under the trespassing and construction scenarios, whereas, under the industrial scenario potential risk to workers was indicated. Both cancer and noncancer risks for industrial workers were attributable to future groundwater use and were attributable mainly to vinyl chloride and arsenic.

The HRA presented in the following sections evaluates potential human health risks associated with exposure to contaminated soil and groundwater under a future residential development scenario. This HRA will be used to evaluate the need for restrictions prohibiting residential reuse of the site under a "no action" scenario.

6.2 Chemicals of Potential Concern

Chemicals of potential concern (CPCs) for the soils and groundwater in this HRA were determined by using 108 soil samples collected since 1993, and 15 groundwater samples collected in 2000. Soil data from all site sampling locations were used, except for samples collected before subsequent removal activities, samples collected at depths greater than ten feet, or samples collected at background locations. The groundwater samples used in the HRA were collected during the July and December 2000 sampling events, which reflect the most comprehensive snapshot of current conditions at the site. Tables 6-1 and 6-2 list the soil and groundwater samples that were used in this HRA and Figures 6-1 and 6-2 show the soil and groundwater sampling locations. Only validated samples were used in accordance with USEPA guidance.

Figure 6-3 presents the two-step methodology utilized for screening of inorganic soil CPCs. All detected organic chemicals are considered CPCs and are included in the HRA. In the first screening step, the concentration of each individual soil sample chemical is compared to the corresponding upper tolerance limit for that chemical derived from basewide background soil data. Based on the USEPA guidance (USEPA 1989a), a one-sided upper tolerance limit with a coverage of 95% and a confidence coefficient of 95% was used for the first screening step. The 95% upper tolerance limit (UTL) is the statistically derived background concentration. If none of the onsite detections of a chemical exceed the 95% UTL, it can be safely concluded that the chemical is present at background levels and the chemical is not considered a CPC. Background data and derivation of 95% UTLs are presented in the basewide background study (URS 1996b). This step is also used in determining which groundwater chemicals are CPCs, as shown in Figure 6-3.

The nature of tolerance intervals is such that, even in the absence of contamination, a certain percentage of measurements can be expected to exceed the upper tolerance limits by random chance. For example, approximately 5 percent (or 1 in every 20) of onsite chemical concentrations would be expected to exceed the 95% UTL if onsite chemical concentrations are at background levels. Because these occasional exceedances do not necessarily indicate the presence of contamination at a site, a second screening step is used for inorganic chemicals in soil which exceed the 95% UTL in one or more onsite samples (Figure 6-3). In the second screening step, which would be applied to soils data only, the onsite mean concentration is compared to the mean of the background samples using the non-parametric Wilcoxon Rank-Sum Test procedure. If the onsite mean concentration does not exceed the mean of the background samples, then the chemical is within the expected background range and is not considered a CPC; otherwise, the chemical is considered a CPC and is included in the HRA.

Appendix K presents the data used in this HRA and Appendix L presents the CPC evaluation for soil and groundwater. The CPCs for soil include 20 volatile organic compounds (VOCs), 26 semivolatile organic compounds (SVOCs), 9 pesticides, 4 metals, and cyanide. The CPCs for groundwater include 10 VOCs, 10 SVOCs, and 4 metals. Parameters detected in soil but not considered CPCs according to the procedure presented in Figure 6-3 include antimony, beryllium, cobalt, copper, manganese, nickel, vanadium, zinc, barium, cadmium, chromium, and lead (Table L-1 of Appendix L). Parameters detected in groundwater but not considered CPCs according to the procedure presented in Figure 6-3 include aluminum, cobalt, copper, manganese, nickel, vanadium, zinc, chromium and lead (Table L-4 of Appendix L). Additionally, the inorganic metals calcium, magnesium, iron, sodium, and potassium were not included in the HRA, because in accordance with *RAGS*, "Chemicals that are (1) essential human nutrients, (2) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (3) toxic only at very high doses (i.e., much higher than those that could be associated with contact at the site) need not be considered further in the quantitative risk assessment" (USEPA 1989a). The screening processes completed for soil and groundwater are summarized on Tables L-1 to L-5 of Appendix L.

6.3 Exposure Assessment

6.3.1 Exposure Pathways

Exposure pathways are based on the assumption that the site will be developed for residential use in the future. Exposure pathways utilized for this HRA are pathways that would exhibit the highest risk. These pathways are shown in Figure 6-4 and include the following:

- Ingestion of contaminated soil by a residential user
- Dermal contact with and adsorption of contamination from soil by a residential user

- Inhalation (by a residential user) of contaminants volatilizing from soil migrating into indoor air
- Ingestion of contaminated groundwater by a residential user
- Dermal contact with and absorption of contamination from groundwater by a residential user
- Inhalation (by a residential user) of contaminants volatilizing from groundwater and migrating into indoor air

Inhalation of fugitive dust was not evaluated because it is not considered a significant exposure pathway. The site will likely be covered with asphalt or grass under potential future use development scenarios. Inhalation of fugitive dust is discussed further in the uncertainty analysis (Section 6.6).

6.3.2 Exposure Concentrations

As recommended in RAGS, the exposure concentration used to evaluate health risk has been calculated as the 95th percentile upper confidence limit (UL95) on the arithmetic mean. For each of the CPCs identified, a UL95 has been calculated using the procedures described in Supplemental Guidance to RAGS: *Calculating the Concentration Term* (USEPA 1992a) and methodology described by R.O. Gilbert (Gilbert 1987). This procedure involves initially determining the distribution of data for each CPC and then calculating the UL95 using one of two equations, depending on whether the data are normally or log-normally distributed.

Calculation of the UL95 is based on the following:

- For samples where the CPC was not detected, one half of the sample quantitation limit was used as the analyte concentration.

- For duplicate samples (three soil and one groundwater duplicates were analyzed), one concentration was used to represent the sample and duplicate. The concentration was derived as follows: 1) If an analyte was detected in both the sample and duplicate, the average of the detections was used; 2) If an analyte was detected in only the sample or the duplicate the detected concentration was used; and 3) If an analyte was not detected in either the sample or the duplicate, one half the average of the sample quantitation limits was used.

Exposure concentration calculations are summarized in Appendix L.

6.3.3 Exposure Parameters

Exposure parameters are used to calculate exposure dose (human intake) for each CPC. They are factors that express the frequency, duration, and magnitude of exposure. The exposure parameters used for this HRA are summarized in Table 6-3.

As shown, all parameters except Absorption Factors were derived from standard USEPA risk assessment guidance documents. The Absorption Factors were obtained from the USEPA Region II risk assessment group (USEPA 1999, 2001a).

It should be noted that the equation for calculating a 30-year residential exposure to soil and groundwater is divided into two parts in accordance with USEPA guidance (USEPA 1991a). First, a six year exposure duration is evaluated for young children (1 through 6 years old). Second, a 24-year exposure duration is assessed for older children and adults. Total exposure is calculated by adding the exposure for the child and adult.

6.4 Toxicity Assessment

Toxicity data used in this HRA is presented in Tables M-1, M-2, M-14, and M-15 in Appendix M and toxicological profiles of the CPCs are presented in Appendix N. Toxicity data for the CPCs is provided for carcinogenic (cancer causing) and non-carcinogenic (toxic but non-cancer causing) effects where applicable. Because a child's exposure is evaluated, toxicity data for non-carcinogenic effects are divided into subchronic (7 years or less) and chronic (greater than 7 years) values. When subchronic values were not available, the chronic toxicity value was used for subchronic (child) exposure. In accordance with USEPA guidance (USEPA 1989a, b), only one value (based on chronic exposure) is used to evaluate carcinogenic effects.

Toxicity data used in this HRA were obtained from USEPA's Integrated Risk Information System (IRIS) and the Health Effects Assessment Tables (HEAST) via computer linkage with the toxicity database Smart TOX (Smart TOX 2001). In addition, as directed by USEPA Region 2 (USEPA 2001b), toxicity data for chlorinated organic chemicals and polynuclear aromatic hydrocarbons (PAHs) not available from Smart TOX were obtained from USEPA's National Center for Environmental Assessment (NCEA) (USEPA 2001c). This additional toxicity data was used in the HRA in accordance with RAGS.

For the dermal exposure route, toxicity values may be adjusted using oral absorption efficiencies. Based on consultation with USEPA Region 2, the toxicity values should be adjusted if the oral absorption efficiency is less than 50%. Based on data provided by USEPA Region 2, the absorption efficiencies of all CPCs are over 50% (i.e., an oral absorption efficiency of 100% was used) with the exceptions of barium and beryllium. Therefore, only the oral toxicity values for barium and beryllium were adjusted for dermal exposure in this HRA.

6.5 Risk Characterization

Health risk is a function of human exposure (Section 6.3) and chemical toxicity (Section 6.4). Risks are quantified as carcinogenic (cancer causing) and/or noncarcinogenic (non cancer causing). Risks are summarized in Tables 6-4 to 6-8.

Cancer risks for each CPC are calculated by multiplying the estimated exposure dose (human intake) by the chemical-specific slope factor (cancer toxicity value) (see Appendix M). The total cancer risk is obtained by adding the cancer risks for each CPC. According to USEPA guidance (USEPA 1991b) remediation is warranted and cancer risks are a concern when the calculated total cancer risk for any receptor is greater than 1×10^{-4}. A risk of 10^{-4} indicates that an individual would incur an additional risk of 0.0001 (or 1 in 10,000) of contracting cancer if exposed to contaminants at the level evaluated. Cancer risks falling between 10^{-4} and 10^{-6} are considered acceptable by USEPA on a case-by-case basis.

Noncancer risks are evaluated by calculating a "hazard index". The hazard index is the sum of the hazard quotient for each CPC. A hazard quotient for each CPC is obtained by dividing the exposure dose (intake) by the reference dose (non cancer toxicity value) (see

Appendix M). According to USEPA guidance (USEPA 1989a, 1989b), potential non cancer impacts are possible if the hazard index exceeds 1 for any receptor.

6.6 Exposure Assessment Results

Risks associated with the Munitions Maintenance Squadron (SS-013) site are summarized in Tables 6-4 to 6-8, This discussion focuses on the comparison of these risks to acceptable risk levels.

As shown in Table 6-4, the total cancer risk from exposure to soil and groundwater exceeds 10^{-4} and the hazard index exceeds 1. When the media are considered separately, risks from soil exposure are at the upper end of the cancer risk criteria (10^{-4}) but do not exceed the hazard index criteria (1); but risks from groundwater exposure exceed both criteria. The highest carcinogenic and noncarcinogenic risk to a future site resident emanates from ingesting contaminated site groundwater.

Chemical-specific intakes for each pathway for carcinogenic and noncarcinogenic chemicals are summarized in Tables 6-5 and 6-6 for soil, and in Tables 6-7 and 6-8 for groundwater. CPCs that are major contributors to risk include: benzo(a)pyrene, dibenz(a,h)anthracene, arsenic, and vinyl chloride for soil; and vinyl chloride, naphthalene, and arsenic for groundwater.

6.7 Uncertainty Analysis

The estimates of carcinogenic risk and noncarcinogenic health effects (chronic/subchronic) in this HRA are based upon numerous assumptions and, therefore, involve a considerable degree of uncertainty. Some of this uncertainty is inherent in the risk assessment process itself, and in the current limits of scientific knowledge regarding human health risk factors. For example, the necessary extrapolation of animal study data to humans introduces a large uncertainty factor into the process, as does extrapolation from the high doses used in these studies to the low doses associated with most hazardous waste sites, such as the SS-013 site. Likewise, estimating human exposure and human intake is largely judgmental and involves extrapolation of human behavioral patterns (often unknown even at present) into the relatively distant future. The exposure assessment for this study is based upon reasonable maximum exposures, defined as the highest exposure that may be reasonably expected at a site. The intent is to estimate a conservative exposure scenario that is still within the range of possible exposure.

Due to these types of uncertainties, as presented in Table 6-9, the results of the baseline HRA for the SS-013 site should not be taken as a characterization of absolute risk or as a fully probable estimate of this risk. Rather, they are intended to identify the types and relative levels of risk associated with various potential exposure routes at SS-013 so that remedial efforts can be focused upon those aspects of the site that are of greatest concern from a human health standpoint. Table 6-9 presents the uncertainties according to whether they produce an underestimation or overestimation of risk, or whether their effect is unknown. The presentation of uncertainties is broken down categorically by uncertainties concerning the identification of CPCs, exposure assessment, toxicity assessment, as well as risk characterization.

7.0 SUMMARY AND CONCLUSIONS

This Supplemental Remedial Investigation (RI) Report summarizes soil, surface water, sediment, and groundwater investigations and remedial actions undertaken at site SS-013 from 1984 to the present. Investigations at the site include:

- Phase I Records Search (1984-1985)
- Site Investigation (1987)
- Drainage Flow Study (1989-1990)
- Remedial Investigation (1993-1995)
- FT-002/IA Groundwater OU (1996-1999)
- Supplemental Remedial Investigation (2000-2001)

Several remedial actions have been undertaken in coordination with the NYSDEC and USEPA based on the results of the investigations. In addition, equipment removals were executed following the closure of Plattsburgh AFB in 1995. These actions are:

- Fuel-oil Tank UST-3578-A-2 Removal (1996)
- Leach Fields N and A Piping Removals (1996)
- Septic Tank SPT-3578 Removal (1996)
- Former Waste Accumulation Area Solvent Storage Pad Removal (1997)
- Buildings 3578 and 3569 Soil Removal Action (2000-2001)

Three new monitoring wells were installed at the site and an additional comprehensive round of groundwater sampling was accomplished in the fall of 2000 as part of the Supplemental RI. In addition, potential risk to human health was reevaluated using current data under residential reuse assumptions (the previous risk assessment, accomplished as part of the RI, assumed industrial reuse).

Sixteen chemicals were present in groundwater at concentrations above ARARs in 2002 (refer to Figure 5-11). Ten of the contraventions (vinyl chloride, methylene chloride, toluene, ethylbenzene, m&p xylenes, 2,4-dimethylphenol, naphthalene, acenaphthene, dibenzofuran, and carbazole) occurred at MW-13-008. A similar suite of chemicals were detected at MW-13-008 when it was resampled in 2002. In the two most recent sampling events (2000 and 2002), iron, manganese, and sodium were detected in groundwater at concentrations above ARARs in several of the onsite wells. However, all three of these metals were detected in groundwater at concentrations below base background groundwater metals concentrations (URS 1996b). Antimony was detected above ARARs in MW-13-013, -014, and –015 in 2002; however, antimony was also detected in the associated QC blank and its presence may be due to laboratory contamination. Thallium was detected in groundwater at one location in 2000 (MW-13-013); the detected concentration of 4 μg/L in the unfiltered (total) groundwater sample exceeded the 0.5 μg/L ARAR concentration. Thallium was not detected in the filtered (dissolved) groundwater sample at MW-13-013 in 2000. Thallium was detected above its ARAR in MW-13-013, -014, and –015 in 2002 in both the filtered and unfiltered samples.

The two remaining chemicals that were detected in groundwater above ARARs (trichloroethene and 1,2-dichloroethane) appear to be from upgradient. Trichloroethene was detected in groundwater at MW-13-002 at a concentration of 9 μg/L. This contamination is migrating from the flightline area (which lies to the northeast) and will be addressed as part of the FT-002/Industrial Area Groundwater Operable Unit (URS 2000a). Construction of a permeable reactive barrier is proposed to the southwest of MW-13-002, which would effectively prevent further migration of chlorinated hydrocarbons along this route. 1,2-Dichloroethane (1,2-DCA) was detected in groundwater at MW-013-009 at a concentration of 1.2 μg/L, slightly above its ARAR concentration of 0.6 μg/L. This compound was not detected previously at this location. This well is located downgradient from Landfill 023 (LF-023), which lies about 1,500 feet to the north. 1,2-DCA and related chemicals (chloroethane - a breakdown product of DCA) have been detected in groundwater at LF-023 in the past, albeit very sporadically. It appears more likely that the 1,2-DCA detection in groundwater at MW-13-009 is attributable to LF-023 than to the FT-002 plume (which lies to the north-northeast) since volatile organic compounds were not detected in groundwater samples from upgradient wells MW-13-010 and MW-13-011, which are located between the FT-002 plume and site SS-013.

In the RI Report (URS 1996a), five potential soil sources for groundwater contamination were identified within the SS-013 industrial complex. These included:

- former leach field N
- former leach field A
- leach field S
- former waste accumulation area and former solvent storage pad
- former building 3578 UST and vicinity

Subsequent to the RI, soil was removed from a portion of all of these areas. Table 7-1 shows the maximum soil concentrations of chemicals detected in groundwater above ARARs in the year 2000 round of groundwater sampling. Maximum concentrations were determined for groups of soil samples based on the five potential source areas for groundwater contamination. Only soil sample locations not excavated during the removal actions were used. Two chemicals, aluminum and manganese, were detected at concentrations above TBCs (aluminum at Leach Field "N" and Leach Field "S" and manganese near the former waste accumulation area). These TBCs for metals are based on background concentrations. Based on this analysis, it does not appear that a source for organic groundwater contamination remains on-site.

The updated human heath risk assessment performed in the Supplemental RI evaluated risk posed to hypothetical future residents given six exposure pathways:

- Ingestion of Soil
- Dermal Contact with Soil
- Inhalation of Soil Vapors in Indoor Air
- Ingestion of Groundwater
- Dermal Contact with Groundwater
- Inhalation of Groundwater Vapors in Indoor Air

Groundwater samples from the 2000 sampling event, soil samples not excavated during the removal actions, and confirmation soil samples from the removal actions were used in the assessment. The overall excess cancer risk posed by chemicals detected in soil via the three soil exposure pathways is 1×10^{-4}. This risk falls at the upper end of the range of risk (10^{-4} to 10^{-6} excess cancer risk) that may be considered acceptable on a case-by-case basis by current USEPA guidelines. The chemicals primarily responsible for the excess cancer risk posed by chemicals detected in soil include arsenic, vinyl chloride, benzo(a)pyrene, and dibenz(a,h)anthracene. Vinyl chloride was detected at only one soil sampling location (SS-13-018) at a concentration of 2 µg/L. Arsenic was detected above its 7.5 mg/kg TBC (background) at only one soil sampling location (SB-13-008 at 28 mg/kg). Detections of benzo(a)pyrene (11 of 68 samples) and dibenz(a,h)anthracene (5 of 68 samples) in soil were more widespread. The highest concentrations of benzo(a)pyrene in soil occurred at SB-13-006/2-4', SB-13-010/4-6', SS-13-007, and SS-13-010. The highest concentrations of dibenz(a,h)anthracene occurred at SB-13-006/2-4' and SS-13-010. Overall, the area where the four chemicals of most concern in soil are at elevated levels is very small (less than 1 acre). The overall noncancer hazard index for the soil pathways is below the USEPA specified hazard index of 1.

The overall excess cancer risk posed by chemicals detected in groundwater is 5×10^{-4} and the overall hazard index for the groundwater pathways is 50. These risks fall above USEPA's cancer and noncancer target risk thresholds. The chemicals primarily responsible for the excess cancer risk posed by chemicals detected in groundwater include arsenic, vinyl chloride, and naphthalene. Detections of arsenic in groundwater were widespread; however arsenic was not detected in groundwater at concentrations above its ARAR (25 mg/kg) at any location. Vinyl chloride and naphthalene were detected in groundwater only at MW-13-008 (note that the sample used at that location in the analysis was taken prior to the removal of the remaining soil source). Since the sources for this groundwater contamination have been removed, it is expected that groundwater contamination will attenuate slowly to levels below ARARs with time.

A screening level ecological risk assessment (ERA) was performed as part of the SS-013 RI (URS 1996a). Risks to terrestrial wildlife were assessed by evaluating potential impacts of soil and sediment contaminants on four indicator species (meadow jumping mouse, raccoon, fox, and common crow). Results showed no potential threat to the terrestrial species from soil contamination. There was a potential for impacts on the meadow jumping mouse population from sediment exposure; however, the magnitude of the impact was expected to be small.

Risks to aquatic life were achieved by comparing representative contaminant concentrations in surface water to state and federal water quality criteria and guidelines established for protection of aquatic life. Silver, detected in two upstream samples on opposite sides of SS-013, was the only analyte exceeding water quality criteria. The source of the silver in surface water is unknown and is not believed to be attributable to SS-013.

The conclusions of the ERA were that site-related contaminants in soil, sediment, and surface water did not appear to represent a significant threat to ecological receptors.

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TABLE 1-1
MUNITIONS MAINTENANCE SQUADRON (SS-013)
ENVIRONMENTAL ACTIVITY SUMMARY

ACTIVITY	DONE BY	DATES	ENVIRONMENTAL MEDIA SAMPLED						
			SOIL GAS	SOIL	SURFACE WATER	SEDIMENT	GROUNDWATER	TANK CONTENTS	CONCRETE
Phase I Records Search	Radian	1984 – 1985							
Site Investigation	E.C. Jordan	1987	●		●	●	●		
Drainage Flow Study	ABB	1989 – 1990			●				
Remedial Investigation	URS	1993 – 1995	●	●	●	●	●		
Fuel-oil Tank UST-3578-A-2 Removal	OHM	1996		●			●		
Septic Tank SPT-3578 Removal	OHM	1996		●			●	●	
Former Waste Accumulation Area Solvent Storage Pad Removal	Parsons – OHM	1997		●					●
FT-002/Industrial Area Groundwater Operable Unit Remedial Investigation/ Feasibility Study	URS	1996 – 1999			●		●		
Supplemental Remedial Investigation Groundwater Sampling	URS	2000					●		
Buildings 3578 and 3569 Soil Removal Action	Versar	2000 - 2001		●					

TABLE 1-2

MUNITIONS MAINTENANCE SQUADRON (SS-013)

STORAGE TANK DATA SUMMARY

ID NO.	YEAR INSTALLED	YEAR REMOVED	DESCRIPTION
UNDERGROUND STORAGE TANKS			
UST-3569	1956	1994	Munitions Storage Facility 1,000 gallon No. 2 Fuel Oil Underground Storage Tank – Tank was located at northwest corner of Building 3569. There was no contamination found at the time of removal.
UST-3570	1956	1994	Munitions Storage Facility 1,000 gallon No. 2 Fuel Oil Underground Storage Tank - Tank was located southwest of Building 3570. There was no contamination found at the time of removal.
UST-3578-A-1	Unknown	1986	Missile Assembly Shop 2,000 gallon No. 2 Fuel Oil Underground Storage Tank – Tank was located on southwest corner of Building 3578. The tank was removed in 1986 due to leakage and replaced with UST-3578-A-2.
UST-3578-A-2	1986	1996	Missile Assembly Shop 6,000 gallon No. 2 Fuel Oil Underground Storage Tank – Tank was located on southwest corner of Building 3578 and was a replacement for UST-3578-A-1. The tank and associated piping were removed in 1996, but not all contaminated soils were removed. A time critical removal action was conducted in 2000/2001 to remove the remaining contaminated soils.
UST-3580	1956	1994	Munitions Storage Facility 1,000 gallon No. 2 Fuel Oil Underground Storage Tank – Tank was located south of Building 3580. There was no contamination found at the time of removal.
UST-3582	1956	1996	Munitions Storage Facility 750 gallon No. 2 Fuel Oil Underground Storage Tank – Tank was located west of Building 3582. The UST was closed in-place in 1994 and subsequently removed in 1996. There was minor contamination at levels not requiring remedial or removal actions.
UST-3583-A-1	1981	1992	Emergency Power Station 5000 gallon Diesel Fuel Underground Storage Tank – Tank was removed in 1992 and replaced with UST-3583-A-2. There was minor contamination at levels not requiring remedial or removal actions.
UST-3583-A-2	1992	1996	Emergency Power Station 3,000 gallon Diesel Fuel Underground Storage Tank – The tank was located west of Building 3583 to provide fuel for emergency electrical generators. Facility personnel stated that the tank was never filled. The tanks was removed in 1996 and minor contamination was present at levels not requiring remedial or removal actions.
UST-3584-A	1956	1990	Munitions Storage Facility 1,000 gallon No. 2 Fuel Oil Underground Storage Tank – Historic drawings indicate that the tank was southeast of Building 3584. The area was investigated with a gradiometer and test pits and no signs of a UST were noted. No contamination was noted.

TABLE 1-2 (Continued)

ID NO.	YEAR INSTALLED	YEAR REMOVED	DESCRIPTION
UST-3584-B	Unknown	1988-1990	Munitions Storage Facility 5,000 gallon Diesel Fuel Underground Storage Tank – This tank was identified from historical drawings and personnel interviews. It was located on the west side of Building 3584. No evidence of the tank or any related contamination was noted during a 1994 visual site inspection.
UST-3585	1990	1994	Vehicle Refueling/Munitions Storage Facility 1,000 gallon Unleaded Gasoline Underground Storage Tank – Tank was located north of Building 3584. There was no contamination found at the time of removal.
UST-3586	1956	1994	Munitions Storage Facility 550 gallon No. 2 Fuel Oil Underground Storage Tank – Tank was located south of Building 3586. There was not contamination found at the time of removal.
UST-3592	1956	1990	Administration Building 550 gallon No. 2 Fuel Oil Underground Storage Tank – Tank was located northeast of Building 3592. According to PAFB personnel, the tank may have leaked. Groundwater characterization performed in 1996 indicated low levels of toluene (0.2 ppb maximum), ethylbenzene (0.2 ppb), 1,2,4-trimethylbenzene (0.1 ppb), and xylenes (0.6 ppb), but at concentrations below regulatory standards.
ABOVEGROUND STORAGE TANKS			
AST-3578	1986	Unknown	Missile Assembly Shop 550 gallon No. 2 Fuel Oil Aboveground Storage Tank – Temporary tank used during installation of UST-3578-A-2. No evidence of staining visible at former tank location.
AST-3583	Unknown	Still in place	Emergency Power Station 75 gallon Diesel Day Tank – Tank is inside Building 3583 and is an integral part of the generator.
AST-3592	Unknown	1995	Administration Building 500 gallon No. 2 Fuel Oil Aboveground Storage Tank – Tank was located outside of east wall of Building 3592. The tank had no base and was resting on the ground, however, no soil staining was observed during a 1994 visual site inspection.

TABLE 3-1

MUNITIONS MAINTENANCE SQUADRON (SS-013)

SOIL CLASSIFICATION

Soil Unit No.	Great Group/Series Designation	Description
5	Fluvaquents/Udifluvents Complex	Very deep and nearly level. Formed in alluvial sediments. Subject to flooding. Variable permeability.
45A	Junius Loamy Fine Sand	Very deep, somewhat poorly drained. Formed in glacial outwash on terraces, deltas, and outwash plains. High to very high permeability.
104	Udorthents	Very deep and somewhat poorly drained. Formed in a variety of materials in disturbed areas.
108A	Urban Land-Plainfield Complex	Buildings, streets, parking lots, etc., with interspersed Plainfield soils.
114	Udipsamments and Psammaquents	Very deep, excessively drained to somewhat poorly drained. Formed along lake shores and in cut/fill areas.
20A	Croghan Loamy Fine Sand	Very deep, moderately well drained. Formed in sandy glacial outwash. High permeability.
33	Pipestone Loamy Sand	Very deep, somewhat poorly drained. Formed in low medium-lime glacial outwash and lake plains, terraces, and outwash plains. High permeability.
144A	Raynham Silt Loam	Very deep, poorly drained silty soil. Formed in medium-lime lacustrine deposits. Permeability is moderately low.
171B	Plainfield Loamy Sand	Very deep, excessively drained. Formed in medium- to high-lime glacial outwash. High permeability.

See Figure 3-4 for soils maps.

TABLE 3-2
MUNITIONS MAINTENANCE SQUADRON (SS-013)
COMPARISON OF ESTIMATED CHANGES IN SURFACE ELEVATIONS DUE TO BASE CONSTRUCTION TO FILL/REGRADED MATERIAL THICKNESSES FROM SOIL BORING LOG DATA

WELL/BORING I.D.	ESTIMATED CHANGE IN SURFACE ELEVATION DUE TO BASE CONSTRUCTION (Figure 3-14)	FILL/REGRADED MATERIAL THICKNESS FROM BORING LOG DATA (Appendix C)	FILL/REGRADED MATERIAL DESCRIPTION
CROSS SECTION A -A' (Figure 3-9)			
MW-13-011	9.5	10	Fine to coarse sand, trace gravel
SB-13-006	3	8	Fine to coarse sand with brick fragments; regraded clayey silt
MW-13-007/SB-13-004	3	5	Silty fine sand; regraded clayey silt
MW-13-008/SB-13-015	3	8.5	Fine to coarse sand; regraded clayey silt
SB-13-014	3	5.5	Clayey silt with some sand and cobbles
MW-13-012	2	5	Silty sand (possibly regraded)
MW-13-005	-5	7.5	Silty sand with wood pieces (possibly regraded?)*
CROSS SECTION B-B' (Figure 3-10)			
MW-13-002	5	18	Fine to coarse sand*
MW-13-003	20	>22.5	Fine to coarse sand*
MW-13-006/SB-13-012	15	31.5	Fine to coarse sand, trace gravel
SB-13-007	5	14	Fine to coarse sand
MW-13-005	-5	7.5	Silty sand with wood pieces (possibly regraded?)*
CROSS SECTION C-C' (Figure 3-11)			
MW-23-008	0	0	None noted*
MW-13-009	0	5	Fine sand, some medium sand (probably regraded)
MW-13-007/SB-13-004	5	5	Silty fine sand; regraded clayey silt
SB-13-003	5	5	Fine to coarse sand; regraded clayey silt
MW-13-006/SB-13-012	15	31.5	Fine to coarse sand, trace gravel

* The soil boring log for this boring had some contradictory descriptive information.

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TABLE 3-3
MUNITIONS MAINTENANCE SQUADRON (SS-016)
GROUNDWATER/SURFACE WATER ELEVATION DATA

MONITORING WELL/ PIEZOMETER/ STREAM GAUGE I.D.	MEASURING POINT ELEVATION*	WATER ELEVATIONS*							
		DATES							
		9/25/93	12/3/93	1/6/94	1/7/94	2/16/94	9/21/95	10/5/95	12/13/00
MW-13-001	178.47	171.66			171.48	171.14		171.38	171.01
MW-13-002	177.93	171.72						171.43	171.12
MW-13-003	183.27	169.23			169.17	169.01	169.16	169.12	168.94
MW-13-004	154.32	147.56			147.44	147.43	147.54	147.46	148.08
MW-13-005	155.71	150.95						152.06	150.27
MW-13-006	176.26		165.75	165.69		165.61	165.57	165.55	165.46
MW-13-007	162.81		156.38	156.42		156.43	156.41	157.10	156.89
MW-13-008	160.34		156.22	155.49		154.65	155.46	155.94	
MW-13-009	163.37						158.51	158.98	159.27
MW-13-010	168.71						161.34	161.56	161.38
MW-13-011	169.63						163.05	163.22	163.20
MW-13-012	157.38						154.19	154.94	153.88
MW-13-013	160.81								156.85
MW-13-014	165.24								162.45
MW-13-015	164.80								161.70
MW-02-021	193.85							189.77	189.08
MW-02-022	191.75							187.44	
MW-02-040	209.02							199.21	
MW-02-043	185.47							182.19	
MW-02-044	190.24							181.64	
MW-02-045	181.65							178.65	178.12
MW-02-049	189.51							173.64	172.78
MW-04-001	181.01							179.19	
MW-04-006	207.27							189.86	
MW-23-001	235.85							211.79	212.78
MW-23-008	235.30							210.33	211.71
MW-23-011	233.80								211.35
MW-23-103	207.98								203.41
MW-23-104	198.28								193.56
MW-26-003	183.44							172.28	172.14
MW-27-001	214.59							207.20	208.00
PZ-13-01	175.94						169.23	169.49	
PZ-13-02	165.18						158.43	159.26	160.89
PZ-13-03	162.19						156.26	157.79	157.58
PZ-13-04	164.75						156.27	156.28	
PZ-13-04R	161.11								156.69
PZ-13-05	160.20						156.29	156.48	
PZ-13-06	161.95						158.54	158.73	158.68
PZ-13-07	188.82						167.36	167.28	167.09
PZ-13-08	179.67						164.88	164.70	164.67
PZ-4S	181.27								181.24
PZ-5S	153.76							147.29	146.88
PZ-6S	175.03								
PZ-7S	183.11							173.61	
HEADWALL 1-C	163.54								159.37
SG-13-01	161.99						159.91	160.38	
SG-13-02	160.73						155.63	155.64	155.46
SG-13-03	162.13						158.65	159.05	159.66
SG-13-04	159.35						155.43	155.48	154.47
SG-13-05	157.05						153.60	153.77	152.36
SG-13-06	160.53						159.63	159.60	160.06
SG-13-07	158.40						156.90	156.80	156.84
SG-13-08	162.26						159.94	160.01	160.40
SG-13-09	150.84						154.22	144.23	144.13
SG-13-10	149.16						143.29	143.51	143.93
SG-13-11	150.25						145.52	145.90	146.14
SG-13-12	155.91						153.53	153.68	151.42

*Elevations are in feet above mean sea level.

TABLE 4-1

MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION
CHEMICAL-SPECIFIC ARARs/TBCs

PARAMETER	Class	Groundwater		Fresh Surface Water Class A Human		Fresh Surface Water Classes A,B,C Aquatic		Fresh Surface Water Class D		Soil	
		ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	TBC Value (ug/kg)	Source
Chloromethane	VOC	5	A	5	A						
Bromomethane	VOC	5	A	5	A						
Vinyl Chloride	VOC	2	A	0.3	A					200	G
Chloroethane	VOC	5	A	5	A					1,900	G
Methylene Chloride	VOC	5	A	5	A					100	G
Acetone	VOC	50	A	50	A					200	G
Carbon Disulfide	VOC	50	F	50	F					2,700	G
1,1-Dichloroethene	VOC	5	A	0.07	A	11,000	B			400	G
1,1-Dichloroethane	VOC	5	A	5	A					200	G
1,2-Dichloroethene (total)	VOC	5	A(1)	5	A(1)					300	G (1)
Chloroform	VOC	7	A	7	A	1200	B			300	G
1,2-Dichloroethane	VOC	0.6	A	0.6	A	20,000	B			100	G
2-Butanone (or MEK)	VOC	50	A	50	A					300	G
1,1,1-Trichloroethane	VOC	5	A	5	A					800	G
Carbon Tetrachloride	VOC	5	A	0.4	A	35,000	B			600	G
Bromodichloromethane	VOC	50	A	50	A						
1,2-Dichloropropane	VOC	1	A	1	A						
cis-1,3-dichloropropene	VOC	0.4	A(2)	0.4	A(2)	200	B				
Trichloroethene	VOC	5	A	5	A	40	A	40	A	700	G
Dibromochloromethane	VOC	50	A	50	A						
1,1,2-Trichloroethane	VOC	1	A	1	A	9,400	B				
Benzene	VOC	1	A	1	A	10	A	10	A	60	G
trans-1,3-dichloropropene	VOC	0.4	A(2)	0.4	A(2)	200	B				
Bromoform	VOC	50	A	50	A						
4-Methyl-2-pentanone	VOC	50	F	50	F					1,000	G
2-Hexanone	VOC	50	A	50	A						
Tetrachloroethene	VOC	5	A	0.7	A	1	A	1	A	1,400	G
1,1,2,2-Tetrachloroethane	VOC	5	A	0.2	A	50	B			600	G
Toluene	VOC	5	A	5	A	17,000	B			1,500	G
Chlorobenzene	VOC	5	A	5	A	5	A	50	A	1,700	G
Ethylbenzene	VOC	5	A	5	A	32,000	B			5,500	G
Styrene	VOC	5	A	5	A						
Total Xylenes	VOC	5	A	5	A(1)					1,200	G

TABLE 4-1

MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION
CHEMICAL-SPECIFIC ARARs/TBCs

PARAMETER	Class	Groundwater		Fresh Surface Water Class A Human		Fresh Surface Water Classes A,B,C Aquatic		Fresh Surface Water Class D		Soil	
		ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	TBC Value (ug/kg)	Source
Phenol	SVOC	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)	30	G
bis(2-Chloroethyl)ether	SVOC	1	A	0.03	A						
2-Chlorophenol	SVOC	1	A(P)	1	A(P)	1	A(CP)	1	A(CP)	800	G
1,3-Dichlorobenzene	SVOC	3	A	3	A	5	A(3)	50	A(3)	1,600	G
1,4-Dichlorobenzene	SVOC	3	A	3	A	5	A(3)	50	A(3)	8,500	G
1,2-Dichlorobenzene	SVOC	3	A	3	A	5	A(3)	50	A(3)	7,900	G
2-Methylphenol	SVOC	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)	100	G
Bis(2-chloroisopropyl)ether	SVOC	50	F	50	F						
4-Methylphenol	SVOC	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)	900	G
N-Nitroso-di-n-propylamine	SVOC	50	F	50	F						
Hexachloroethane	SVOC	5	A	50/1.9	G,B	540	B				
Nitrobenzene	SVOC	0.4	A	0.4	A	27,000	B			200	
Isophorone	SVOC	50	A	50	A	117,000	B			4,400	G
2-Nitrophenol	SVOC	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)	330	G
2,4-Dimethylphenol	SVOC	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)		
Bis(2-chloroethoxy)methane	SVOC	5	A	5	F						
2,4-Dichlorophenol	SVOC	1	A(P)	5	A	1	A(CP)	1	A(CP)	400	G
1,2,4-Trichlorobenzene	SVOC	5	A	5	A(3)	5	A(3)	50	A(3)	3,400	G
Naphthalene	SVOC	10	A	10	A					13,000	G
4-Chloroaniline	SVOC	5	A	5	A					220	G
Hexachlorobutadiene	SVOC	0.5	A	0.5	A	1	A	10	A		
4-Chloro-3-methylphenol	SVOC	1	A(P)	1	A(P)	1	A(CP)	1	A(CP)	240	G
2-Methylnaphthalene	SVOC	50	F	50	F					36,400	G
Hexachlorocyclopentadiene	SVOC	5	A	5	A	0.45	A	4.5	A		
2,4,6-Trichlorophenol	SVOC	1	A(P)	1	A(P)	1	A(CP)	1	A(CP)		
2,4,5-Trichlorophenol	SVOC	1	A(P)	1	A(P)	1	A(CP)	1	A(CP)	100	G
2-Chloronaphthalene	SVOC	10	A	10	A	1,600	B				
2-Nitroaniline	SVOC	5	A	5	A					430	G
Dimethylphthalate	SVOC	50	A	50	A	3	B			2,000	G
Acenaphthylene	SVOC	50	F	50	F					41,000	G
2,6-Dinitrotoluene	SVOC	5	A	0.07	A					1,000	G

TABLE 4-1

MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION
CHEMICAL-SPECIFIC ARARs/TBCs

PARAMETER	Class	Groundwater		Fresh Surface Water Class A Human		Fresh Surface Water Classes A,B,C Aquatic		Fresh Surface Water Class D		Soil	
		ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	TBC Value (ug/kg)	Source
3-Nitroaniline	SVOC	5	A	5	A					500	G
Acenaphthene	SVOC	20	A	20	A	500	B			50,000	G
2,4-Dinitrophenol	SVOC	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)	200	G
4-Nitrophenol	SVOC	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)	100	G
Dibenzofuran	SVOC	50	F	50	F					6,200	G
2,4-Dinitrotoluene	SVOC	5	A	5	A						
Diethylphthalate	SVOC	50	A	50	A	3	B			7,100	G
4-Chlorophenyl-phenylether	SVOC	50	F	50	F						
Fluorene	SVOC	50	A	50	A					50,000	G
4-Nitroaniline	SVOC	5	A	5	A						
4,6-Dinitro-2-methylphenol	SVOC	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)		
N-nitrosodiphenylamine	SVOC	50	A	50	A						
4-Bromophenylphenylether	SVOC	50	F	50	F						
Hexachlorobenzene	SVOC	0.04	A	0.04	A					410	G
Pentachlorophenol	SVOC	1	A(P)	1	A(P)	1	A(CP)	1	A(CP)	1,000	G
Phenanthrene	SVOC	50	A	50	A					50,000	G
Anthracene	SVOC	50	A	50	A					50,000	G
Carbazole	SVOC	50	F	50	F						
Di-n-butylphthalate	SVOC	50	A	50	A	3	B			8,100	G
Fluoranthene	SVOC	50	A	50	A	3900	B			50,000	G
Pyrene	SVOC	50	A	50	A					50,000	G
Butylbenzylphthalate	SVOC	50	A	50	A	3	B			50,000	G
3,3'-Dichlorobenzidine	SVOC	5	A	0.02	B						
Benzo(a)anthracene	SVOC	0.002	A	0.002	A					224	G
Chrysene	SVOC	0.002	A	0.002	A					400	G
bis(2-Ethylhexyl)phthalate	SVOC	5	A	5	A	0.6	A			50,000	G
Di-n-octylphthalate	SVOC	50	A	50	A	3	B			50,000	G
Benzo(b)fluoranthene	SVOC	0.002	A	0.002	A					1,100	G
Benzo(k)fluoranthene	SVOC	0.002	A	0.002	A					1,100	G
Benzo(a)pyrene	SVOC	ND	A	0.002	A	0.0012	A	0.0012	A	61	G
Indeno(1,2,3-cd)pyrene	SVOC	0.002	A	0.002	A					3,200	G
Dibenz(a,h)anthracene	SVOC	50	F	50	F					14	G
Benzo(g,h,i)perylene	SVOC	50	F	50	F					50,000	G
Pyridine	SVOC	50	A	50	A						

TABLE 4-1

MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION
CHEMICAL-SPECIFIC ARARs/TBCs

PARAMETER	Class	Groundwater		Fresh Surface Water Class A Human		Fresh Surface Water Classes A,B,C Aquatic		Fresh Surface Water Class D		Soil	
		ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	TBC Value (ug/kg)	Source
alpha-BHC	PST	0.01	A	0.01	A					110	G
beta-BHC	PST	0.04	A	0.04	A					200	G
delta-BHC	PST	0.04	A	0.04	A					300	G
gamma-BHC (Lindane)	PST	0.05	A	0.05	A	0.95	A	0.95	A	60	G
Heptachlor	PST	0.04	A	0.04	A	0.0002	A	0.0002	A	100	G
Aldrin	PST	ND	A	0.002	A	0.001	A(5)	0.001	A(5)	41	G
Heptachlor epoxide	PST	0.03	A	0.03	A	0.0003	A	0.0003	A	20	G
Endosulfan I	PST	50	F	50	F	0.009	A	0.22	A	900	G
Dieldrin	PST	0.004	A	0.004	A	0.001	A(5)	0.001	A(5)	44	G
4,4'-DDE	PST	0.2	A	0.2	A	7×10^{-6}	A(6)	7×10^{-6}	A(6)	2,100	G
Endrin	PST	ND	A	0.2	A	0.002	A	0.002	A	100	G
Endosulfan II	PST	50	F	50	F	0.009	A	0.22	A	900	G
4,4'-DDD	PST	0.3	A	0.3	A	8×10^{-5}	A(6)	8×10^{-5}	A(6)	2,900	G
Endosulfan sulfate	PST	50	F	50	F					1,000	G
4,4'-DDT	PST	0.2	A	0.2	A	1×10^{-5}	A(6)	1×10^{-5}	A(6)	2,100	G
Methoxychlor	PST	35	A	35	A	0.03	A			10,000	G
Endrin ketone	PST	5	A	5	A						
Endrin aldehyde	PST	5	A	5	A						
alpha-Chlordane	PST	0.05	A	0.05	A	2×10^{-5}	A	2×10^{-5}	A	540	G
gamma-Chlordane	PST	0.05	A	0.05	A	2×10^{-5}	A	2×10^{-5}	A	540	G
Toxaphene	PST	0.06	A	0.06	A	0.005	A	1.6	A		G
2,4-D	HERB	50	A	50	A					500	G
2,4,5-TP (Silvex)	HERB	35	A							1900	G
Aroclor-1016	PCB	0.09	A(7)	0.09	A(7)	1×10^{-6}	A(7)	1×10^{-6}	A(7)	1,000/10,000	G(4)
Aroclor-1221	PCB	0.09	A(7)	0.09	A(7)	1×10^{-6}	A(7)	1×10^{-6}	A(7)	1,000/10,000	G(4)
Aroclor-1232	PCB	0.09	A(7)	0.09	A(7)	1×10^{-6}	A(7)	1×10^{-6}	A(7)	1,000/10,000	G(4)
Aroclor-1242	PCB	0.09	A(7)	0.09	A(7)	1×10^{-6}	A(7)	1×10^{-6}	A(7)	1,000/10,000	G(4)
Aroclor-1248	PCB	0.09	A(7)	0.09	A(7)	1×10^{-6}	A(7)	1×10^{-6}	A(7)	1,000/10,000	G(4)
Aroclor-1254	PCB	0.09	A(7)	0.09	A(7)	1×10^{-6}	A(7)	1×10^{-6}	A(7)	1,000/10,000	G(4)
Aroclor-1260	PCB	0.09	A(7)	0.09	A(7)	1×10^{-6}	A(7)	1×10^{-6}	A(7)	1,000/10,000	G(4)

TABLE 4-1

MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION
CHEMICAL-SPECIFIC ARARs/TBCs

PARAMETER	Class	Groundwater		Fresh Surface Water Class A Human		Fresh Surface Water Classes A,B,C Aquatic		Fresh Surface Water Class D		Soil	
		ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	ARAR Value (µg/l)	Source	TBC Value (mg/kg)	Source
Aluminum	MET	50 to 200	E			100	A			8,510	SB
Antimony	MET	3	A	3	A	1600	B			12.6	SB
Arsenic	MET	25	A	50	A	150	A	340	A	7.5	G
Barium	MET	1,000	A	1,000	A					300	G
Beryllium	MET	3	A	3	A	11	A(8)			0.74	SB
Cadmium	MET	5	A	5	A	CALC	A	CALC	A	1.3	SB
Calcium	MET									30,200	SB
Chromium	MET	50	A	50	A	CALC	A	CALC	A	19.5	SB
Chromium (hexavalent)	MET	50	A	11	A	11	A	16	A		
Cobalt	MET					5	A	110	A	30	G
Copper	MET	200	A	200	A	CALC	A	CALC	A	44.1	SB
Iron	MET	300	A(9)	300	A	300	A	300	A	36,700	SB
Lead	MET	15	E	15	E	CALC	A	CALC	A	79.4	SB
Magnesium	MET	35,000	A	35,000	A					3,340	SB
Manganese	MET	300	A(9)	300	A					474	SB
Mercury	MET	0.7	A	0.7	A	7 x 10^-4	A	7 x 10^-4	A	0.1	G
Nickel	MET	100	A	100	B	CALC	A	CALC	A	13	G
Potassium	MET									929	SB
Selenium	MET	10	A,E	10	A	4.6	A			2	G
Silver	MET	50	A	50	A	0.1	A	CALC	A	ND	SB
Sodium	MET	20,000	A							520	SB
Thallium	MET	0.5	A	0.5	A	8	A	20	A	ND	SB
Vanadium	MET					14	A	190	A	150	G
Zinc	MET	2,000	A	2,000	A	CALC	A	CALC	A	63.4	SB
Cyanide	MISC	200	A	200	A	5.2	A	22	A		

TABLE 4-1

MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION
CHEMICAL-SPECIFIC ARARs/TBCs

Parameter	Class	Groundwater		Fresh Surface Water Class A Human		Fresh Surface Water Classes A,B,C Aquatic		Fresh Surface Water Class D		Soil	
		ARAR Value (μg/l)	Source	ARAR Value (μg/l)	Source	ARAR Value (μg/l)	Source	ARAR Value (μg/l)	Source	TBC Value (ug/kg)	Source
Total Phenols	MISC	1	A	1	A	1	A(P)	1,5	A(CP,UP)		
Ammonia-Nitrogen	MISC	2,000	A	2,000	A	CALC	A	CALC	A		
Total Kjeldahl Nitrogen	MISC										
Bromide	MISC	2,000	A	2,000	A						
TOC	MISC										
Bicarbonate, as CaCO3	MISC										
BOD	MISC										
COD	MISC										
Hardness, as CaCO3	MISC										
Alkalinity, as CaCO3	MISC										
Acidity, as CaCO3	MISC										
NO3-N	MISC	10,000	A	10,000	A						
NO2-N	MISC	10,000	A	100/20	A(10)						
Phosphate	MISC										
Oil & Grease	MISC	None visible	C	None visible	A	None visible	A	None visible	A		
TSS	MISC										
TDS	MISC	<= 500,000	C	<= 500,000	C						
Sulfate	MISC	250,000	A	250,000	A						
Total Sulfide (as H2S)	MISC	50	A	50	A	2	A				
Chloride	MISC	250,000	A	250,000	A						
pH	MISC	6.5-8.5	C	6.5-8.5	C	6.5-8.5	C	6.5-9.5	C		
Dissolved Oxygen	MISC					>= 4000 >= 7000(T)	C	>= 3000	C		
Ethylene Glycol	MISC	50	A	50	A	500000	A	1000000	A		

TABLE 4-1

MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION
CHEMICAL-SPECIFIC ARARs/TBCs

NOTES:

(1) Applies to each isomer individually.
(2) Applies to the sum of cis- and trans-1,3-dichloropropene.
(3) Applies to the sum of all isomers.
(4) 1000 µg/kg applies to surface soils.
10,000 µg/kg applies to subsurface soils.
(5) Applies to the sum of aldrin and dieldrin.
(6) Applies to the sum of DDD, DDE, and DDT.
(7) Applies to total PCBs.
(8) Beryllium standard is 11 when hardness is 75 µg/L or less and 1,100 when hardness is greater than 75 µg/L.
(9) Standard for the sum of iron and manganese is 500 µg/L.
(10) 100 ppb for warm water fisheries: 20 ppb for cold water fisheries.

(P) Phenolic compound. Standard is for total phenols.
(CP) Phenolic compound. Standard is for total chlorinated phenols.
(UP) Phenolic compound. Standard is for total unchlorinated phenols.
(T) Trout stream requirement.
µg/l and µg/kg are equivalent to parts per billion (ppb).
mg/l and mg/kg are equivalent to parts per million (ppm).

SOURCES:

A - NYSDEC Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, TOGS 1.1.1, June 1998.
B - Clean Water Act Guidelines.
C - NYSDEC Water Quality Regulations 6NYCRR 703.
E - USEPA Drinking Water Standards 40 CFR 141.
F - Subpart 5-1, Public Water Systems, New York State Department of Health.
G - NYSDEC Soil Cleanup Objectives and Cleanup Levels, TAGM HWR-94-4046, January 1994 (Recommended Soil Cleanup Objective Values).
SB - Site background level from "Background Surface Soil & Groundwater Study for Plattsburgh Air Force Base" (URS 1996).

ABBREVIATIONS:

VOC - Volatile Organic Compound.
SVOC - Semivolatile Organic Compound.
PST - Pesticides.
HERB - Herbicides.
PCB - Polychlorinated biphenyls.
MET - Metals.
MISC - Miscellaneous.
CALC - Calculated values. See Table 4-2.
ND - Non-detectable.

TABLE 4-2
MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION CALCULATED SURFACE WATER ARARs FOR AQUATIC HEALTH CONCERNS

Sample ID		SW-13-01	SW-13-04	SW-13-07	SW-13-12
Surface Water Classification		Class D	Class D	Class D	Class D
Date Sampled		10/8/93	10/8/93	10/8/93	10/8/93
Analyte	Type				
Cadmium	MET	11.18	11.18	11.18	11.18
Chromium	MET	1238.26	1238.26	1238.26	1238.26
Lead	MET	267.89	267.89	267.89	267.89
Silver	MET	20.72	20.72	20.72	20.72
These standards are based upon the Hardness (mg/l) at SW-13-01	MISC	258	258	258	258

Notes:

All units are in ug/l (ppb) unless otherwise noted.
Metals standards apply to acid-soluble forms only.
Source: NYSDEC, 1998. TOGS 1.1.1.

Formulas:

Cadmium Standard = (0.85)exp(1.128[ln(ppm hardness)] - 3.6867)
Chromium Standard = (0.316)exp(0.819[ln(ppm hardness)] + 3.7256)
Lead Standard = (1.46203 - [ln(ppm hardness)(0.145712)])exp(1.273[ln(ppm hardness)] - 1.052)
Silver Standard = exp(1.72[ln(ppm hardness)] - 6.52)

TABLE 4-3
MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION
SEDIMENT QUALITY SCREENING CRITERIA

CONTAMINANT	LOG Kow	HUMAN HEALTH BIOACCUMULATION		BENTHIC AQUATIC LIFE ACUTE TOXICITY		BENTHIC AQUATIC LIFE CHRONIC TOXICITY		WILDLIFE BIOACCUMULATION	
		AWQS/GV (ug/l)	SEDIMENT CRITERIA (ug/g OC)	AWQS/GV (ug/l)	SEDIMENT CRITERIA (ug/g OC)	AWQS/GV (ug/l)	SEDIMENT CRITERIA (ug/g OC)	AWQS/GV (ug/l)	SEDIMENT CRITERIA (ug/g OC)
Methylene Chloride	-	-	-	-	-	-	-	-	-
Acetone	-	-	-	-	-	-	-	-	-
2-Butanone	-	-	-	-	-	-	-	-	-
Toluene	-	-	-	-	-	-	-	-	-
Naphthalene	-	-	-	-	-	-	-	-	-
Acenaphthene	4.33	-	-	-	-	-	140 (1)	-	-
Dibenzofuran	-	-	-	-	-	-	-	-	-
Diethylphthalate	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	-	-	-
Phenanthrene	4.45	-	-	-	-	-	120 (1)	-	-
Anthracene	-	-	-	-	-	-	-	-	-
Carbazole	-	-	-	-	-	-	-	-	-
Fluoranthene	5.19	-	-	-	-	-	1,020 (1)	-	-
Pyrene	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	6.04	0.0012	1.3	-	-	-	-	-	-
Chrysene	6.04	0.0012	1.3	-	-	-	-	-	-
Di-n-octylphthalate	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	6.04	0.0012	1.3	-	-	-	-	-	-
Benzo(k)fluoranthene	6.04	0.0012	1.3	-	-	-	-	-	-
Benzo(a)pyrene	6.04	0.0012	1.3	-	-	-	-	-	-
Benzo(g,h,i)fluoranthene	-	-	-	-	-	-	-	-	-
Aldrin & Dieldrin	5.0	0.001	0.1	-	-	-	-	0.0077	0.77
4,4'-DDE; 4,4'-DDD; 4,4'-DDT	6.0	1.00E-05	0.01	1.1 (2)	1100	0.001 (2)	1.0	0.001	1.0
Aroclor 1248 (PCB)	6.14	6.00E-07	0.0008	2.0	2760.8	0.014	19.3	0.001	1.4

Source: *Technical Guidance for Screening Contaminated Sediments*, NYSDEC, 1998.

Notes:
(1) EPA proposed Sediment Quality Criteria for protection of benthic organisms
(2) EPA Water Quality Criteria (1991)
AWQS/GV - Ambient Water Quality Standard/Guidance Value
Sediment Criteria = AWQS/GV x Kow x 0.001 (See also Note 1)
Log Kow values from NYSDEC (1998)

TABLE 4-4
MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION
SAMPLE SPECIFIC SEDIMENT TBC's

SAMPLE ID			SD-13-01	SD-13-02	SD-13-03	SD-13-04	SD-13-05	SD-13-06	SD-13-07	SD-13-08	SD-13-09	SD-13-10	SD-13-11	SD-13-12
TOC (g/kg)			3.36	5.8	37	36	4.3	41	38	12	20	7.8	6.0	2.0
PARAMETER	SEDIMENT CRITERIA (ug/g OC)		SAMPLE SPECIFIC TBC VALUES (ug/kg)											
Acenaphthene	140	(2)	470	812	5,180	5,040	602	5,740	5,320	1,680	2,800	1,092	840	280
Phenanthrene	120	(2)	403	696	4,440	4,320	516	4,920	4,560	1,440	2,400	936	720	240
Fluoranthene	1,020	(2)	3,427	5,916	37,740	36,720	4,386	41,820	38,760	12,240	20,400	7,956	6,120	2,040
Benzo(a)pyrene	1.3	(0)	4.4	7.5	48	47	5.6	53	49	16	26	10	7.8	2.6
Benzo(b)fluoranthene	1.3	(0)	4.4	7.5	48	47	5.6	53	49	16	26	10	7.8	2.6
Benzo(a)anthracene	1.3	(0)	4.4	7.5	48	47	5.6	53	49	16	26	10	7.8	2.6
Benzo(k)fluoranthene	1.3	(0)	4.4	7.5	48	47	5.6	53	49	16	26	10	7.8	2.6
Chrysene	1.3	(0)	4.4	7.5	48	47	5.6	53	49	16	26	10	7.8	2.6
Aldrin & Dieldrin (total)	0.1	(0)	0.34	0.58	3.7	3.6	0.43	4.1	3.8	1.2	2.0	0.78	0.6	0.20
	0.77	(3)	2.6	4.5	28	28	3.3	32	29	9.2	15	6.0	4.6	1.5
4,4'-DDE; 4,4'-DDD; 4,4'-DDT (total)	0.01	(0)	0.03	0.06	0.37	0.36	0.04	0.41	0.38	0.12	0.20	0.08	0.06	0.02
	1,100	(1)	3,696	6,380	40,700	39,600	4,730	45,100	41,800	13,200	22,000	8,580	6,600	2,200
	1.0	(2,3)	3.4	5.8	37	36	4.3	41	38	12	20	7.8	6.0	2.0
Aroclor 1248 (PCB)	0.0008	(0)	0.003	0.005	0.03	0.03	0.003	0.03	0.030	0.010	0.02	0.006	0.005	0.002
	2,760.8	(1)	9,276	16,013	102,150	99,389	11,871	113,193	104,910	33,130	55,216	21,534	16,565	5,522
	19.3	(2)	65	112	714	695	83	791	733	232	386	151	116	39
	1.4	(3)	4.7	8.1	52	50	6.0	57	53	17	28	11	8.4	2.8

Notes:

0 - Human Health Bioaccumulation TBC.
1 - Benthic Aquatic Life Acute Toxicity TBC.
2 - Benthic Aquatic Life Chronic Toxicity TBC.
3 - Wildlife Bioaccumulation TBC.
Sample Specific TBC = Sediment Criteria x Total Organic Carbon (TOC)
Sediment Criteria from Table 4-3.
All values in ug/kg (ppb) unless otherwise noted.

TABLE 4-5
MUNITIONS MAINTENANCE SQUADRON (SS-013) - SUPPLEMENTAL REMEDIAL INVESTIGATION
SEDIMENT CRITERIA FOR METALS

Analyte	Lowest Effect Level (ppm)	Severe Effect Level (ppm)
Antimony	2.0 (L)	25.0 (L)
Arsenic	6.0 (P)	33.0 (P)
Cadmium	0.6 (P)	9.0 (L)
Chromium	26.0 (P)	110.0 (P)
Copper	16.0 (P)	110.0 (P)
Iron	20,000 (P)	40,000 (P)
Lead	31.0 (P)	110.0 (L)
Manganese	460.0 (P)	1100.0 (L)
Mercury	0.15 (L)	1.3 (L)
Nickel	16.0 (P)	50.0 (L)
Silver	1.0 (L)	2.2 (L)
Zinc	120.0 (P,L)	270.0 (L)

Notes:

(L) Long and Morgan (1990).
(P) Persaud et al. (1992).
ppm (parts per million) is equivalent to mg/kg.

TABLE 5-1

MUNITIONS MAINTENANCE SQUADRON (SS-013)
REMEDIAL INVESTIGATION
DETECTED ANALYTES IN SURFACE SOIL SAMPLES (1993-1995)

ANALYTE	CLASS	*TBC VALUE	FREQUENCY OF DETECTIONS	DETECTED MINIMUM CONCENTRATION	DETECTED MAXIMUM CONCENTRATIONS	AVERAGE OF DETECTIONS	LOCATION OF MAXIMUM DETECTION
Methylene Chloride	VOC	100	2/22	46	53	49.5	SS-13-007
Acetone	VOC	200	2/22	40	44	42	SB-13-017-1
1,2-Dichloroethene (total)	VOC	300	1/22	1,300	1,300	1300.00	SB-13-017-1
2-Butanone	VOC	300	2/22	24	41	32.5	SB-13-017-1
Trichloroethene	VOC	700	1/22	25	25	25	SB-13-017-1
2-Hexanone	VOC	---	1/22	3	3**	3	SS-13-006
Toluene	VOC	1,500	3/22	4	24,000	9,101	SB-13-017-1
Ethylbenzene	VOC	5,500	1/22	97	97	97	SB-13-017-1
Xylene (total)	VOC	1,200	2/22	2	470	236	SB-13-017-1
Naphthalene	SVOC	13,000	1/22	120	120	120	SB-13-007
Acenaphthene	SVOC	50,000	3/22	24	1,100	488	SS-13-010
Dibenzofuran	SVOC	6,200	3/22	10	540	250	SS-13-010
Diethylphthalate	SVOC	7,100	1/22	3,400	3,400	3,400	SS-13-004
Fluorene	SVOC	50,000	3/22	24	1,200	551.3	SS-13-010
Phenanthrene	SVOC	50,000	8/22	45	9,500	1,679.6	SS-13-010
Anthracene	SVOC	50,000	4/22	28	2,400	815.5	SS-13-010
Carbazole	SVOC	---	3/22	26	1,100	542	SS-13-010
Di-n-butylphthalate	SVOC	8,100	3/22	26	57	45.6	SS-13-013
Fluoranthene	SVOC	50,000	9/22	42	10,000	1,645.2	SS-13-010
Pyrene	SVOC	50,000	9/22	45.0	7,700	1,277.0	SS-13-010
Butylbenzylphthalate	SVOC	50,000	2/22	45	45	45	SB-13-017-1
Benzo(a)anthracene	SVOC	224	6/22	36	3,700	875.5	SS-13-010
Chrysene	SVOC	400	9/22	41	3,800	672.8	SS-13-010
bis(2-Ethylhexyl)phthalate	SVOC	50,000	3/22	40	60	48	SB-13-016-1
Benzo(b)fluoranthene	SVOC	1,100	9/22	41	2,900	709.2	SS-13-010
Benzo(k)fluoranthene	SVOC	1,100	6/22	40	3,100	716.3	SS-13-010
Benzo(a)pyrene	SVOC	61	7/22	59	3,200	797.4	SS-13-010
Indeno(1,2,3-cd)pyrene	SVOC	3,200	5/22	52	1,900	626.8	SS-13-010
Dibenz(a,h)anthracene	SVOC	41	4/22	23	870	322.8	SS-13-010
Benzo(g,h,i)perylene	SVOC	50,000	4/22	64	810	356	SS-13-010
4,4'-DDE	PEST	2,100	2/4	5.5	5.5	5.5	SS-13-009
4,4'-DDD	PEST	2,900	2/4	0.80	4.6	2.7	SS-13-007
Endosulfan sulfate	PEST	1,000	2/4	2.0	5.2	3.6	SS-13-007
4,4'-DDT	PEST	2,100	3/4	3.4	4.0	3.7	SS-13-007
Methoxychlor	PEST	10	1/4	9.4	9.4	9.4	SS-13-007
alpha-Chlordane	PEST	540	1/4	0.55	0.55	0.55	SS-13-006
Aroclor-1254	PCB	1,000	1/4	17	17	17	SS-13-006

Results reported in ug/kg (ppb)
* TBC values from Table 4-1
--- - No TBC available
▨ - Exceeds TBC
** Maximum value obtained from duplicate sample

VOC - Volatile Organic Compound
SVOC - Semivolatile Organic Compound
PEST - Pesticide
PCB - Polychlorinated biphenyls

TABLE 5-1 (con't)

MUNITIONS MAINTENANCE SQUADRON (SS-013)
REMEDIAL INVESTIGATION
DETECTED ANALYTES IN SURFACE SOIL SAMPLES (1993-1995)

ANALYTE	CLASS	*TBC VALUE	FREQUENCY OF DETECTIONS	DETECTED MINIMUM CONCENTRATION	DETECTED MAXIMUM CONCENTRATIONS	AVERAGE OF DETECTIONS	LOCATION OF MAXIMUM DETECTION
Aluminum	MET	8,510	19/19	1,750	7,620	3,260	SS-13-019
Antimony	MET	12.6	1/19	10.5	10.5	10.5	SS-13-004
Arsenic	MET	7.5	22/22	0.32	2.3	1.20	SS-13-011
Barium	MET	300	2/22	4.6	53.9	18.2	SS-13-001
Beryllium	MET	0.74	18/19	0.13	0.44	0.25	SS-13-011
Cadmium	MET	1.3	6/22	0.44	1	0.57	SS-13-004
Calcium	MET	30,200	19/19	381	10,900	3,017	SS-13-011
Chromium	MET	19.5	22/22	1.8	12.4	6.09	SS-13-004
Cobalt	MET	30	19/19	0.89	5.3	2.05	SS-13-001
Copper	MET	44.1	18/19	1.6	15.4	7.09	SS-13-011
Iron	MET	36,700	19/19	3,860	10,900	6,245.3	SS-13-001
Lead	MET	79.4	22/22	0.85	66.6	15.3	SS-13-001
Magnesium	MET	3,340	19/19	497	3,520	1,272.7	SS-13-011
Manganese	MET	474	19/19	25	679	126.2	SS-13-001
Nickel	MET	13	19/19	2.2	8.1	4.4	SS-13-011
Potassium	MET	929	15/19	103	632	341.2	SS-13-002
Sodium	MET	520	13/19	20.3	76.2	38.8	SS-13-013
Thallium	MET	ND	1/19	0.22	0.22**	0.22	SS-13-006
Vanadium	MET	150	19/19	3.9	16.3	8.6	SS-13-001
Zinc	MET	63.4	19/19	7.0	43.8	24.2	SS-13-009
Cyanide	MET	---	1/19	3.5	3.5	3.5	SS-13-007

Results reported in mg/kg (ppm)
* TBC values from Table 4-1
Sample SS-13-019 is the background sample
--- - No TBC available
▨ - Exceeds TBC
** Maximum value obtained from duplicate sample

MET - Metals
ND - Not Detected

TABLE 5-2

MUNITIONS MAINTENANCE SQUADRON (SS-013)
REMEDIAL INVESTIGATION
DETECTED ANALYTES IN SUBSURFACE SOIL SAMPLES (1993)

ANALYTE	CLASS	*TBC VALUE	FREQUENCY OF DETECTIONS	DETECTED MINIMUM CONCENTRATION	DETECTED MAXIMUM CONCENTRATIONS	AVERAGE OF DETECTIONS	LOCATION OF MAXIMUM DETECTION
Vinyl Chloride	VOC	200	1/20	120	120	120	SB-13-003-2
Methylene Chloride	VOC	100	2/20	24	45	34.5	SB-13-004-3
Acetone	VOC	200	4/20	22	610	208.5	SB-13-001-2
1,2-Dichloroethene (total)	VOC	300	2/20	30	97	63.5	SB-13-003-5
2-Butanone	VOC	300	3/20	11	170	65.7	SB-13-001-2
Benzene	VOC	60	1/20	10	10	10	SB-13-001-2
Toluene	VOC	1,500	5/20	0.9	110	28.4	SB-13-001-2
Ethylbenzene	VOC	5,500	1/20	6	6	6	SB-13-006-2
Xylene (total)	VOC	1,200	4/20	3	47	19	SB-13-006-2
1,2-Dichlorobenzene	SVOC	7,900	1/20	23	23	23	SB-13-009-2
1,2,4-Trichlorobenzene	SVOC	3,400	1/20	12	12	12	SB-13-009-2
Naphthalene	SVOC	13,000	2/20	98	100	99	SB-13-010-4
2-Methylnaphthalene	SVOC	36,400	1/20	120	120**	120	SB-13-001-3
Acenaphthylene	SVOC	41,000	1/20	94	94**	94	SB-13-001-3
Acenaphthene	SVOC	50,000	3/20	37	830	318.3	SB-13-010-4
Dibenzofuran	SVOC	6,200	2/20	9	48	28.5	SB-13-001-3
Diethylphthalate	SVOC	7,100	10/20	9	54	29.5	SB-13-001-3
Fluorene	SVOC	50,000	3/20	32	1,400	530.1	SB-13-010-4
Phenanthrene	SVOC	50,000	6/20	27	8,700	1,633.5	SB-13-010-4
Anthracene	SVOC	50,000	4/20	74	2,900	813.5	SB-13-010-4
Carbazole	SVOC	---	2/20	49	1,000	524.5	SB-13-010-4
Fluoranthene	SVOC	50,000	8/20	6	11,000	1,819.9	SB-13-010-4
Pyrene	SVOC	50,000	8/20	5	11,000	1,819.8	SB-13-010-4
Butylbenzylphthalate	SVOC	50,000	3/20	10	80	37	SB-13-005-3
Benzo(a)anthracene	SVOC	224	4/20	160	4,500	1,585	SB-13-010-4
Chrysene	SVOC	400	5/20	130	4,500	1,304	SB-13-010-4
Benzo(b)fluoranthene	SVOC	1,100	4/20	130	3,400	1,225	SB-13-010-4
Benzo(k)fluoranthene	SVOC	1,100	4/20	120	3,900	1,415	SB-13-010-4
Benzo(a)pyrene	SVOC	61	4/20	120	4,100	1,485	SB-13-010-4
Indeno(1,2,3-cd)pyrene	SVOC	3,200	4/20	57	2,700	925	SB-13-010-4
Dibenz(a,h)anthracene	SVOC	41	1/20	450	450	450	SB-13-006-2
Benzo(g,h,i)perylene	SVOC	50,000	2/20	600	2,100	1,350	SB-13-010-2
Dieldrin	PEST	44	1/20	1.8	1.8	1.8	SB-13-010-4
4,4'-DDE	PEST	2,100	5/20	1.1	11	4.02	SB-13-008-4
4,4'-DDD	PEST	2,900	9/20	0.29	3.6	1.6	SB-13-006-2
Endosulfan sulfate	PEST	1,000	1/20	5.8	5.8	5.8	SB-13-006-4
4,4'-DDT	PEST	2,100	3/20	2.9	7.6	5.4	SB-13-008-4
Methoxychlor	PEST	10,000	2/20	0.89	5.3	3.1	SB-13-001-2
Endrin ketone	PEST	---	1/20	20	20	20	SB-13-001-3
alpha-Chlordane	PEST	540	1/20	0.3	0.3	0.3	SB-13-008-2

Results reported in ug/kg (ppb)
* TBC values from Table 4-1
--- - No TBC available
▨ - Exceeds TBC
** Maximum value obtained from duplicate sample

VOC - Volatile Organic Compound
SVOC - Semivolatile Organic Compound
PEST - Pesticide

TABLE 5-2 (con't)

MUNITIONS MAINTENANCE SQUADRON (SS-013)

REMEDIAL INVESTIGATION

DETECTED ANALYTES IN SUBSURFACE SOIL SAMPLES (1993)

ANALYTE	CLASS	*TBC VALUE	FREQUENCY OF DETECTIONS	DETECTED MINIMUM CONCENTRATION	DETECTED MAXIMUM CONCENTRATIONS	AVERAGE OF DETECTIONS	LOCATION OF MAXIMUM DETECTION
Aluminum	MET	8,510	20/20	1,080	15,500	4,839	SB-13-003-2
Antimony	MET	12.6	3/20	6.7	23.6	15.3	SB-13-001-3
Arsenic	MET	7.5	19/20	0.33	27.7	4.2	SB-13-008-2
Barium	MET	300	19/20	2.1	102**	23.6	SB-13-003-2
Beryllium	MET	0.74	3/20	0.28	0.62	0.40	SB-13-003-2
Cadmium	MET	1.3	1/20	0.47	0.47	0.47	SB-13-008-2
Calcium	MET	30,200	20/20	335	60,200	10,175	SB-13-008-4
Chromium	MET	19.5	20/20	1.7	128	17.1	SB-13-001-2
Cobalt	MET	30	16/20	0.61	9.2	2.8	SB-13-003-2
Copper	MET	44.1	14/20	1.7	43.1	12.5	SB-13-008-4
Iron	MET	36,700	20/20	1,180	25,900	6,923.5	SB-13-003-2
Lead	MET	79.4	19/20	0.49	1,370	82.8	SB-13-008-4
Magnesium	MET	3,340	20/20	218	9,740	2,032.3	SB-13-008-2
Manganese	MET	474	19/20	18.2	441	99.9	SB-13-008-4
Nickel	MET	13	12/20	2.1	20.8	7.6	SB-13-008-4
Potassium	MET	929	14/20	123	1,680	564.2	SB-13-008-4
Selenium	MET	2	3/20	1.2	5.6	2.7	SB-13-001-3
Sodium	MET	520	16/20	28.0	155	62.9	SB-13-008-4
Vanadium	MET	150	12/20	5.1	43.9	14.3	SB-13-003-2
Zinc	MET	63.4	20/20	1.5	116	20.2	SB-13-008-4

Results reported in mg/kg (ppm)

MET - Metals

* TBC values from Table 4-1

--- - No TBC available

▨ - Exceeds TBC

** Maximum value obtained from duplicate sample

TABLE 5-3

MUNITIONS MAINTENANCE SQUADRON (SS-013)

SITE INVESTIGATION

DETECTED ANALYTES IN SURFACE WATER AND SEDIMENT SAMPLES

SAMPLE ID	SW -1	SD -1
MEDIUM	SURFACE WATER	SEDIMENT
DATE SAMPLED	11/17/87	11/17/87
ANALYTE		
Chloroform*		2.6 J
Methylene Chloride*	---	30 B
Acetone*		10 JB
Trichloroethene*	1 J	---
bis(2-Ethylhexyl)phthalate*	---	68 J
Aluminum**	31 [ ]	3,260
Arsenic**	---	5.3 N
Barium**	17 [ ]	52 [ ]
Calcium**	68,300	7,260
Chromium**	---	6.7 E
Copper**	---	6.8 [ ]
Iron**	982	28,400 *
Lead**	---	6
Magnesium**	22,800 E	1,830 [ ]E
Manganese**	542	3770 N
Potassium**	4,570 [ ]	---
Sodium**	22,000 E	422 [ ]
Thallium**	1.1 [ ]	1.1 [ ]
Vanadium**	5 [ ]	12 [ ]E
Zinc**	18 [ ]E	57

* - Results reported in ug/l (ppb) for surface water and in ug/kg (ppb) for sediment.
** - Results reported in ug/l (ppb) for surface water and in mg/kg (ppm) for sediment.
B - Indicates analyte was detected in both the sample and the associated method blank.
J - Indicates an estimated concentration because QC criteria were not met.
E - The reported concentration is estimated because of the presence of an interference.
N - Spiked sample recovery not within control limits.
* - Duplicate analysis not within control limits.
--- - Compound analyzed but not detected.
[ ] - Concentration reported is below CRQL.
Source: E.C. Jordan, 1989

TABLE 5-4

MUNITIONS MAINTENANCE SQUADRON (SS-013)

DRAINAGE FLOW STUDY

SURFACE WATER SAMPLE ANALYTICAL RESULTS

SITE I.D.	DETECTION LIMIT	ROUND	1Q	2	3	4Q	5	6	7	8Q	9	10	11	12Q
		DATE SAMPLED	10/31/89	12/06/89	12/27/89	02/06/90	02/27/90	03/29/90	05/09/90	06/05/90	06/27/90	08/07/90	08/28/90	10/11/90
		ANALYTE												
		VOC (ug/l)												
SW-13-015	5	1,2-Dichloroethene (Total)	-	5	-	-	-	-	-	-	-	-	-	-
SW-13-016	5	1,2-Dichloroethene (Total)	6	NS	NS	11	NA	NA	NA	NA	NA	NA	NA	NA
	5	Trichloroethene	-	NS	NS	5	NA	NA	NA	NA	NA	NA	NA	NA
SW-13-017	5	1,2-Dichloroethene (Total)	NA	NA	NA	NA	110	90	21	41	38	31	26	44
	5	Trichloroethene	NA	NA	NA	NA	55	44	14	24	16	16	13	20
SW-13-018	5	1,2-Dichloroethene (Total)	NA	NA	NA	NA	-	-	-	-	8	-	5	11
	5	Trichloroethene	NA	NA	NA	NA	-	-	-	-	5	-	-	9
		SVOC (ug/l)												
SW-13-017	2	Phenol	NA	NA	NA	NA	3	-	-	-	-	-	-	-
		TICs (ug/l)												
SW-13-019	2*	Dimethylethylphenol Isomer	NS	NS	NS	NS	NS	NS	NS	-	-	-	-	17J
		HARDNESS (mg/l)												
SW-13-015	1		240	250	260	230	180	250	212	300	250	220	230	240
SW-13-016	1		270	NS	NS	240	NS	NS	NS	NS	NS	NS	NS	NS
SW-13-017	1		NS	NS	NS	NS	190	270	254	270	270	250	230	280
SW-13-018	1		NS	NS	NS	NS	150	110	145	140	160	180	180	160
SW-13-019	1		220	NS	NS	250	NS	NS	NS	280	NS	NS	NS	340
SW-13-020	1		410	NS	NS	390	NS	NS	NS	270	NS	NS	NS	310
SW-13-021	1		240	NS	NS	250	NS	NS	NS	300	NS	NS	NS	510
		GLYCOL (ug/l)												
SW-13-015	75		NS	NS	NS	NS	NS	NS	NS	NS	NS	190	NS	280

NS = Not sampled
NA = Not applicable
\- = Not detected
J = Value below detection limit
* An approximation based on a response factor of 1
Q = Used to denote a quarterly sampling event.
ug/l is equivalent to ppb
mg/l is equivalent to ppm
Source: ABB Environmental Services, 1991

TABLE 5-5

MUNITIONS MAINTENANCE SQUADRON (SS-013)
REMEDIAL INVESTIGATION
DETECTED ANALYTES IN SURFACE WATER SAMPLES (1993)

ANALYTE	ARAR VALUE	FREQUENCY OF DETECTIONS	DETECTED MINIMUM CONCENTRATION	DETECTED MAXIMUM CONCENTRATION	AVERAGE OF DETECTIONS	LOCATION OF MAXIMUM DETECTION
1,2-Dichloroethene (total)	-	2/12	4	4	4	SW-13-002
Trichloroethene	40[0]	3/12	2	4	3	SW-13-002
Xylene (total)	-	2/12	4	7	5.5	SW-13-006
bis(2-Ethylhexyl)phthalate	-	2/12	4	12	8	SW-13-001
Barium	-	4/4	19.2	34.8	24.2	SW-13-007
Chromium	1238.26[1]	1/4	10.6	10.6**	10.6	SW-13-012
Silver	20.72[1]	2/4	2	2.5	2.3	SW-13-001

Results reported in ug/l (ppb)

** Maximum value obtained from duplicate sample

[0] - ARAR value from Table 4-1

[1] - ARAR value from Table 4-2

(-) No ARAR available

TABLE 5-6

MUNITIONS MAINTENANCE SQUADRON (SS-013)

REMEDIAL INVESTIGATION

DETECTED ANALYTES IN SEDIMENT SAMPLES (1993-1995)

ANALYTE	FREQUENCY OF DETECTION	DETECTED MINIMUM CONCENTRATION	DETECTED MAXIMUM CONCENTRATION	AVERAGE OF DETECTIONS	LOCATION OF MAXIMUM DETECTION
Methylene Chloride	5/12	2	8	5	SD-13-006
Acetone	10/12	10	60	26.7	SD-13-009
2-Butanone	4/12	7	18	11.5	SD-13-009
Toluene	1/12	2	2	2	SD-13-009
Naphthalene	1/12	17	17	17	SD-13-005
Acenaphthene	1/12	20	20	20	SD-13-005
Dibenzofuran	1/12	10	10	10	SD-13-005
Diethylphthalate	2/12	20	24	22	SD-13-007
Fluorene	1/12	17	17	17	SD-13-005
Phenanthrene	6/12	13	180	53.7	SD-13-005
Anthracene	1/12	18	18	18	SD-13-005
Carbazole	1/12	87	87	87	SD-13-005
Fluoranthene	8/12	19	200	70.9	SD-13-005
Pyrene	8/12	12	140	69.5	SD-13-008
Benzo(a)anthracene	3/12	28	66	49.3	SD-13-007
Chrysene	5/12	14	75	39.8	SD-13-005
Di-n-octylphthalate	3/12	21	41	31.7	SD-13-006
Benzo(b)fluoranthene	2/12	34	72	53	SD-13-005
Benzo(k)fluoranthene	1/12	50	50	50	SD-13-005
Benzo(a)pyrene	2/12	52	56	54	SD-13-005
Benzo(g,h,i)perylene	1/12	93	93	93	SD-13-011
Aldrin	2/4	0.85	3.2	2.0	SD-13-007
4,4'-DDE	2/4	0.29	2.3	1.3	SD-13-004
4,4'-DDD	1/4	0.85	0.85	0.85	SD-13-007
Aroclor- 1248	1/4	53	53	53	SD-13-007

Results reported in ug/kg (ppb)

▨ - One or more detections of this compound exceeded a sample specific TBC value.

TABLE 5-6 (con't)

MUNITIONS MAINTENANCE SQUADRON (SS-013)
REMEDIAL INVESTIGATION
DETECTED ANALYTES IN SEDIMENT SAMPLES (1993-1995)

ANALYTE	FREQUENCY OF DETECTION	DETECTED MINIMUM CONCENTRATION	DETECTED MAXIMUM CONCENTRATION	AVERAGE OF DETECTIONS	LOCATION OF MAXIMUM DETECTION
Aluminum	4/4	1,590	3,480	2,355	SD-13-007
Antimony	1/4	4.6	4.6**	4.6	SD-12-012
Arsenic*	4/4	0.37	5.4	2.3	SD-13-004
Barium*	4/4	6.8	68.3	28.8	SD-13-004
Cadmium*	1/4	0.75	0.75	0.75	SD-13-004
Calcium	4/4	872	4,990	2,788	SD-13-007
Chromium*	4/4	3.6	7.2	5.4	SD-13-007
Cobalt	4/4	0.84	3.2	1.9	SD-13-004
Copper	1/4	2.4	2.4	2.4	SD-13-007
Iron	4/4	3,700	41,100	14,400	SD-13-004
Lead*	4/4	1.1	5.0	2.5	SD-13-007
Magnesium	4/4	509	1,390	925.5	SD-13-007
Manganese	4/4	83.2	2,570	785.3	SD-13-004
Nickel	1/4	2.0	2.0**	2.0	SD-13-012
Potassium	1/4	218	218	218	SD-13-007
Sodium	4/4	25.5	275	148.6	SD-13-004
Vanadium	3/4	5.7	11.6	8	SD-13-007
Zinc	4/4	8.2	51.7	25.4	SD-13-004

Results reported in mg/kg (ppm) unless otherwise noted

▨ - Exceeds either Lowest or Severe Effect Level.

* RCRA metals

** Maximum value obtained from duplicate sample.

TABLE 5 - 7

ANALYTES DETECTED IN WEAPON STORAGE AREA DRAINAGE SURFACE WATER SAMPLES

		SW-MNA-6 (monitoring point is upstream from SS-013)														
DETECTED ANALYTE	CLASS D CRITERIA*	Feb 1998	April 1998	May 1998	July 1998	Sept 1998	Dec 1998	Mar 1999	June 1999	Sept 1999	Dec 1999	Mar 2000	June 2000	Sept 2000	Dec 2000	Model Prediction**
Benzene	10	0.63	ND	ND	ND	0.28	0.60	0.4	ND	ND	0.5	0.6	0.2	0.3	0.5	---
Trichloroethene	40	69	42	48	24	40	84	84	15	13	74	51	32	19	49	30 - 50
1,2-Dichloroethene (total)	NS	63	30	39	22	35	49	44	11	10	51	45	22	28	130	60 - 90
1,1-Dichloroethene	NS	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND	0.1	ND	ND	0.1	---
Vinyl Chloride	NS	3.9	0.76	1.2	1.2	2.8	11	2.0	0.20	0.2	2.0	0.8	0.6	0.4	1.4	---

		SW-MNA-8 (monitoring point is downstream from SS-013)														
DETECTED ANALYTE	CLASS D CRITERIA*	Feb 1998	April 1998	May 1998	July 1998	Sept 1998	Dec 1998	Mar 1999	June 1999	Sept 1999	Dec 1999	Mar 2000	June 2000	Sept 2000	Dec 2000	Model Prediction**
Benzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---
Trichloroethene	40	5.3	1.8	1.7	2.4	1.8	5.0	4.0	0.30	0.9	3.0	3.0	2.0	2.0	2.4	ND to 5
1,2-Dichloroethene (total)	NS	4.2	1.0	0.95	1.9	1.3	2.0	2.0	0.20	0.6	2.0	2.0	2.0	1.0	6.4	ND to 5
1,1-Dichloroethene	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---
Vinyl Chloride	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---

All values are in reported in micrograms per liter.

NS = No standard listed in TOGS 1.1.1
ND = Not Detected
--- = Concentration not predicted by model

* Source is NYSDEC *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations,TOGS 1.1.1*, Table 1 - Class D Standards H(WS), June 1998.

** Model predictions are from the *Fire Training Area (FT-002) / Industrial Area Groundwater Operable Unit Remedial Investigation / Feasibility Study* report (URS 2000).

TABLE 5-8

MUNITIONS MAINTENANCE SQUADRON (SS-013)
SITE INVESTIGATION
DETECTED ANALYTES IN GROUNDWATER SAMPLES

MONITORING WELL ID	MW-13-001	MW-13-002	MW-13-003	MW-13-004	MW-13-005
DATE SAMPLED	12/09/87	12/09/87	12/09/87	12/09/87	12-09-87
ANALYTE					
Methylene Chloride	---	---	1.7 J	6.3	---
2-Butanone	---	---	59	170	---
Xylene (total)	---	---	---	---	3.1 J
bis(2-Ethylhexyl)phthalate	NR	NR	NR	NR	3.8 J
Aluminum	---	33 [ ]	---	122 [ ]	729
Arsenic	4.2 [ ]	4 [ ]	---	2.2 [ ]	5.7 [ ]
Barium	18 [ ]	6.3 [ ]	5.2 [ ]E	7.9 [ ]E	24 [ ]
Beryllium	---	---	---	3.6 [ ]	---
Cadmium	---	---	---	5.9	---
Calcium	41,200	29,300	46,500	23,700	18,300
Chromium	---	---	7.2 [ ]	11	---
Cobalt	5.1 [ ]E	---	---	---	5.4 [ ]E
Copper	---	---	---	32	17 [ ]
Iron	18,400	28 [ ]	9.3 [ ]	121	926
Lead	---	---	3.2 [ ]	3.5 [ ]	8.2
Magnesium	13,000 E	9,690 E	13,400 E	7,540 E	6,140 E
Manganese	3,110	21	5.5 [ ]	95	85
Potassium	---	---	4,040 [ ]	6,840	3,330 [ ]
Selenium	---	---	1.8 [ ]	1.7 [ ]	---
Sodium	1,730 [ ]E	3,630 E	4,190 [ ]	7,350	30,300 E
Vanadium	1.2 [ ]	1.2 [ ]	7.4 [ ]	14 [ ]	7.5 [ ]
Zinc	7 [ ]E	11 [ ]E	13 [ ]	14 [ ]	36 E
Petroleum Hydrocarbons (mg/l)	---	---	---	---	NR

Results reported in ug/l (ppb) unless otherwise specified.

J - The value was estimated because it was below the Contract Required Detection Limit (CRDL) or quality assurance criteria were not met during analysis.

E -The reported value was estimated because of interference.

[ ] - Reported value is less than the CRDL.

NR - Analysis not requested.

Source: E.C. Jordan, 1989.

TABLE 5-9

MUNITIONS MAINTENANCE SQUADRON (SS-013)
REMEDIAL INVESTIGATION
DETECTED ANALYTES IN GROUNDWATER SAMPLES

ANALYTE	CLASS	*ARAR VALUE (ug/l)	ROUND - 1 FREQUENCY OF DETECTION	ROUND - 1 DETECTED MINIMUM CONCENTRATION (ug/l)	ROUND - 1 DETECTED MAXIMUM CONCENTRATION (ug/l)	ROUND - 1 AVERAGE OF DETECTION (ug/l)	ROUND - 1 LOCATION OF MAXIMUM DETECTION	ROUND - 2 FREQUENCY OF DETECTION	ROUND - 2 DETECTED MINIMUM CONCENTRATION (ug/l)	ROUND - 2 DETECTED MAXIMUM CONCENTRATION (ug/l)	ROUND - 2 AVERAGE OF DETECTION (ug/l)	ROUND - 2 LOCATION OF MAXIMUM DETECTION
Chloromethane	VOC	5	3/5	6	9	7.3	MW-13-008	4/5	1.4	5.2	2.8	MW-13-004
Vinyl Chloride	VOC	2	1/5	53	53	53	---	1/5	27	27	27	MW-13-008
Acetone	VOC	50	ND	---	---	---	---	2/5	6.8	19	12.9	MW-13-007
1,2- Dichloroethene (total)	VOC	5	ND	---	---	---	MW-13-008	1/5	1	1	1	MW-13-008
1,2- Dichloroethane	VOC	0.6	3/5	3	4	3.3	MW-13-008	4/6	2.1	3.6	2.65	MW-13-004
Toluene	VOC	5	1/5	6	5	6	MW-13-008	1/5	6	6	6	MW-13-008
Ethylbenzene	VOC	5	1/5	23	23	23	MW-13-008	1/5	9	9	9	MW-13-008
Styrene	VOC	5	1/5	2	2	2	MW-13-008	1/5	1	1	1	MW-13-008
Xylene (total)	VOC	5	1/5	21	21	21	MW-13-008	1/5	17	17	17	MW-13-008
2,4-Dimethylphenol	SVOC	1	---	---	---	---	---	1/5	430	430	430	MW-13-008
Naphthalene	SVOC	10	2/5	5	2,700	1,352.5	MW-13-008	1/5	860	860	860	MW-13-008
2-Methylnaphthalene	SVOC	50	1/5	330	330	330	MW-13-008	1/5	72	72	72	MW-13-008
Acenaphthylene	SVOC	50	---	---	---	---	---	1/5	2	2	2	MW-13-008
Acenaphthene	SVOC	20	1/5	120	120	120	MW-13-008	1/5	77	77	77	MW-13-008
Dibenzofuran	SVOC	50	1/5	33	33	33	MW-13-008	1/5	32	32	32	MW-13-008
Fluorene	SVOC	50	1/5	22	22	22	MW-13-008	1/5	22	22	22	MW-13-008
Phenanthrene	SVOC	50	---	---	---	---	---	1/5	5	5	5	MW-13-008
Carbazole	SVOC	50	1/5	53	53	53	MW-13-008	1/5	39	39	39	MW-13-008
Arsenic (Unfiltered)	MET	25	3/5	19.5	25.8	21.8	MW-13-006	3/5	7.3	15.5	11.1	MW-13-006
Barium (Unfiltered)	MET	1,000	3/5	200	307	251	MW-13-008	4/5	8	192	102.3	MW-13-008
Cadmium (Unfiltered)	MET	5	---	---	---	---	---	2/5	2.4	2.8	2.6	MW-13-008
Chromium (Unfiltered)	MET	50	4/5	4.5	57.7	42.7	MW-13-006	3/5	16.8	44.5	31.5	MW-13-006
Lead (Unfiltered)	MET	15	5/5	1.4	34	15	MW-13-006	3/5	7.1	22.7	13.7	MW-13-006
Mercury (Unfiltered)	MET	0.7	1/5	0.25	0.25	0.25	MW-13-004	---	---	---	---	---
Selenium (Unfiltered)	MET	10	1/5	1.7	1.7	1.7	MW-13-006	---	---	---	---	---
Arsenic (Filtered)	MET	25	2/5	2.1	6.3**	4.2	MW-13-007	2/5	3.4	5.4	4.4	MW-13-007
Barium (Filtered)	MET	1,000	3/5	24.5	169	74	MW-13-008	4/5	17.9	53.3	30.5	MW-13-008
Cadmium (Filtered)	MET	5	---	---	---	---	---	3/5	2.6	6.9	4.8	MW-13-007
Chromium (Filtered)	MET	50	---	---	---	---	---	1/5	4.5	4.5	4.5	MW-13-004
Selenium (Filtered)	MET	10	1/5	1.4	1.4	1.4	MW-13-001,007	---	---	---	---	---

* ARAR value from Table 4-1

▨ - Exceeds ARAR

ND - Not Detected

** Maximum value obtained from duplicate sample.

VOC - Volatile Organic Compound

SVOC - Semivolatile Organic Compound

MET - Metals

ug/l is equivalent to (ppb)

TABLE 5-9 (cont.)

MUNITIONS MAINTENANCE SQUADRON (SS-013)
REMEDIAL INVESTIGATION
DETECTED ANALYTES IN GROUNDWATER SAMPLES

ANALYTE	CLASS	*ARAR VALUE (ug/l)	ROUND - 3				
			FREQUENCY OF DETECTION	DETECTED MINIMUM CONCENTRATION (ug/l)	DETECTED MAXIMUM CONCENTRATION (ug/l)	AVERAGE OF DETECTION (ug/l)	LOCATION OF MAXIMUM DETECTION
Vinyl Chloride	VOC	2	1/21	38	38	38	MW-13-008
1,2- Dichloroethene (total)	VOC	5	8/21	0.3	4.0	1.3	MW-02-044
Chloroform	VOC	7	1/21	0.2	0.2	0.2	MW-13-011
Trichloroethene	VOC	5	5/21	0.6	83	21.2	MW-02-044
Benzene	VOC	1	2/21	0.5	4.1	2.3	MW-13-008
Tetrachloroethene	VOC	5	1/21	0.3	0.3	0.3	MW-02-044
Toluene	VOC	5	1/21	4.7	4.7	4.7	MW-13-008
Chlorobenzene	VOC	5	1/21	1.5	1.5	1.5	MW-23-001
Ethylbenzene	VOC	5	1/21	4.4	4.4	4.4	MW-13-008
Styrene	VOC	5	1/21	1.0	1.0	1.0	MW-13-008
Xylene (total)	VOC	5	1/21	15.0	15.0	15.0	MW-13-008

* ARAR value drom Table 4-1.
▨ - Exceeds ARAR
VOC - Volatile Organic Compound
ug/l is equivalent to (ppb).

TABLE 5-10
PLATTSBURGH AFB - SS-013
2000 SUPPLEMENTAL REMEDIAL INVESTIGATION
DETECTED GROUNDWATER SAMPLE ANALYTICAL RESULTS

Location ID			MW-13-001	MW-13-002	MW-13-003	MW-13-004	MW-13-006
Sample ID			MW-13-001	MW-13-002	MW-13-003	MW-13-004	MW-13-006
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/19/00	12/19/00	12/21/00	12/19/00	12/20/00
Parameter	**Units**	**Criteria***					
Volatile Organic Compounds							
Vinyl chloride	UG/L	2					
Methylene chloride	UG/L	5			0.12		
Acetone	UG/L	50	R	R	R	R	R
1,1-Dichloroethane	UG/L	5					
1,2-Dichloroethene (cis)	UG/L	5		0.20			
1,2-Dichloroethane	UG/L	0.6					
Trichloroethene	UG/L	5	3.18	9.39			
Toluene	UG/L	5					
Ethylbenzene	UG/L	5					
m&p-Xylene	UG/L	5					
Semivolatile Organic Compounds							
2,4-Dimethylphenol	UG/L	50					
Naphthalene	UG/L	10					
2-Methylnaphthalene	UG/L	-					
Acenaphthylene	UG/L	50					
Acenaphthene	UG/L	20					
Dibenzofuran	UG/L	50					
Fluorene	UG/L	50					
Phenanthrene	UG/L	50					
Carbazole	UG/L	50					
bis(2-Ethylhexyl)phthalate	UG/L	5			3.24	1.41	1.58

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, Revised April 2000, Class GA.

⬭ Concentration Exceeds Criteria.

R - Rejected Value
NA - Not Analyzed

Only Detected Results Reported.

TABLE 5-10
PLATTSBURGH AFB - SS-013
2000 SUPPLEMENTAL REMEDIAL INVESTIGATION
DETECTED GROUNDWATER SAMPLE ANALYTICAL RESULTS

Location ID			MW-13-001	MW-13-002	MW-13-003	MW-13-004	MW-13-006
Sample ID			MW-13-001	MW-13-002	MW-13-003	MW-13-004	MW-13-006
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/19/00	12/19/00	12/21/00	12/19/00	12/20/00
Parameter	**Units**	**Criteria***					
Total Metals							
Aluminum	UG/L	-	NA	NA	1400	620	2880
Arsenic	UG/L	25	NA	NA			3.0
Barium	UG/L	1000	NA	NA	10.8	16.7	19.7
Beryllium	UG/L	3	NA	NA	0.23	0.23	0.32
Calcium	UG/L	-	NA	NA	42370	17840	43260
Chromium	UG/L	50	NA	NA	4.0	3.0	9.0
Cobalt	UG/L	-	NA	NA	1.1		2.3
Copper	UG/L	200	NA	NA	2.0	1.0	3.0
Iron	UG/L	300	NA	NA	1835	1259	5242
Lead	UG/L	25	NA	NA	1.7		3.4
Magnesium	UG/L	35000	NA	NA	11330	6581	12210
Manganese	UG/L	300	NA	NA	82.5	492.7	189.3
Nickel	UG/L	100	NA	NA			2.8
Potassium	UG/L	-	NA	NA	2101	868	3373
Sodium	UG/L	20000	NA	NA	1480	3340	1760
Thallium	UG/L	0.5	NA	NA			
Vanadium	UG/L	-	NA	NA	3.0	3.0	7.0
Zinc	UG/L	2000	NA	NA	9.1	2.4	12.8
Filtered Metals							
Aluminum	UG/L	-	NA	NA	430	250	280
Arsenic	UG/L	25	NA	NA			
Barium	UG/L	1000	NA	NA	5.9	7.7	6.8

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, Revised April 2000, Class GA.

⬭ Concentration Exceeds Criteria.

R - Rejected Value
NA - Not Analyzed

Only Detected Results Reported.

TABLE 5-10
PLATTSBURGH AFB - SS-013
2000 SUPPLEMENTAL REMEDIAL INVESTIGATION
DETECTED GROUNDWATER SAMPLE ANALYTICAL RESULTS

Location ID			MW-13-001	MW-13-002	MW-13-003	MW-13-004	MW-13-006
Sample ID			MW-13-001	MW-13-002	MW-13-003	MW-13-004	MW-13-006
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/19/00	12/19/00	12/21/00	12/19/00	12/20/00
Parameter	Units	Criteria*					
Filtered Metals							
Beryllium	UG/L	3	NA	NA	0.41	0.10	0.24
Cadmium	UG/L	5	NA	NA	0.4		
Calcium	UG/L	-	NA	NA	40370	18360	42830
Chromium	UG/L	50	NA	NA	3.0	2.0	3.0
Copper	UG/L	200	NA	NA	1.0	2.0	3.0
Iron	UG/L	300	NA	NA	479	432	445
Magnesium	UG/L	35000	NA	NA	10660	6716	11380
Manganese	UG/L	300	NA	NA	16.1	193.8	15.5
Potassium	UG/L	-	NA	NA	1822	849	2568
Sodium	UG/L	20000	NA	NA	1430	3540	1760
Vanadium	UG/L	-	NA	NA	1.0	2.0	
Zinc	UG/L	2000	NA	NA	4.4	6.0	3.8

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, Revised April 2000, Class GA.

⬭ Concentration Exceeds Criteria.

R - Rejected Value
NA - Not Analyzed

Only Detected Results Reported.

TABLE 5-10
PLATTSBURGH AFB - SS-013
2000 SUPPLEMENTAL REMEDIAL INVESTIGATION
DETECTED GROUNDWATER SAMPLE ANALYTICAL RESULTS

Location ID			**MW-13-007**	**MW-13-008**	**MW-13-009**	**MW-13-010**	**MW-13-011**
Sample ID			MW-13-007	MW-13-008	MW-13-009	MW-13-010	MW-13-011
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/20/00	07/13/00	12/20/00	12/21/00	12/21/00
Parameter	**Units**	**Criteria***					
Volatile Organic Compounds							
Vinyl chloride	UG/L	2		21.75			
Methylene chloride	UG/L	5		8.19			
Acetone	UG/L	50	R		R	R	R
1,1-Dichloroethane	UG/L	5			0.45		
1,2-Dichloroethene (cis)	UG/L	5					
1,2-Dichloroethane	UG/L	0.6			1.23		
Trichloroethene	UG/L	5					
Toluene	UG/L	5		5.63			
Ethylbenzene	UG/L	5		19.74			
m&p-Xylene	UG/L	5		8.68			
Semivolatile Organic Compounds							
2,4-Dimethylphenol	UG/L	50		209.69			
Naphthalene	UG/L	10		4528.57			
2-Methylnaphthalene	UG/L	-		475.51			
Acenaphthylene	UG/L	50		2.12			
Acenaphthene	UG/L	20		172.45			
Dibenzofuran	UG/L	50		63.73			
Fluorene	UG/L	50		40.68			
Phenanthrene	UG/L	50		9.69			
Carbazole	UG/L	50		75.78			
bis(2-Ethylhexyl)phthalate	UG/L	5				1.11	

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, Revised April 2000, Class GA.

⬭ Concentration Exceeds Criteria.

R - Rejected Value
NA - Not Analyzed

Only Detected Results Reported.

TABLE 5-10
PLATTSBURGH AFB - SS-013
2000 SUPPLEMENTAL REMEDIAL INVESTIGATION
DETECTED GROUNDWATER SAMPLE ANALYTICAL RESULTS

Location ID			MW-13-007	MW-13-008	MW-13-009	MW-13-010	MW-13-011
Sample ID			MW-13-007	MW-13-008	MW-13-009	MW-13-010	MW-13-011
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/20/00	07/13/00	12/20/00	12/21/00	12/21/00
Parameter	**Units**	**Criteria***					
Total Metals							
Aluminum	UG/L	-	1390	NA	NA	NA	NA
Arsenic	UG/L	25	6.0	NA	NA	NA	NA
Barium	UG/L	1000	41.1	NA	NA	NA	NA
Beryllium	UG/L	3	0.22	NA	NA	NA	NA
Calcium	UG/L	-	24660	NA	NA	NA	NA
Chromium	UG/L	50	4.0	NA	NA	NA	NA
Cobalt	UG/L	-	1.5	NA	NA	NA	NA
Copper	UG/L	200	3.0	NA	NA	NA	NA
Iron	UG/L	300	2050	NA	NA	NA	NA
Lead	UG/L	25	2.3	NA	NA	NA	NA
Magnesium	UG/L	35000	8434	NA	NA	NA	NA
Manganese	UG/L	300	156.6	NA	NA	NA	NA
Nickel	UG/L	100	1.2	NA	NA	NA	NA
Potassium	UG/L	-	8402	NA	NA	NA	NA
Sodium	UG/L	20000	31140	NA	NA	NA	NA
Thallium	UG/L	0.5		NA	NA	NA	NA
Vanadium	UG/L	-	3.0	NA	NA	NA	NA
Zinc	UG/L	2000	13.6	NA	NA	NA	NA
Filtered Metals							
Aluminum	UG/L	-	500	NA	NA	NA	NA
Arsenic	UG/L	25	6.0	NA	NA	NA	NA
Barium	UG/L	1000	34.7	NA	NA	NA	NA

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, Revised April 2000, Class GA.

⬭ Concentration Exceeds Criteria.

R - Rejected Value
NA - Not Analyzed

Only Detected Results Reported.

TABLE 5-10
PLATTSBURGH AFB - SS-013
2000 SUPPLEMENTAL REMEDIAL INVESTIGATION
DETECTED GROUNDWATER SAMPLE ANALYTICAL RESULTS

Location ID			MW-13-007	MW-13-008	MW-13-009	MW-13-010	MW-13-011
Sample ID			MW-13-007	MW-13-008	MW-13-009	MW-13-010	MW-13-011
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/20/00	07/13/00	12/20/00	12/21/00	12/21/00
Parameter	**Units**	**Criteria***					
Filtered Metals							
Beryllium	UG/L	3	0.26	NA	NA	NA	NA
Cadmium	UG/L	5		NA	NA	NA	NA
Calcium	UG/L	-	24640	NA	NA	NA	NA
Chromium	UG/L	50	3.0	NA	NA	NA	NA
Copper	UG/L	200	1.0	NA	NA	NA	NA
Iron	UG/L	300	795	NA	NA	NA	NA
Magnesium	UG/L	35000	8384	NA	NA	NA	NA
Manganese	UG/L	300	142.8	NA	NA	NA	NA
Potassium	UG/L	-	8274	NA	NA	NA	NA
Sodium	UG/L	20000	28540	NA	NA	NA	NA
Vanadium	UG/L	-	2.0	NA	NA	NA	NA
Zinc	UG/L	2000	4.8	NA	NA	NA	NA

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, Revised April 2000, Class GA.

⬭ Concentration Exceeds Criteria.

R - Rejected Value
NA - Not Analyzed

Only Detected Results Reported.

TABLE 5-10
PLATTSBURGH AFB - SS-013
2000 SUPPLEMENTAL REMEDIAL INVESTIGATION
DETECTED GROUNDWATER SAMPLE ANALYTICAL RESULTS

Location ID			MW-13-011	MW-13-012	MW-13-013	MW-13-014	MW-13-015
Sample ID			MW-13-011 DUP	MW-13-012	MW-13-013	MW-13-014	MW-13-015
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/21/00	07/13/00	12/14/00	12/14/00	12/14/00
Parameter	Units	Criteria*	Field Duplicate (1-1)				
Volatile Organic Compounds							
Vinyl chloride	UG/L	2					
Methylene chloride	UG/L	5		0.28			
Acetone	UG/L	50	R	2.00	3.55	1.62	1.99
1,1-Dichloroethane	UG/L	5					
1,2-Dichloroethene (cis)	UG/L	5					
1,2-Dichloroethane	UG/L	0.6					
Trichloroethene	UG/L	5					
Toluene	UG/L	5					
Ethylbenzene	UG/L	5					
m&p-Xylene	UG/L	5					
Semivolatile Organic Compounds							
2,4-Dimethylphenol	UG/L	50					
Naphthalene	UG/L	10					
2-Methylnaphthalene	UG/L	-					
Acenaphthylene	UG/L	50					
Acenaphthene	UG/L	20					
Dibenzofuran	UG/L	50					
Fluorene	UG/L	50					
Phenanthrene	UG/L	50					
Carbazole	UG/L	50					
bis(2-Ethylhexyl)phthalate	UG/L	5	1.27			1.75	

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, Revised April 2000, Class GA.

⬭ Concentration Exceeds Criteria.

R - Rejected Value
NA - Not Analyzed

Only Detected Results Reported.

TABLE 5-10
PLATTSBURGH AFB - SS-013
2000 SUPPLEMENTAL REMEDIAL INVESTIGATION
DETECTED GROUNDWATER SAMPLE ANALYTICAL RESULTS

Location ID			MW-13-011	MW-13-012	MW-13-013	MW-13-014	MW-13-015
Sample ID			MW-13-011 DUP	MW-13-012	MW-13-013	MW-13-014	MW-13-015
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/21/00	07/13/00	12/14/00	12/14/00	12/14/00
Parameter	Units	Criteria*	Field Duplicate (1-1)				
Total Metals							
Aluminum	UG/L	-	NA	NA	24210	2320	2230
Arsenic	UG/L	25	NA	NA	10.0		2.0
Barium	UG/L	1000	NA	NA	232.2	34.2	27.7
Beryllium	UG/L	3	NA	NA	1.28	0.28	0.27
Calcium	UG/L	-	NA	NA	47520	68600	63810
Chromium	UG/L	50	NA	NA	40.0	7.0	7.0
Cobalt	UG/L	-	NA	NA	12.1	1.6	1.3
Copper	UG/L	200	NA	NA	26.0	2.0	2.0
Iron	UG/L	300	NA	NA	32681	2238	2542
Lead	UG/L	25	NA	NA	12.0	2.1	1.9
Magnesium	UG/L	35000	NA	NA	24160	21180	23080
Manganese	UG/L	300	NA	NA	602.3	55.6	131.7
Nickel	UG/L	100	NA	NA	26.7		1.8
Potassium	UG/L	-	NA	NA	9772	2525	2062
Sodium	UG/L	20000	NA	NA	20100	3490	3180
Thallium	UG/L	0.5	NA	NA	4.0		
Vanadium	UG/L	-	NA	NA	50.0	4.0	5.0
Zinc	UG/L	2000	NA	NA	76.7	6.9	6.0
Filtered Metals							
Aluminum	UG/L	-	NA	NA	140.0	50.0	40.0
Arsenic	UG/L	25	NA	NA	4.0		
Barium	UG/L	1000	NA	NA	29.6	16.0	10.9

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, Revised April 2000, Class GA.

⬭ Concentration Exceeds Criteria.

R - Rejected Value
NA - Not Analyzed

Only Detected Results Reported.

TABLE 5-10
PLATTSBURGH AFB - SS-013
2000 SUPPLEMENTAL REMEDIAL INVESTIGATION
DETECTED GROUNDWATER SAMPLE ANALYTICAL RESULTS

Location ID			MW-13-011	MW-13-012	MW-13-013	MW-13-014	MW-13-015
Sample ID			MW-13-011 DUP	MW-13-012	MW-13-013	MW-13-014	MW-13-015
Matrix			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)			-	-	-	-	-
Date Sampled			12/21/00	07/13/00	12/14/00	12/14/00	12/14/00
Parameter	**Units**	**Criteria***	Field Duplicate (1-1)				
Filtered Metals							
Beryllium	UG/L	3	NA	NA	0.16	0.27	0.18
Cadmium	UG/L	5	NA	NA			
Calcium	UG/L	-	NA	NA	30920	67010	63300
Chromium	UG/L	50	NA	NA	3.0	4.0	5.0
Copper	UG/L	200	NA	NA	1.0	1.0	1.0
Iron	UG/L	300	NA	NA	117	59.0	108.0
Magnesium	UG/L	35000	NA	NA	10710	20010	22330
Manganese	UG/L	300	NA	NA	170.6	26.4	107.1
Potassium	UG/L	-	NA	NA	2359	1749	1333
Sodium	UG/L	20000	NA	NA	16970	3260	3070
Vanadium	UG/L	-	NA	NA	2.0		1.0
Zinc	UG/L	2000	NA	NA	2.8	10.6	5.0

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, Revised April 2000, Class GA.

⬭ Concentration Exceeds Criteria.

R - Rejected Value
NA - Not Analyzed

Only Detected Results Reported.

TABLE 6-1
MUNITIONS MAINTENANCE SQUADRON (SS-013)
SOIL SAMPLE LOCATIONS USED IN HRA

LOCATION	DEPTH INTERVAL	DATE SAMPLED
EX3578SS	1-1	10/3/1996
SB-13-001	2-3	11/4/1993
	2.5-3	11/4/1993
	3-4	11/4/1993
	3.5-4	11/4/1993
SB-13-002	2-2.5	11/4/1993
	2-3	11/4/1993
	3-4	11/4/1993
	3.5-4	11/4/1993
SB-13-004	1.5-2	9/7/1993
	3-4	11/5/1993
	3.5-4	11/5/1993
SB-13-005	1.5-2	9/7/1993
	3-4	11/8/1993
	3.5-4	11/8/1993
SB-13-006	2-4	11/9/1993
	2.5-3	11/9/1993
	4-6	11/9/1993
	5.5-6	11/9/1993
SB-13-007	1.5-2	9/21/1993
	3-5	11/3/1993
	3.5-4	11/3/1993
	5-5.5	11/3/1993
	5-6	11/3/1993
SB-13-008	2-4 *	11/9/1993
	3.5-4	11/9/1993
	4-4.5	11/9/1993
	4-6	11/9/1993
SB-13-009	1.5-2	9/22/1993
	2-4	11/10/1993
	3.5-4	11/10/1993
SB-13-010	2-2.5	11/3/1993
	2-4	11/3/1993
	4-4.5	11/3/1993
	4-6	11/3/1993
SB-13-011	1.5-2	9/22/1993
SB-13-016	1-2	9/20/1995
Field Replicate	1-2	9/20/1995
SS-13-001	0-0.5	9/7/1993
	1.5-2	9/7/1993
SS-13-002	0-0.5	9/7/1993
	1.5-2	9/7/1993
SS-13-003	0-0.5	9/7/1993
	1.5-2	9/7/1993
SS-13-004	0-0.5	9/7/1993
	1.5-2	9/7/1993

TABLE 6-1
MUNITIONS MAINTENANCE SQUADRON (SS-013)
SOIL SAMPLE LOCATIONS USED IN HRA

LOCATION	DEPTH INTERVAL	DATE SAMPLED
SS-13-005	0-0.5	9/7/1993
	1.5-2	9/7/1993
SS-13-006	0-0.5	9/21/1993
Field Replicate	0-0.5	9/21/1993
	1.5-2	9/21/1993
Field Replicate	1.5-2	9/21/1993
SS-13-007	0-0.5	9/21/1993
	1.5-2	9/21/1993
SS-13-008	0-0.5	9/21/1993
	1.5-2	9/21/1993
SS-13-009	0-0.5	9/21/1993
	1.5-2	9/21/1993
	0-0.5	10/19/93
SS-13-010	0-0.5	9/21/1993
	1.5-2	9/21/1993
SS-13-011	0-0.5	9/21/1993
	1.5-2	9/21/1993
SS-13-013	0-0.5	9/21/1993
	1.5-2	9/21/1993
SS-13-014	0-0.5	9/22/1993
	1.5-2	9/22/1993
SS-13-015	0-0.5	9/22/1993
	1.5-2	9/22/1993
SS-13-016	0-0.5	9/22/1993
	1.5-2	9/22/1993
SS-13-017	0-0.5	9/22/1993
	1.5-2	9/22/1993
SS-13-018	0-0.5	9/22/1993
	1.5-2	9/22/1993
SS013-025	1-1	11/20/2000
SS013-026	1-1	11/20/2000
SS013-027	1-1	11/20/2000
SS013-028	1-1	11/20/2000
SS013-028B	1-1	12/12/2000
SS013-029	1-1	11/20/2000
SS013-030	1-1	11/20/2000
SS013-031	1-1	11/20/2000
SS013-032	1-1	11/20/2000
SS013-033	1-1	11/20/2000
SS013-034	1-1	11/20/2000
SS013-035	1-1	11/20/2000
SS013-036	1-1	11/20/2000
SS013-037	1-1	11/20/2000
SS013-038	1-1	11/20/2000
SS013-039	1-1	11/20/2000
SS13-B-1	0-0	11/3/1997

TABLE 6-1
MUNITIONS MAINTENANCE SQUADRON (SS-013)
SOIL SAMPLE LOCATIONS USED IN HRA

LOCATION	DEPTH INTERVAL	DATE SAMPLED
SS13-E-1	0-0	11/3/1997
SS13-N-1	0-0	11/3/1997
SS13-S-1	0-0	11/3/1997
SS13-W-1	0-0	11/3/1997
SS13B-001A	0-0	05/08/01
SS13B-002	1-1	12/11/2000
SS13B-003	1-1	12/11/2000
SS13B-004	1-1	12/11/2000
SS13B-005	1-1	12/11/2000
SS13B-006	1-1	12/11/2000
SS13B-007	1-1	12/11/2000
SS13B-008	1-1	12/11/2000
SS13B-009	1-1	12/11/2000
SS13B-010	1-1	12/11/2000
SS13B-011	1-1	12/11/2000

Note:
* Two samples were collected from the same depth, at different times of the same date, for different parameters

TABLE 6-2
MUNITIONS MAINTENANCE SQUADRON (SS-013)
GROUNDWATER SAMPLE LOCATIONS USED IN HRA

LOCATION	DATE SAMPLED
MW-13-001	12/19/2000
MW-13-002	12/19/2000
MW-13-003	12/21/2000
MW-13-004	12/19/2000
MW-13-006	12/20/2000
MW-13-007	12/20/2000
MW-13-008	7/13/2000
MW-13-009	12/20/2000
MW-13-010	12/21/2000
MW-13-011	12/21/2000
Field Duplicate	12/21/2000
MW-13-012	7/13/2000
MW-13-013	12/14/2000
MW-13-014	12/14/2000
MW-13-015	12/14/2000

TABLE 6 - 3
MUNITIONS MAINTENANCE SQUADRON (SS-013)
EXPOSURE PARAMETERS - RESIDENTIAL USE

PARAMETER	UNITS	SYMBOL	ADULT RESIDENT		CHILD RESIDENT	
			VALUE	SOURCE	VALUE	SOURCE
1. ALL PATHWAYS (SOIL AND GROUNDWATER)						
Chemical Concentration in Soil	mg/kg	CS	chemical-specific	Appendix L	chemical-specific	Appendix L
Chemical Concentration in Groundwater	mg/l	CW	chemical-specific	Appendix L	chemical-specific	Appendix L
Chemical Concentration in Air	mg/m^3	CA	chemical-specific	Appendix M	chemical-specific	Appendix M
Exposure Frequency	days/year or events/year	EF	350	USEPA 1991	350	USEPA 1991
Exposure Duration	years	ED	24	USEPA 1991	6	USEPA 1991
Body Weight	kg	BW	70	USEPA 1991	15	USEPA 1991
Averaging Time - noncarcinogenic	days	Atn	8760	USEPA 1991	2190	USEPA 1991
Averaging Time - carcinogenic	days	Atc	25550	USEPA 1989	25550	USEPA 1989
Conversion Factor	kg/mg	CF	1.00E-06	USEPA 1989	1.00E-06	USEPA 1989
Volumetric Conversion Factor	$liter/cm^3$	CF	1.00E-03	USEPA 1989	1.00E-03	USEPA 1989
2. PATHWAY - SPECIFIC						
INGESTION OF SOIL						
Fraction Ingested from Contaminated Source	-	FI	1	USEPA 1989	1	USEPA 1989
Ingestion Rate-soil	mg soil/day	IR	100	USEPA 1991	200	USEPA 1991
INGESTION OF GROUNDWATER						
Ingestion Rate-water	liters/day	IRw	2	USEPA 1991	2	USEPA 1991
DERMAL CONTACT WITH SOIL						
Skin Surface Area Available for Contact (It includes arms, hands and legs)	cm^2/event	SA	7948	USEPA 2000	3520	USEPA 2000
Soil to Skin Adherence Factor	mg/cm^2	AF	1	USEPA 1992	1	USEPA 1992
Absorption Factor	-	ABS	chemical-specific	USEPA 1999	chemical-specific	USEPA 1999
DERMAL CONTACT WITH GROUNDWATER						
Skin Surface Area Available for Contact (It includes total body surface area)	cm^2	SA	18150	USEPA 2000	7213	USEPA 2000
Exposure Time (It includes time for one bath per day)	hours/event	ET	0.33	USEPA 2000	0.33	USEPA 2000
Dermal Permeability Constant	cm/hour	PC	chemical-specific	USEPA 1992	chemical-specific	USEPA 1992
INHALATION OF INDOOR AIR (SOIL AND GROUNDWATER)						
Inhalation Rate	m^3/day	IR	15	USEPA 1991	15	USEPA 1991

EQUATIONS - SOIL:

Ingestion: $\text{Intake} = (CS \times IR \times CF \times FI \times EF \times ED) / (BW \times AT)$

Dermal Contact: $\text{Absorbed Dose} = (CS \times CF \times SA \times AF \times ABS \times EF \times ED) / (BW \times AT)$

Inhalation: $\text{Intake} = (CA \times IR \times EF \times ED) / (BW \times AT)$

EQUATIONS - GROUNDWATER:

Ingestion: $\text{Intake} = (CW \times IR \times EF \times ED) / (BW \times AT)$

Dermal Contact: $\text{Absorbed Dose} = (CW \times SA \times PC \times ET \times EF \times ED \times CF) / (BW \times AT)$

Inhalation: $\text{Intake} = (CA \times IR \times EF \times ED) / (BW \times AT)$

USEPA 1989: *Risk Assessment Guidance for Superfund, Vol I:Environmental Evaluation Manual*, EPA/540/1-89/001. Washington, DC.USEPA

USEPA 1991: *Standard Default Exposure Factors.Human Health Evaluation Manual, Supplemental Guidance*, OSWER Directive 9285.6-03. Cincinnati, OH.USEPA

USEPA 1992: Dermal *Exposure Assessment: Principles and Applications*, EPA/600/8-91/011B. Washington, DC.USEPA

USEPA 1999: Telephone conversation between M. Maddaloni of USEPA Region II and D. Papademetriou of URS regarding Dermal *Absorption Values. April.*

USEPA 2000: *Exposure Factors Handbook*, EPA/600/P-95/002Fa; http://www.epa.gov/ncea/exposfac. USEPA

TABLE 6-4

MUNITIONS MAINTENANCE SQUADRON (SS-013)

SUMMARY OF RISKS

EXPOSURE PATHWAY	CANCER RISK	HAZARD INDEX
SOIL		
Ingestion of Soil	2.14E-05	1.58E-01
Dermal Contact with Soil	7.46E-05	1.47E-01
Inhalation of Soil Vapors in Indoor Air	1.31E-05	1.55E-01
TOTAL EXPOSURE CANCER RISK - SOIL	**1.09E-04**	-
TOTAL EXPOSURE HAZARD INDEX - SOIL	-	**4.60E-01**
GROUNDWATER		
Ingestion of Groundwater	3.84E-04	3.79E+01
Dermal Contact with Groundwater	2.31E-06	3.45E+00
Inhalation of Groundwater Vapors in Indoor Air	8.36E-05	8.79E+00
TOTAL EXPOSURE CANCER RISK - GROUNDWATER	**4.70E-04**	-
TOTAL EXPOSURE HAZARD INDEX - GROUNDWATER	-	**5.01E+01**
TOTAL EXPOSURE CANCER RISK	**5.79E-04**	-
TOTAL EXPOSURE HAZARD INDEX	-	**5.06E+01**

NOTES-

- Soil consists of surface and subsurface soil combined.

TABLE 6 - 5
MUNITIONS MAINTENANCE SQUADRON (SS-013)
SUMMARY OF CARCINOGENIC RISKS FROM SOIL
FUTURE USE - RESIDENTIAL

PARAMETER	RISK TO RESIDENTIAL RECEPTORS					
	INGESTION		DERMAL CONTACT		INHALATION	
	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD
Vinyl chloride	1.32E-09	3.07E-09	NV	NV	5.21E-06	6.08E-06
Methylene chloride	3.63E-11	8.46E-11	NV	NV	9.75E-08	1.14E-07
Trichloroethene	2.58E-11	6.03E-11	NV	NV	6.76E-08	7.89E-08
Benzene	1.59E-10	3.71E-10	NV	NV	6.84E-07	7.98E-07
Naphthalene	NV	NV	NV	NV	NV	NV
N-Nitrosodiphenylamine	9.04E-10	2.11E-09	7.19E-09	3.71E-09	NV	NV
Carbazole	3.36E-09	7.85E-09	2.67E-08	1.38E-08	NV	NV
Butylbenzylphthalate	NV	NV	NV	NV	NV	NV
Benzo(a)anthracene	2.00E-07	4.66E-07	2.07E-06	1.07E-06	NV	NV
Chrysene	1.93E-09	4.51E-09	1.99E-08	1.03E-08	NV	NV
bis(2-Ethylhexyl)phthalate	3.42E-10	7.98E-10	2.72E-09	1.40E-09	NV	NV
Benzo(b)fluoranthene	1.93E-07	4.51E-07	2.00E-06	1.03E-06	NV	NV
Benzo(k)fluoranthene	1.74E-08	4.06E-08	1.80E-07	9.29E-08	NV	NV
Benzo(a)pyrene	2.08E-06	4.85E-06	2.15E-05	1.11E-05	NV	NV
Indeno(1,2,3-cd)pyrene	1.87E-07	4.35E-07	1.93E-06	9.96E-07	NV	NV
Dibenz(a,h)anthracene	1.57E-06	3.67E-06	1.62E-05	8.39E-06	NV	NV
Dieldrin	1.35E-08	3.16E-08	1.08E-07	5.55E-08	1.21E-11	1.41E-11
4,4'-DDE	6.41E-10	1.50E-09	5.10E-09	2.63E-09	NV	NV
4,4'-DDD	4.89E-10	1.14E-09	3.89E-09	2.01E-09	NV	NV
4,4'-DDT	6.96E-10	1.62E-09	1.66E-09	8.57E-10	2.80E-12	3.26E-12
Arsenic	2.14E-06	4.99E-06	5.10E-06	2.63E-06	NV	NV
TOTAL CANCER RISK	**6.41E-06**	**1.50E-05**	**4.92E-05**	**2.54E-05**	**6.06E-06**	**7.07E-06**

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TABLE 6 - 6
MUNITIONS MAINTENANCE SQUADRON (SS-013)
SUMMARY OF NONCARCINOGENIC RISKS FROM SOIL
FUTURE USE - RESIDENTIAL

PARAMETER	RISK TO RESIDENTIAL RECEPTORS					
	INGESTION		DERMAL CONTACT		INHALATION	
	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD
Vinyl chloride	9.13E-07	8.52E-06	NV	NV	1.72E-02	8.05E-02
Methylene chloride	2.35E-07	2.19E-06	NV	NV	2.07E-04	9.68E-04
Acetone	3.54E-07	3.31E-06	NV	NV	NV	NV
Methyl ethyl ketone (2-Butanone)	2.36E-08	2.20E-07	NV	NV	5.46E-06	2.55E-05
Trichloroethene	1.14E-06	1.07E-05	NV	NV	NV	NV
Benzene	NV	NV	NV	NV	NV	NV
Toluene	5.93E-06	5.54E-05	NV	NV	3.32E-04	1.55E-03
Ethylbenzene	1.00E-07	9.36E-07	NV	NV	5.91E-05	2.76E-04
Xylene (total)	6.90E-09	6.44E-08	NV	NV	NV	NV
o-Xylene	2.43E-09	2.27E-08	NV	NV	NV	NV
m&p-Xylene	8.79E-09	8.21E-08	NV	NV	NV	NV
1,1,2-Trichloro-1,2,2-trifluoroethane	1.23E-09	1.15E-08	NV	NV	5.92E-05	2.76E-04
1,2-Dichlorobenzene	3.50E-07	3.27E-06	2.78E-06	5.75E-06	2.61E-04	1.22E-04
1,2,4-Trichlorobenzene	1.64E-06	1.53E-05	1.31E-05	2.70E-05	2.43E-05	1.14E-05
Naphthalene	2.76E-05	2.58E-04	2.85E-04	5.90E-04	9.31E-03	4.35E-02
Isopropylbenzene (Cumene)	1.29E-07	1.21E-06	NV	NV	1.40E-05	2.90E-04
2-Methylnaphthalene	4.81E-05	4.49E-04	3.82E-04	7.90E-04	NV	NV
Acenaphthene	8.19E-06	7.65E-05	8.47E-05	1.75E-04	NV	NV
Diethylphthalate	1.02E-06	9.50E-06	8.09E-06	1.67E-05	NV	NV
Fluorene	1.67E-05	1.56E-04	1.72E-04	3.56E-04	NV	NV
N-Nitrosodiphenylamine	NV	NV	NV	NV	NV	NV
Phenanthrene	4.51E-05	4.21E-04	4.66E-04	9.62E-04	NV	NV
Anthracene	2.27E-06	2.12E-05	2.35E-05	4.85E-05	NV	NV
Carbazole	NV	NV	NV	NV	NV	NV
Di-n-butylphthalate	7.81E-07	7.29E-06	6.21E-06	1.28E-05	NV	NV
Fluoranthene	3.25E-05	3.03E-04	3.36E-04	6.94E-04	NV	NV
Pyrene	3.43E-05	3.20E-04	3.54E-04	7.32E-04	NV	NV
Butylbenzylphthalate	5.48E-07	5.11E-06	4.36E-06	9.00E-06	NV	NV
Benzo(a)anthracene	NV	NV	NV	NV	NV	NV
Chrysene	NV	NV	NV	NV	NV	NV
bis(2-Ethylhexyl)phthalate	3.56E-06	3.32E-05	2.83E-05	5.85E-05	NV	NV
Benzo(b)fluoranthene	NV	NV	NV	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	NV	NV	NV	NV
Benzo(a)pyrene	NV	NV	NV	NV	NV	NV

TABLE 6 - 6
MUNITIONS MAINTENANCE SQUADRON (SS-013)
SUMMARY OF NONCARCINOGENIC RISKS FROM SOIL
FUTURE USE - RESIDENTIAL

PARAMETER	RISK TO RESIDENTIAL RECEPTORS					
	INGESTION		DERMAL CONTACT		INHALATION	
	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD
Indeno(1,2,3-cd)pyrene	NV	NV	NV	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	NV	NV	NV	NV
Benzo(g,h,i)perylene	2.24E-05	2.09E-04	2.32E-04	4.79E-04	NV	NV
Dieldrin	4.93E-05	4.60E-04	3.92E-04	8.10E-04	NV	NV
4,4'-DDE	NV	NV	NV	NV	NV	NV
4,4'-DDD	NV	NV	NV	NV	NV	NV
4,4'-DDT	1.19E-05	1.11E-04	2.85E-05	5.88E-05	NV	NV
alpha-Chlordane	1.45E-06	1.36E-05	1.15E-05	2.39E-05	NV	NV
Methoxychlor	2.58E-06	2.40E-05	2.05E-05	4.23E-05	NV	NV
Aroclor 1254	1.00E-03	1.00E-02	1.20E-02	2.50E-02	NV	NV
Arsenic	1.40E-02	1.29E-01	3.30E-02	6.80E-02	NV	NV
Selenium	1.37E-04	1.00E-03	NV	NV	NV	NV
Cyanide	9.05E-07	8.45E-06	NV	NV	NV	NV

TOTAL HAZARD INDEX	**1.55E-02**	**1.43E-01**	**4.79E-02**	**9.89E-02**	**2.75E-02**	**1.27E-01**

TABLE 6 - 7
MUNITIONS MAINTENANCE SQUADRON (SS-013)
SUMMARY OF CARCINOGENIC RISKS FROM GROUNDWATER
FUTURE USE - RESIDENTIAL

PARAMETER	RISK TO RESIDENTIAL RECEPTORS					
	INGESTION		DERMAL CONTACT		INHALATION	
	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD
Vinyl chloride	3.34E-05	3.90E-05	7.30E-07	3.39E-07	3.85E-05	4.49E-05
Methylene chloride	1.15E-07	1.34E-07	1.55E-09	7.18E-10	1.76E-09	2.06E-09
1,1-Dichloroethane	NV	NV	NV	NV	NV	NV
1,2-Dichloroethane	2.90E-07	3.38E-07	4.60E-09	2.13E-09	1.42E-08	1.65E-08
Trichloroethene	9.70E-07	1.13E-06	4.65E-08	2.16E-08	9.28E-08	1.08E-07
Naphthalene	NV	NV	NV	NV	NV	NV
Carbazole	1.32E-06	1.54E-06	3.60E-07	1.67E-07	NV	NV
bis(2-Ethylhexyl)phthalate	1.89E-07	2.20E-07	1.30E-08	6.02E-09	NV	NV
Arsenic	1.41E-04	1.64E-04	4.22E-07	1.96E-07	NV	NV
Beryllium	NV	NV	NV	NV	NV	NV
TOTAL CANCER RISK	**1.77E-04**	**2.07E-04**	**1.58E-06**	**7.31E-07**	**3.86E-05**	**4.50E-05**

J:\35721.01\ss013_ing_der_gw.xls\RISK_GW
1/13/03\2:44 PM

TABLE 6 - 8

MUNITIONS MAINTENANCE SQUADRON (SS-013)

SUMMARY OF NONCARCINOGENIC RISKS FROM GROUNDWATER

FUTURE USE - RESIDENTIAL

PARAMETER	RISK TO RESIDENTIAL RECEPTORS					
	INGESTION		DERMAL CONTACT		INHALATION	
	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD
Vinyl chloride	2.32E-02	1.08E-01	5.07E-04	9.40E-04	1.27E-01	5.94E-01
Methylene chloride	7.45E-04	3.48E-03	1.00E-05	1.86E-05	3.75E-06	1.75E-05
Acetone	8.99E-04	4.19E-04	1.53E-06	2.84E-07	NV	NV
1,1-Dichloroethane	3.89E-05	1.82E-05	1.04E-06	1.92E-07	2.31E-06	1.08E-06
1,2-Dichloroethene (cis)	5.48E-04	2.56E-04	1.64E-05	3.04E-06	NV	NV
1,2-Dichloroethane	NV	NV	NV	NV	NV	NV
Trichloroethene	4.29E-02	2.00E-01	2.05E-03	3.81E-03	NV	NV
Toluene	6.58E-05	3.07E-05	8.86E-06	1.64E-06	1.52E-05	7.08E-05
Ethylbenzene	7.30E-04	3.41E-03	1.62E-04	3.00E-04	3.37E-05	1.57E-04
m&p Xylene	9.96E-06	4.65E-05	2.39E-06	4.42E-06	NV	NV
Naphthalene	5.46E+00	2.55E+01	1.13E+00	2.09E+00	1.42E+00	6.64E+00
2,4-Dimethylphenol	3.00E-02	1.40E-02	9.89E-03	1.83E-03	NV	NV
2-Methylnaphthalene	1.35E-01	6.32E-01	6.08E-02	1.13E-01	NV	NV
Acenaphthylene	NV	NV	NV	NV	NV	NV
Acenaphthene	9.59E-03	4.48E-03	7.18E-03	1.33E-03	NV	NV
Dibenzofuran	NV	NV	NV	NV	NV	NV
Fluorene	2.38E-03	1.11E-03	1.78E-03	3.31E-04	NV	NV
Phenanthrene	7.03E-04	3.28E-03	5.69E-04	1.05E-03	NV	NV
Carbazole	NV	NV	NV	NV	NV	NV
bis(2-Ethylhexyl)phthalate	1.96E-03	9.17E-03	1.35E-04	2.51E-04	NV	NV
Arsenic	9.13E-01	4.26E+00	2.73E-03	5.07E-03	NV	NV
Barium	8.87E-02	4.14E-01	3.80E-03	7.04E-03	NV	NV
Beryllium	1.07E-02	2.00E-02	4.58E-03	3.40E-03	NV	NV
Thallium	NV	NV	NV	NV	NV	NV

TOTAL HAZARD INDEX	**6.72E+00**	**3.12E+01**	**1.22E+00**	**2.23E+00**	**1.55E+00**	**7.24E+00**

TABLE 6-9

POTENTIAL SOURCES OF UNCERTAINTY

Potential Source	Direction of Effect	Reasons for Uncertainty
Data Evaluation:		
Identification of Chemicals of Potential Concern: Analytical Data	Unknown	Soil and groundwater data were collected from various locations. Samples may not be representative of the entire site.
Background Data	Unknown	The validity of the comparison of onsite data to background data is limited by the number of background samples. However, the background sample population used in this HRA characterizes actual background better than most remedial investigations.
Groundwater Metals Data	Overestimate risk	Groundwater total metal results were used as opposed to filtered metals data. Groundwater used for drinking water would likely be better represented by filtered data.
Exposure Assessment:		
Likelihood of exposure pathways	Overestimate	Pathways may not actually occur. The site's most likely reuse is for industrial development. Site risks may have been overestimated since future receptors were assumed to be site residents, not industrial workers.
Inhalation of particulates and fugitive dust	Unknown/Underestimate risk	Developed sites are covered with buildings, roads, and/or grass, thereby minimizing the likelihood for exposure to site particulates and fugitive dust.
Lack of consideration of transformation of chemicals	Unknown	Risk estimates are based on recent chemical observations, which may change over time.
Exposure assumptions (frequency, duration, and intensity)	Overestimate risk	Parameters are conservative estimates of exposure.
Exposure time (ET)	Risk/Overestimate	Residents are assumed to bath daily instead of showering, which would last a shorter time period.
Absorption of soil contaminants through skin	Overestimate risk	Dermal absorption is a function of the length of actual skin contact, which may be limited at the site.

TABLE 6-9 (Continued)

Potential Source	Direction of Effect	Reasons for Uncertainty
Dermal absorption not calculated for all chemicals	Underestimate risk	Dermal absorption factors are available for certain chemicals only that were detected in site soils. Risk from remaining chemicals could not be quantified.
Dermal absorption – soil to skin adherence factor (AF) not adjusted.	Overestimate risk	A more conservative value of AF, equal to one (1) was selected in the risk assessment. The risk from dermal absorption may have been overestimated.
Toxicity Assessment:		
Estimated orders of potential potencies	Unknown	The slope factors for several carcinogenic PAHs were estimated using their relative potencies compared to benzo(a)pyrene.
Extrapolation of animal toxicity data to humans	Unknown, probably overestimate risk	Animal studies typically involve high-dose exposures whereas humans are exposed to lower doses.
Analytes with no toxicity values	Underestimate risk	Risks associated with chemicals that lack toxicity values cannot be quantified. The greatest data deficiency is related to inhalation toxicity values. The only inhalation pathway of concern at the site is vaporization to indoor air.
Use of NCEA – provisional toxicity values.	Unknown	The use of these values do not represent a USEPA verified assessment because they have not been through the USEPA's formal review process.
Use of linearized, multi-state model to derive cancer slope factors.	Overestimate risk	Model assumes a non-threshold, linear at low dose relationship for carcinogens. Model results in a 95% upper confidence limit of the cancer risk. The true risk is unlikely to be higher and may be as low as zero.

TABLE 6-9 (Continued)

Potential Source	Direction of Effect	Reasons for Uncertainty
Use of uncertainty factors in derivation of reference doses.	Unknown, overestimate probably risk	Ten-fold uncertainty factors are incorporated to account for various sources of uncertainty (e.g., animal to human extrapolation, protection of sensitive human populations, extrapolation from subchronic to chronic data).
Risk Characterization:		
Summation of cancer and noncancer risks	Unknown	Adding risk ignores potential synergistic or antagonistic effects. Assumes similarity in mechanism of action, which is not the case for many substances.
Combination of pathways	Overestimate risk	In order to determine total site-wide risks, the risks were summed over all exposure pathways. However, the net probability of an individual being exposed to all non-exclusive pathways is very low.

Table 7-1
Maximum Soil Concentrations of Chemicals Detected in Groundwater Above ARARs

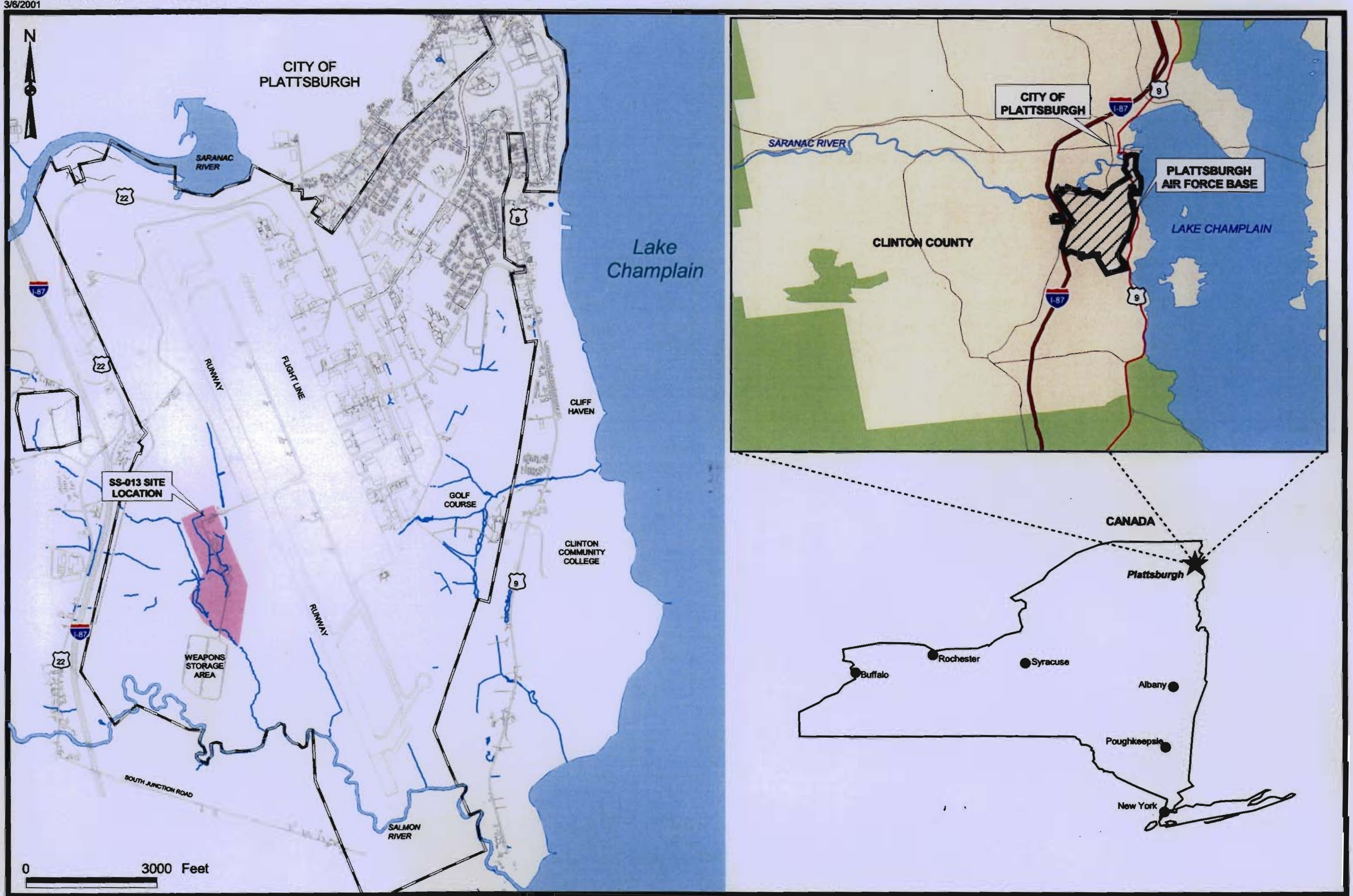
		Maximum Detected Soil Concentration (1)				
Chemical	TBC	**Leach Field "N"**	**Leach Field "A"**	**Leach Field "S"**	**Accumulation Area/Solvent Pad**	**3875 UST**
Vinyl Chloride	**200**	nd	nd	nd	**2**	nd
Methylene Chloride	**100**	nd	nd	**53**	**45**	nd
1,2-Dichloroethane	**100**	nd	nd	nd	nd	nd
Trichloroethene	**700**	nd	nd	nd	**39**	nd
Toluene	**1,500**	**4**	nd	**110**	**48**	nd
Ethylbenzene	**5,500**	**6**	nd	nd	nd	**34.8**
Xylenes	**1,000**	**47**	**2**	**25**	**12**	**94.3**
2,4-Dimethylphenol	ns	nd	nd	nd	nd	nd
2-methylnaphthalene	**36,400**	nd	nd	**97**	nd	**6,450**
Naphthalene	**13,000**	nd	nd	**120**	**100**	**969**
Acenaphthene	**50,000**	nd	nd	**340**	**1,100**	nd
Dibenzofuran	**6,200**	nd	nd	**200**	**540**	nd
Carbazole	ns	nd	nd	**500**	**1,100**	nd
Aluminum	**8,510**	**11,400**	**3,520**	**13,700**	**5,140**	na
Iron	**36,700**	**18,700**	**7,420**	**5,760**	**10,900**	na
Manganese	**474**	**441**	**84.6**	**92.4**	**679**	na
Sodium	**520**	**155**	**36.4**	**33.5**	**82.1**	na
Thallium	**nd**	nd	nd	nd	nd	na

(1) Note that chemical concentrations of organic chemicals are given in ug/kg and inorganic chemicals are given in mg/kg.

ns = no standard
nd = not detected
na = not analyzed

Sample Locations In the Potential Source Areas				
Leach Field "N"	**Leach Field "A"**	**Leach Field "S"**	**Accumulation Area/Solvent Pad**	**3875 UST**
EX3578SS	SS-13-005	SS-13-003	SS-13-N-1	SS013-025
SS-13-002	SS-13-016	SS-13-007	SS-13-E-1	SS013-026
SS-13-014	SS-13-017	SS-13-008	SS-13-S-1	SS013-027
SB-13-006	SS-13-018	SB-13-001	SS-13-W-1	SS013-028
SB-13-008	SB-13-009	SB-13-002	SS-13-B-1	SS013-028B
	SB-13-011	SB-13-007	SB-13-005	SS013-029
		SS13B-001A	SB-13-004	SS013-030
		SS13B-002	SB-13-010	SS013-031
		SS13B-003	SB-13-016	SS013-032
		SS13B-004	SS-13-001	SS013-033
		SS13B-005	SS-13-013	SS013-034
		SS13B-006	SS-13-009	SS013-035
		SS13B-007	SS-13-010	SS013-036
		SS13B-008	SS-13-011	SS013-037
		SS13B-009	SS-13-004	SS013-038
		SS13B-010		SS013-039
		SS13B-011		

j:\0100013.10\gis\applications\sitelocation.apr SS-013 SITE LOCATION
3/6/2001



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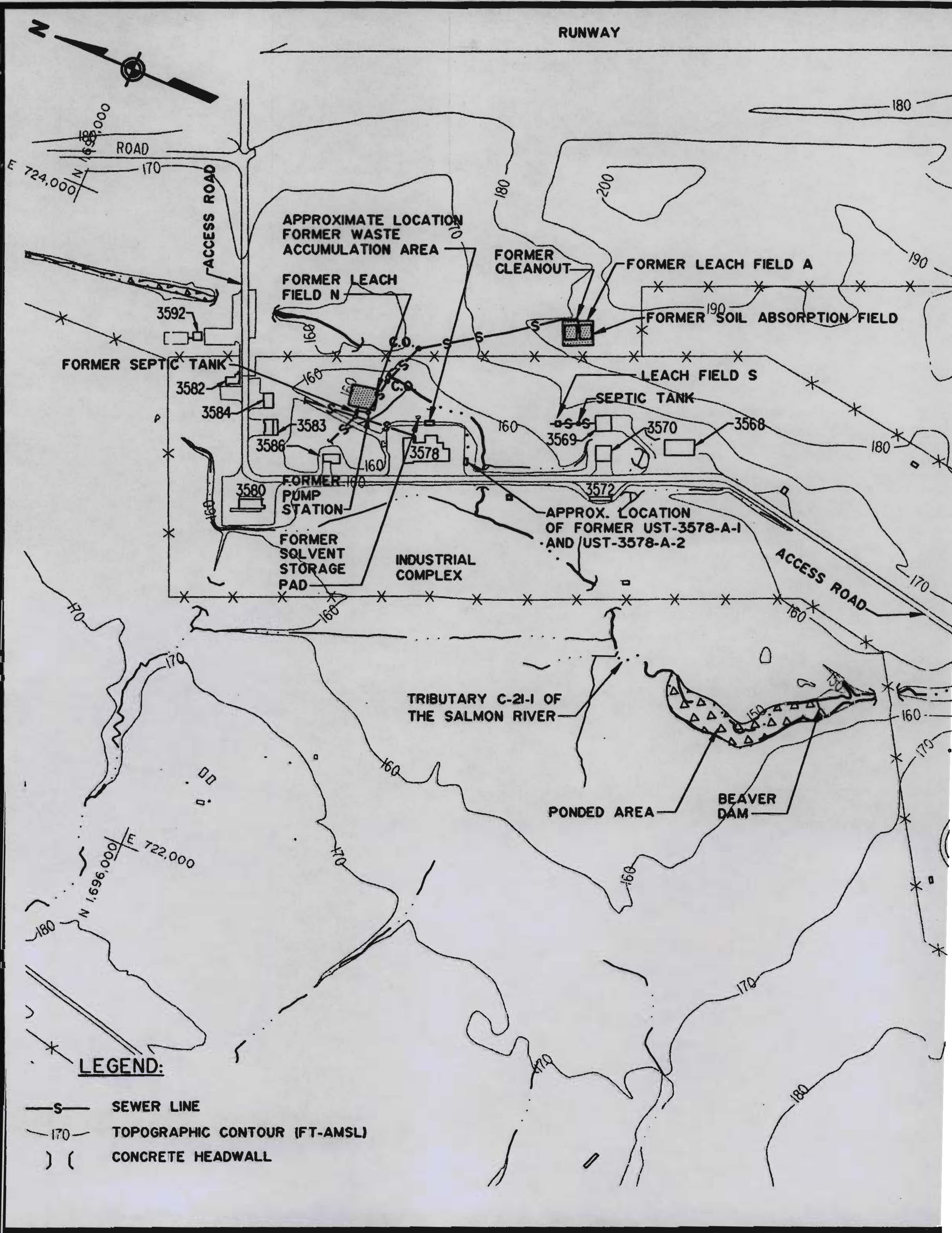
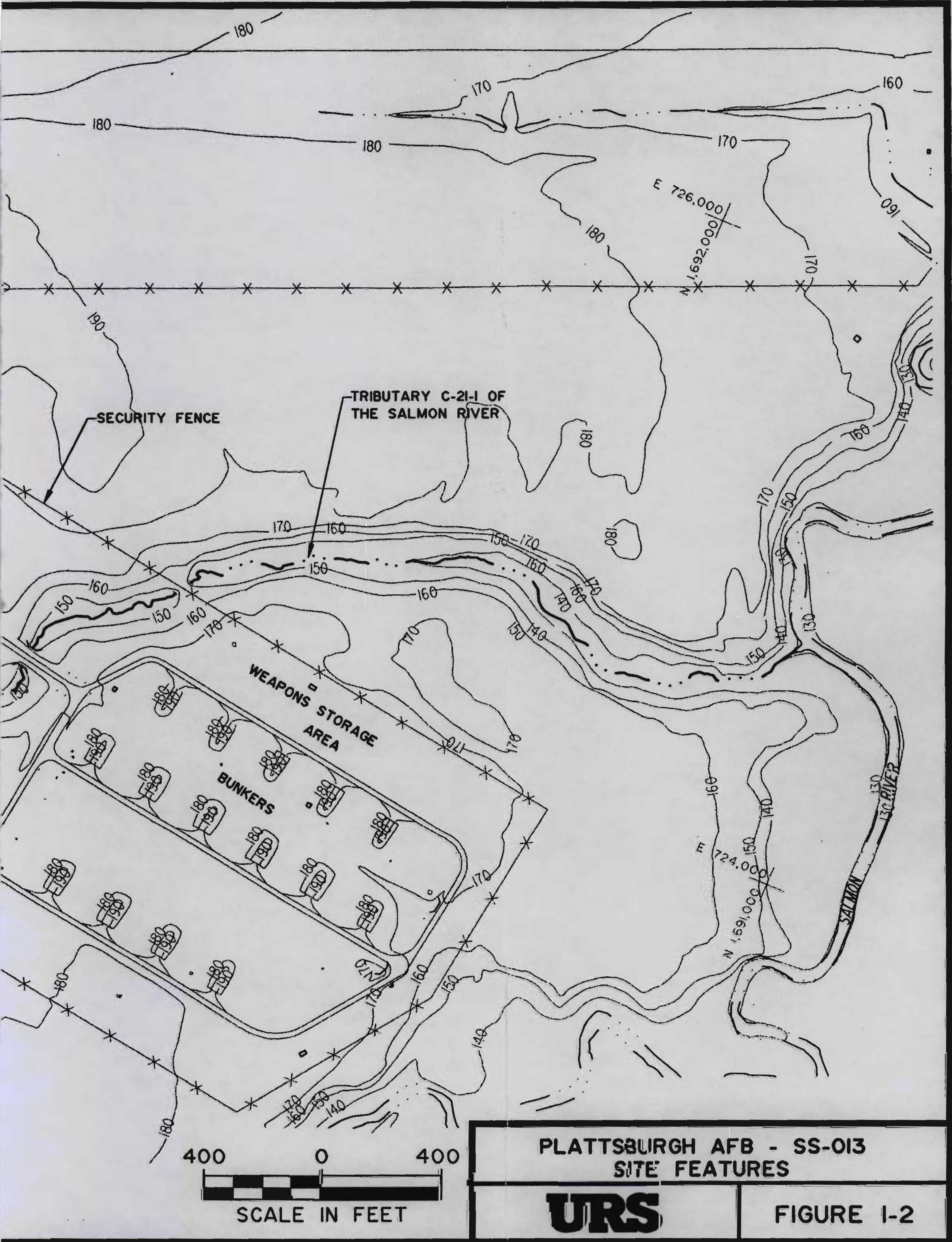
PLATTSBURGH AIR FORCE BASE
SS-013 SITE LOCATION MAP

FIGURE 1-1


RUNWAY
N
ROAD
ACCESS ROAD
N 1,698,000
E 724,000
180
170
200
190
160
150
APPROXIMATE LOCATION FORMER WASTE ACCUMULATION AREA
FORMER LEACH FIELD N
FORMER CLEANOUT
FORMER LEACH FIELD A
FORMER SOIL ABSORPTION FIELD
C.O.
S
3592
FORMER SEPTIC TANK
3582
3584
3583
3586
3578
3580
FORMER PUMP STATION
FORMER SOLVENT STORAGE PAD
INDUSTRIAL COMPLEX
LEACH FIELD S
SEPTIC TANK
3569
3570
3568
3572
APPROX. LOCATION OF FORMER UST-3578-A-1 AND UST-3578-A-2
ACCESS ROAD
TRIBUTARY C-21-1 OF THE SALMON RIVER
PONDED AREA
BEAVER DAM
N 1,696,000
E 722,000
LEGEND:
S SEWER LINE
170 TOPOGRAPHIC CONTOUR (FT-AMSL)
) (CONCRETE HEADWALL



PLATTSBURGH AFB - SS-013
SITE FEATURES

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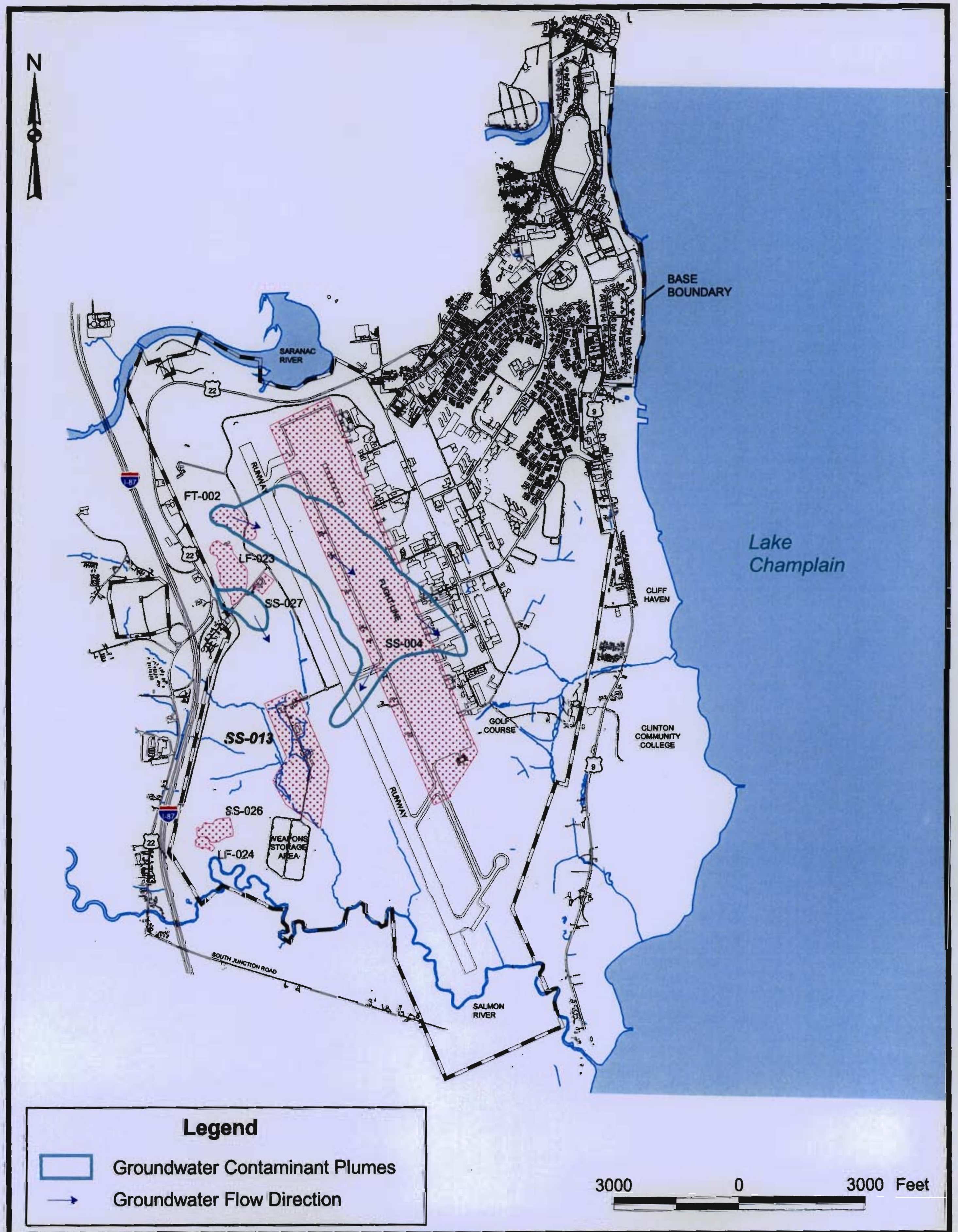
FIGURE 1-2

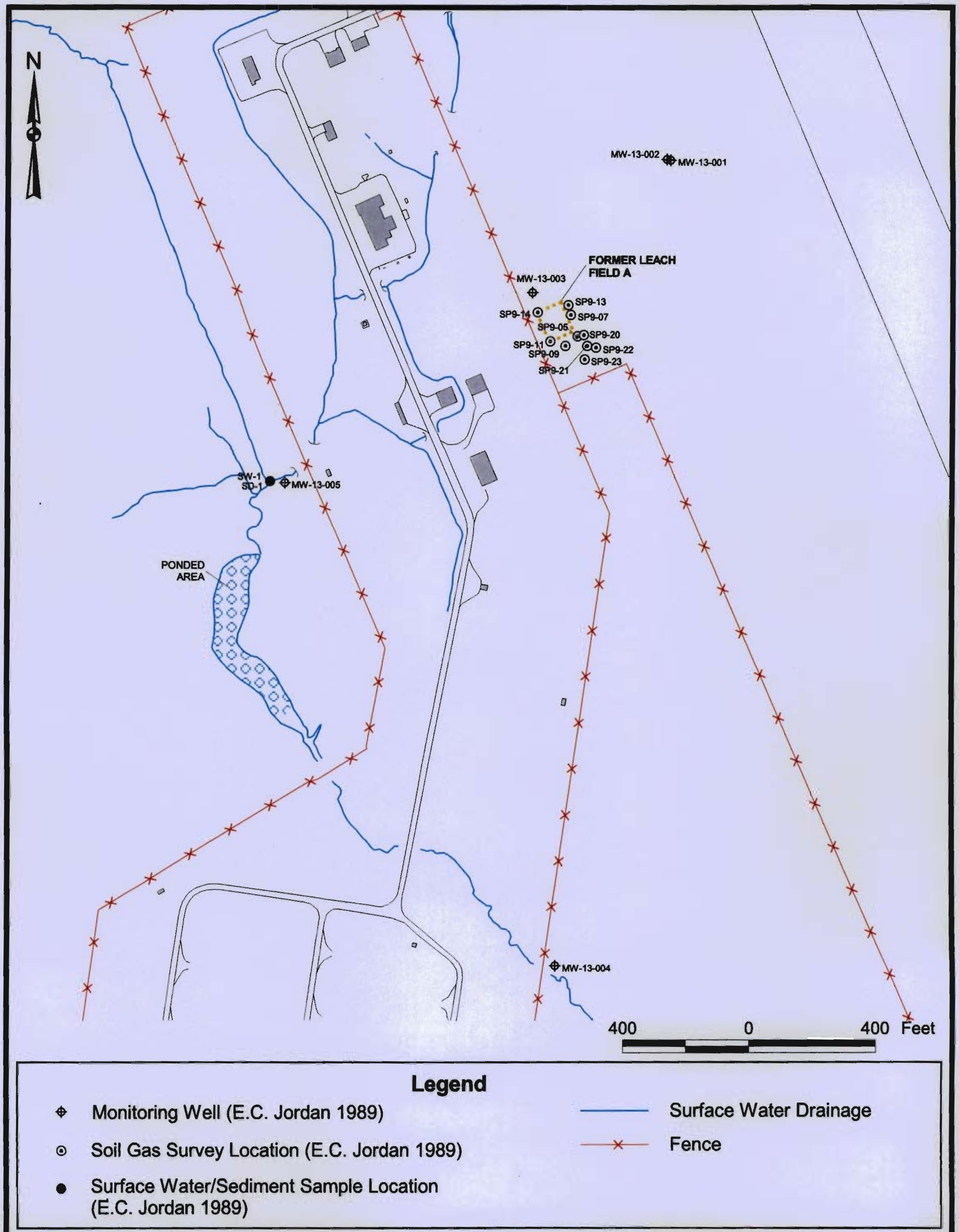


URS

MUNITIONS MAINTENANCE SQUADRON (SS-013)
ADJACENT IRP SITES

FIGURE 1-3

J:\0100013.10\gis\Applications\ss-013.apr ADJACENT IRP SITES
8/27/2001



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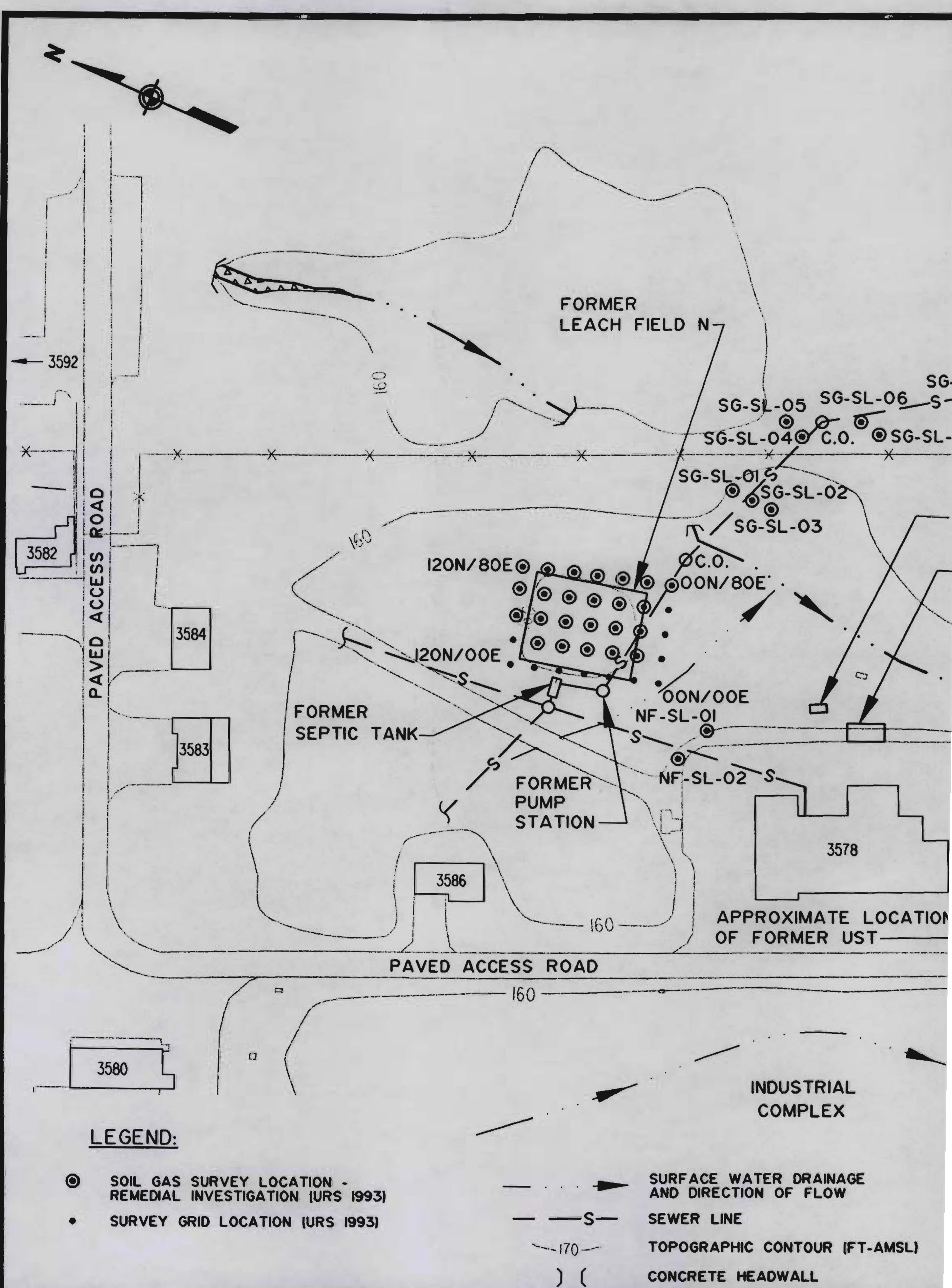
MUNITIONS MAINTENANCE SQUADRON (SS-013)
SITE INVESTIGATION SAMPLE LOCATIONS

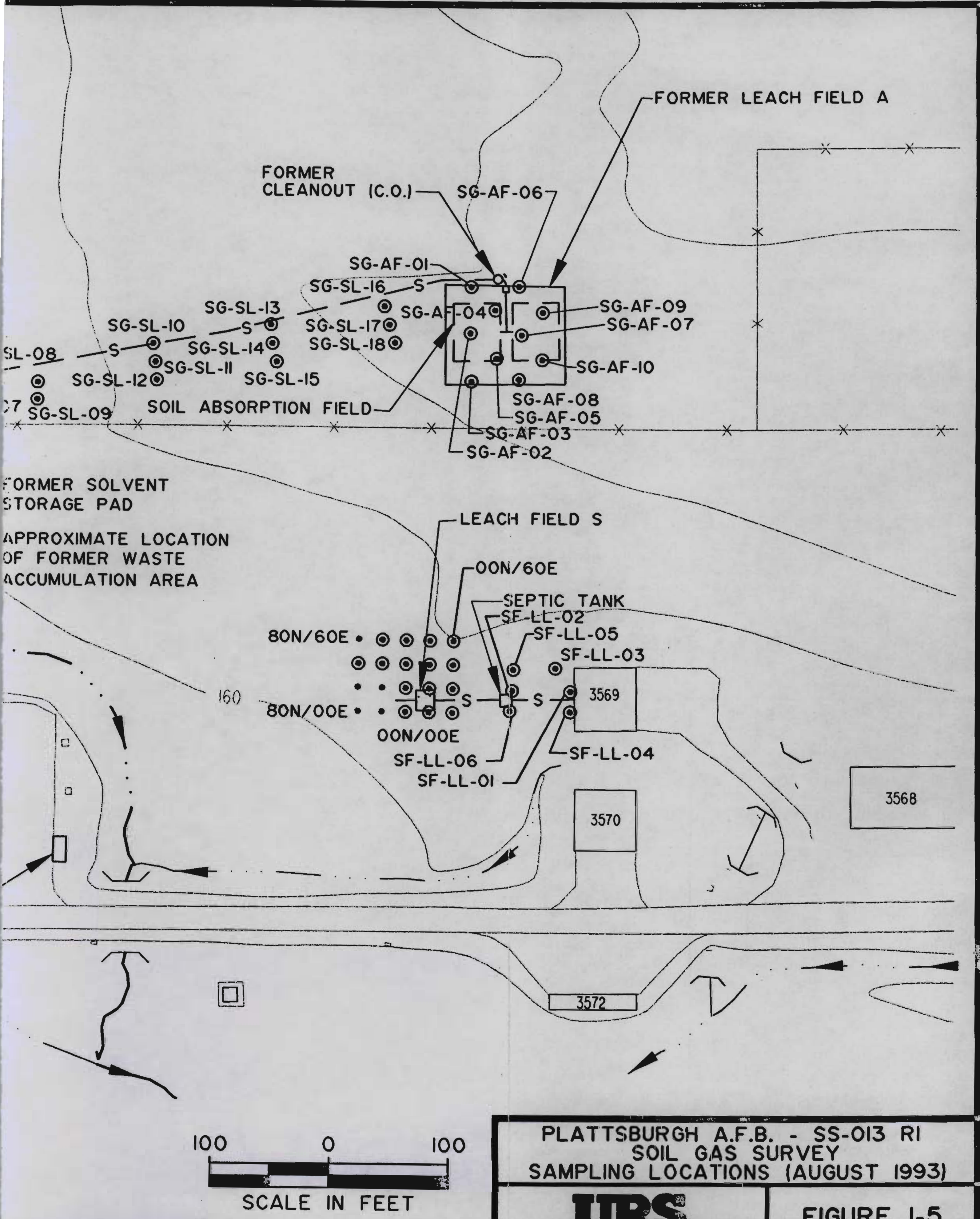
FIGURE 1-4

J:\0100013.10\gis\Applications\ss-013.apr SI SAMPLING LOCATIONS
4/2/2001



\35721.01\CAD\SS013\ 1:100 5/2/02-1 PAL

C-2898C

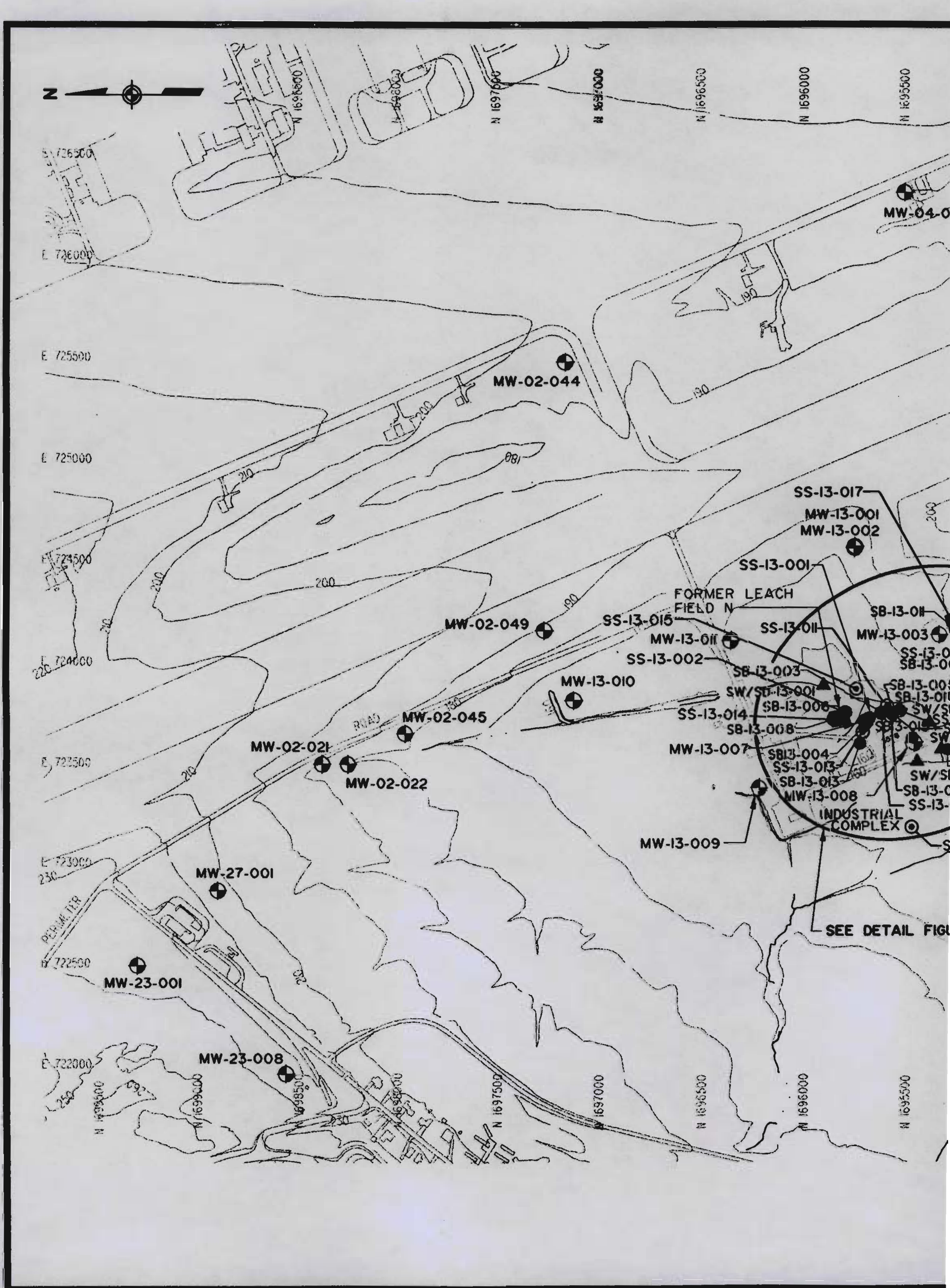


PLATTSBURGH A.F.B. - SS-013 RI
SOIL GAS SURVEY
SAMPLING LOCATIONS (AUGUST 1993)

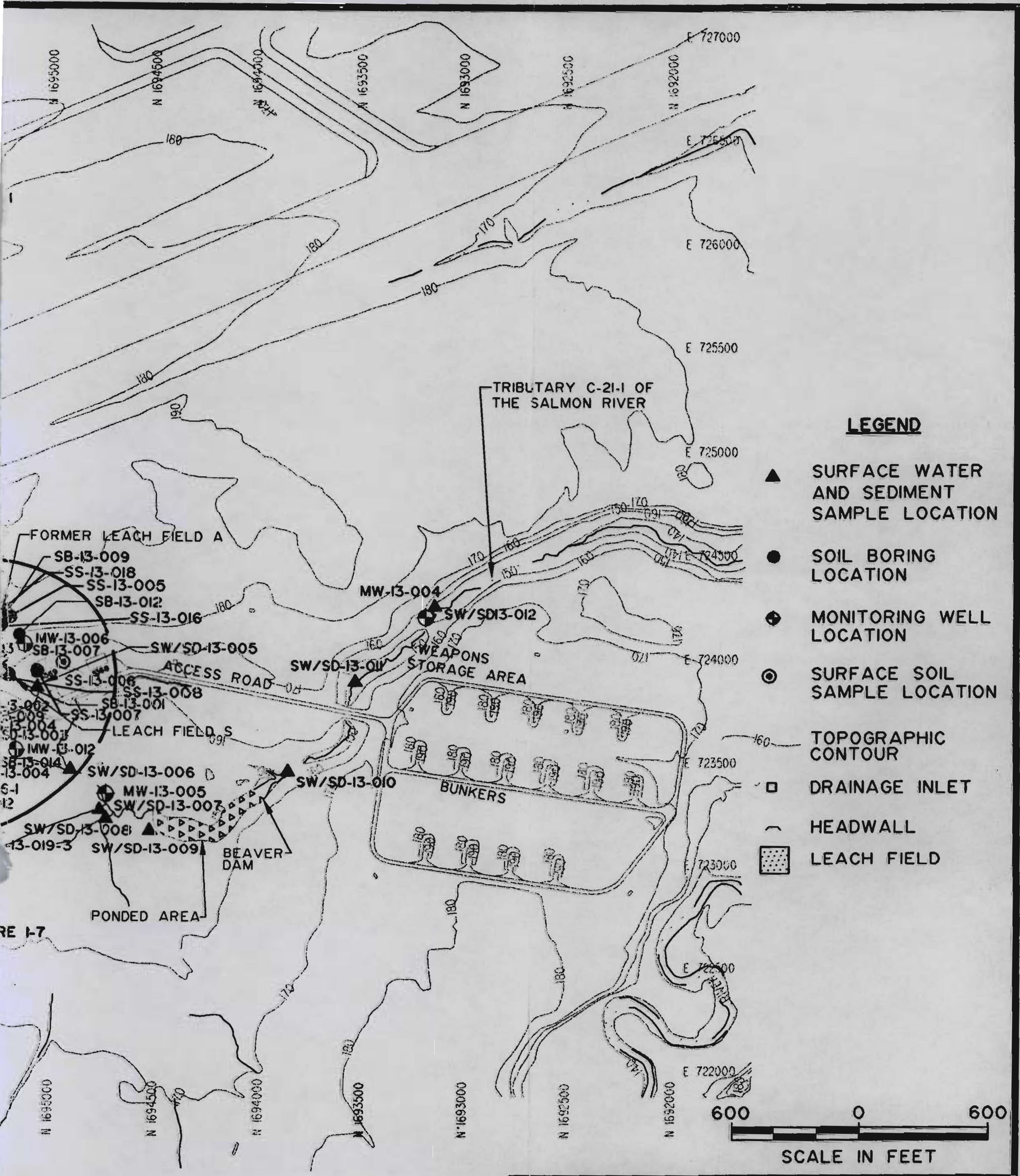
URS

FIGURE 1-5

J:\35721.01\CAD\SS013\ 1=600 5/2/02-1 PAL



CC-3713B



PLATTSBUGH A.F.B. - SS-013 RI
SAMPLE LOCATIONS (1993-1995)

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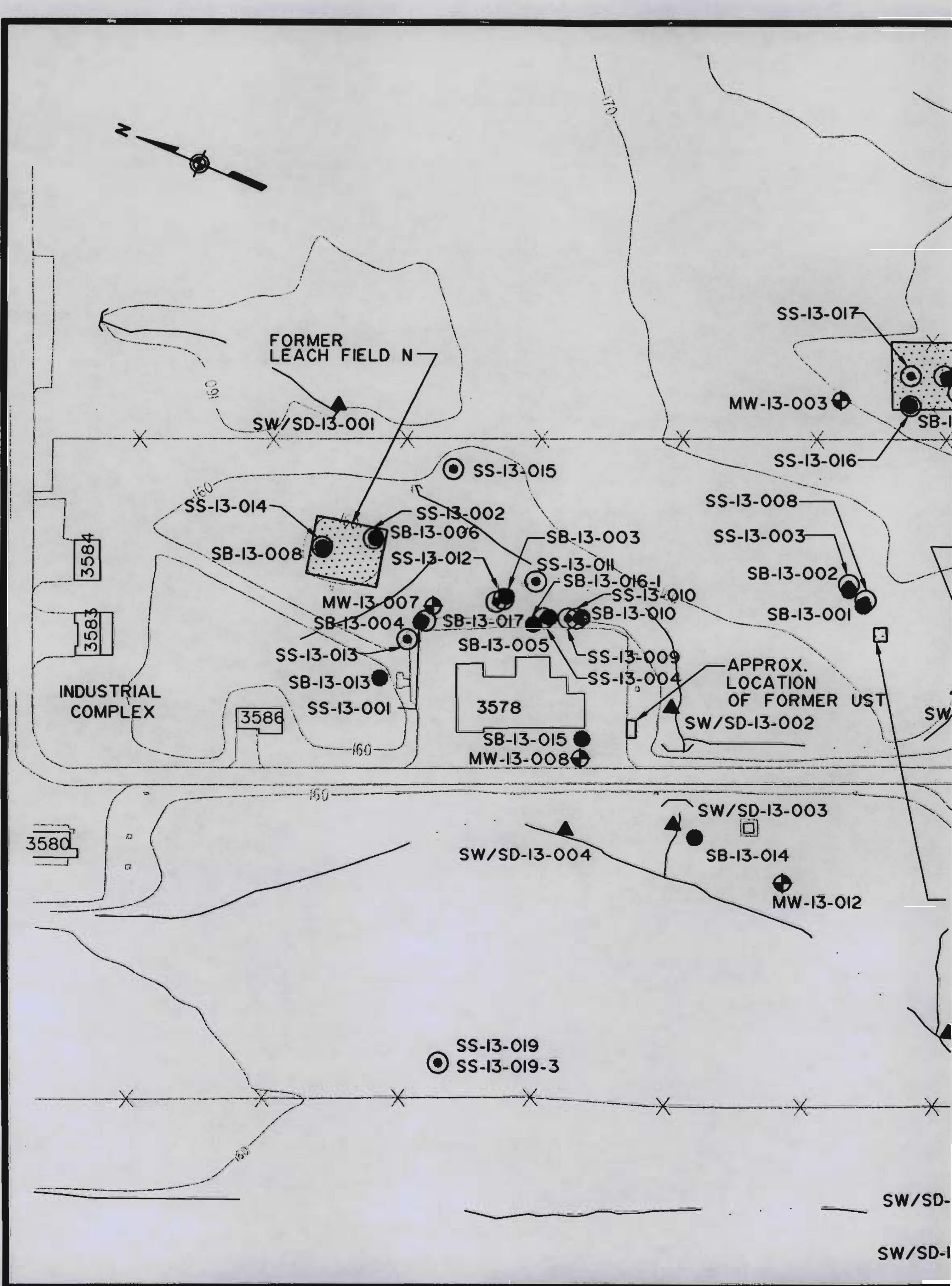
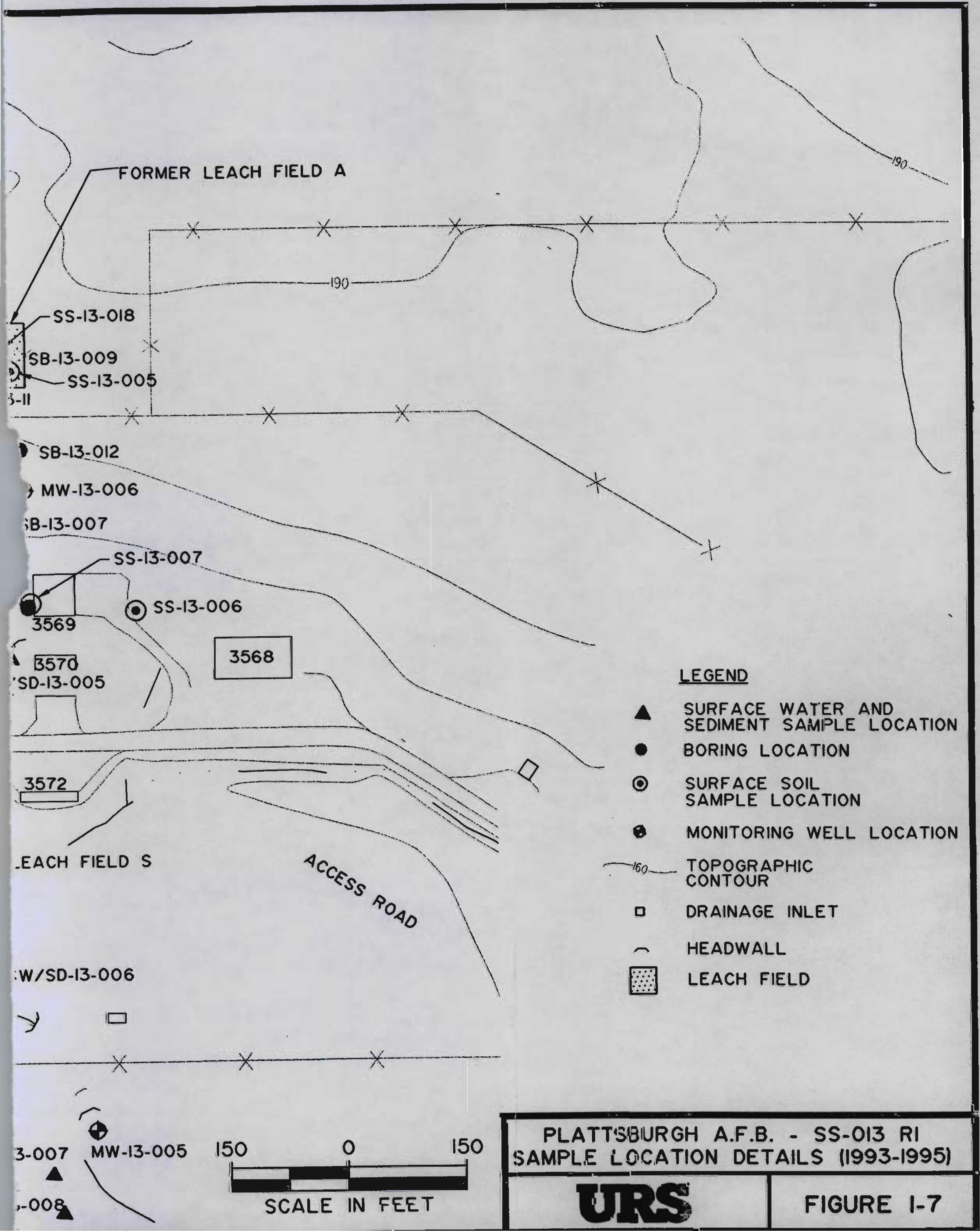
FIGURE 1-6

J:\35721.01\CAD\SS013\ 1=150 5/2/02-1 PAL



CC-2999B



PLATTSBURGH A.F.B. - SS-013 RI
SAMPLE LOCATION DETAILS (1993-1995)

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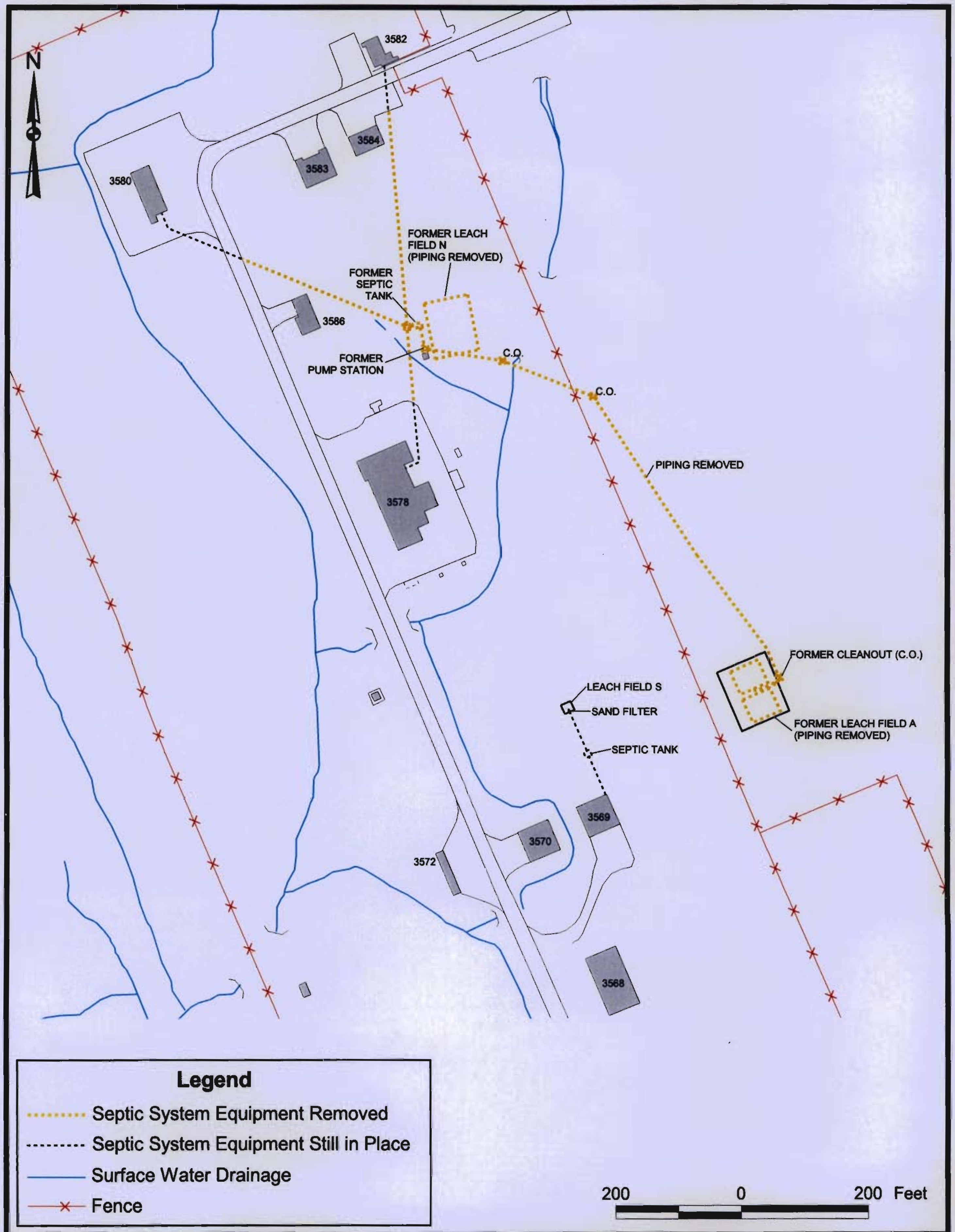
FIGURE 1-7



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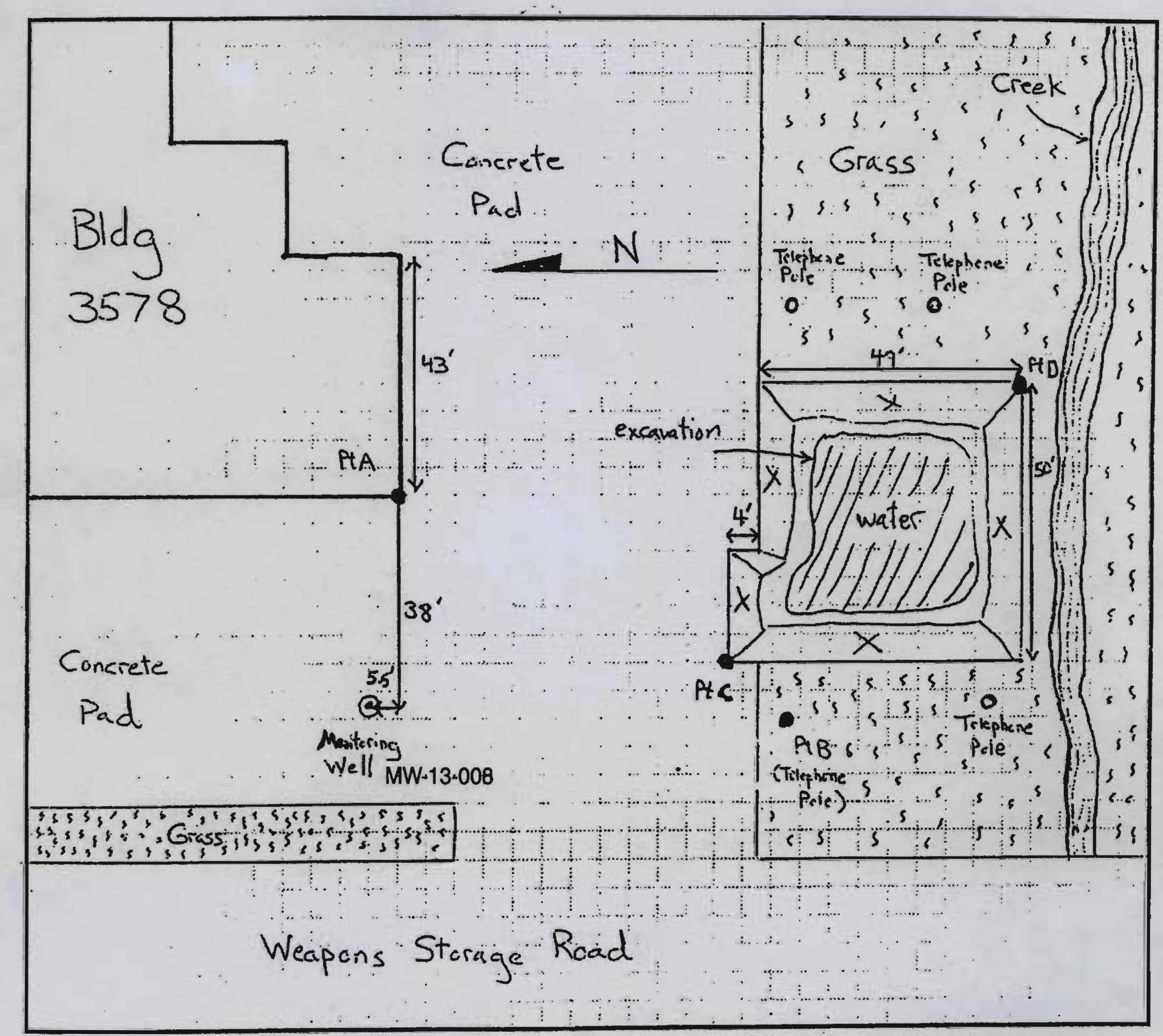
MUNITIONS MAINTENANCE SQUADRON (SS-013)
OHM 1996 SEPTIC SYSTEM EQUIPMENT
REMOVAL SUMMARY

FIGURE 1-8

J:\0100013.10\gis\Applications\ss-013.apr SEPTIC SYSTEM REMOVAL
4/2/2001



Ref Points

A→C : 65'
A→D : 128'
B→C : 13'
B→D : 78'

Comments

- Not drawn to scale
- X denotes sampling locations for the excavation composite sample (EX3578A & B)
- A grab sample was collected from the water within the excavation (EX3578A-LQ)
- A grab sample was collected from the groundwater monitoring well (MW3578-LQ)

Source: UST-3578-A-2 Closure Report, OHM Remediation Services Corp., January 22, 1997.

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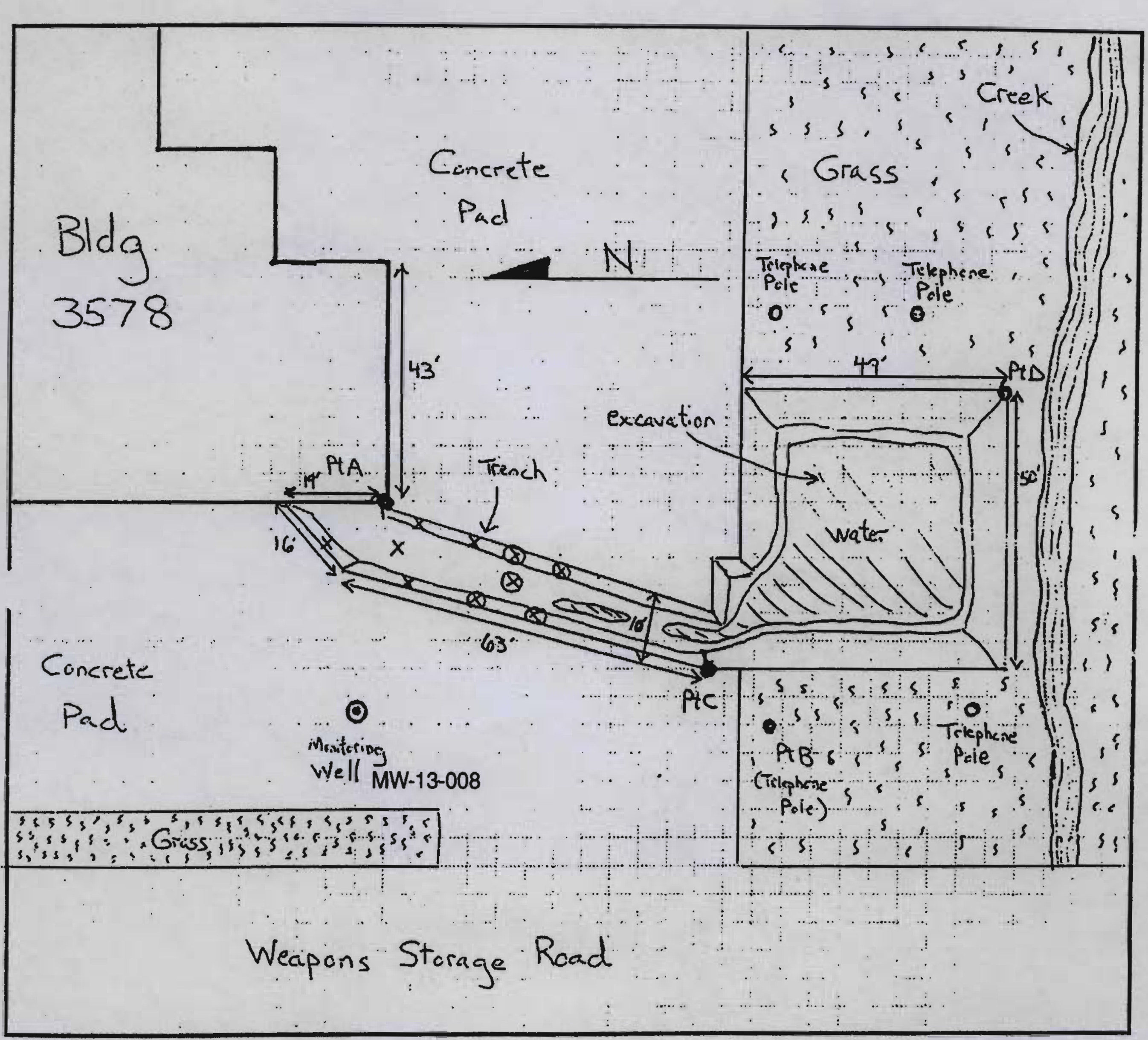
SITE CONDITIONS & SAMPLE LOCATIONS
UST-3578-A-2 REMOVAL, JULY 1996

FIGURE 1-9



Ref Points

A→C : 65'
A→D : 128'
B→C : 13'
B→D : 78'

Comments

- Not drawn to scale
- x denotes sampling locations for the trench composite: EX3578-1
- ⊗ denotes sampling locations for the trench composite: Ex3578-2
- A grab sample was collected from the water within the tench (EX3578-LQ)

Source: UST-3578-A-2 Closure Report, OHM Remediation Services Corp., January 22, 1997.

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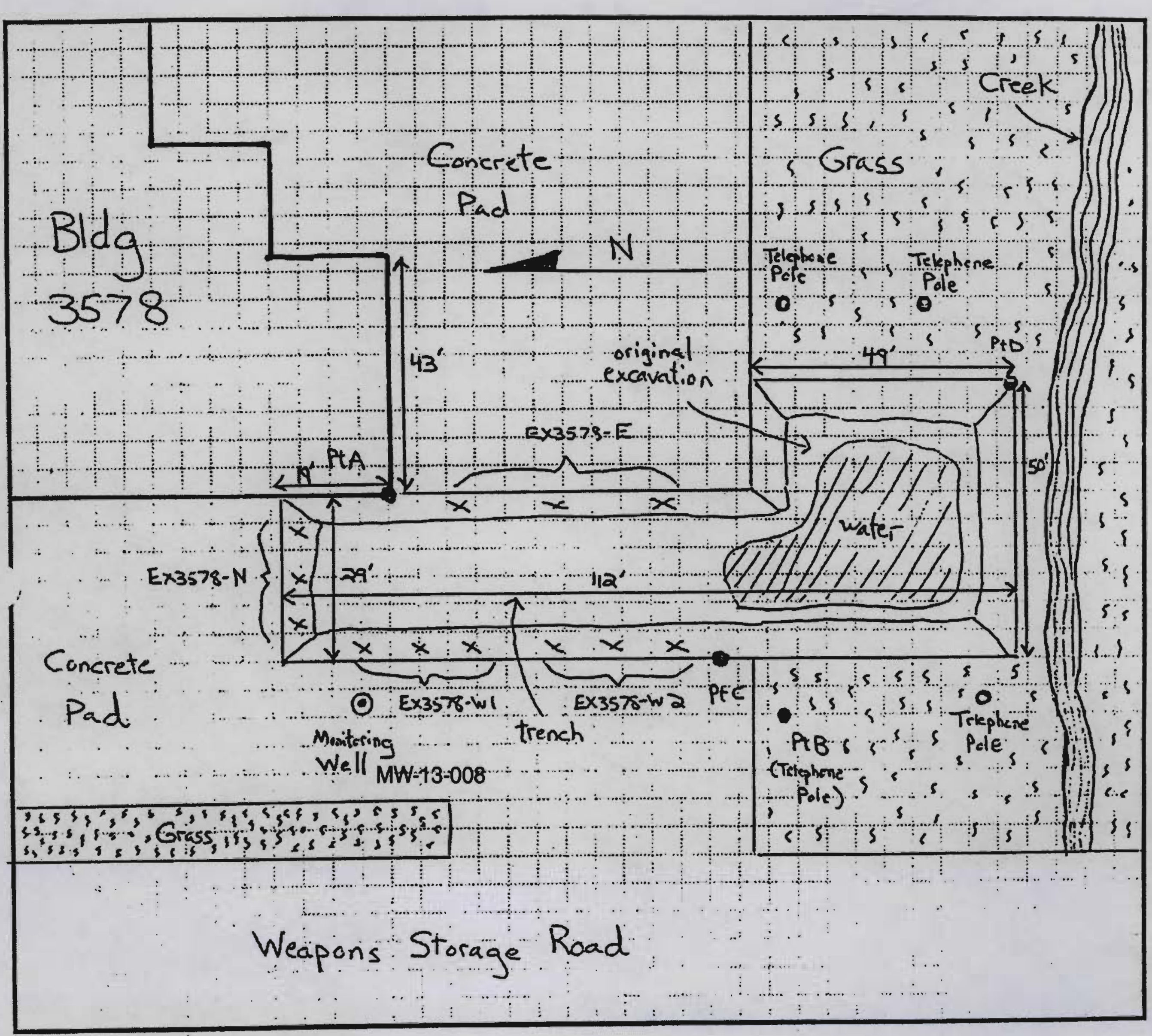
SITE CONDITIONS & SAMPLE LOCATIONS
UST-3578-A-2 REMOVAL, OCTOBER 1996

FIGURE 1-10



Ref Points

A→C: 65'

A→D: 128'

B→C: 13'

B→D: 78'

Comments

- Not drawn to scale
- X denotes sampling locations for the ~~four~~ trench sidewall composites (see map)

Source: *UST-3578-A-2 Closure Report, OHM Remediation Services Corp., January 22, 1997.*

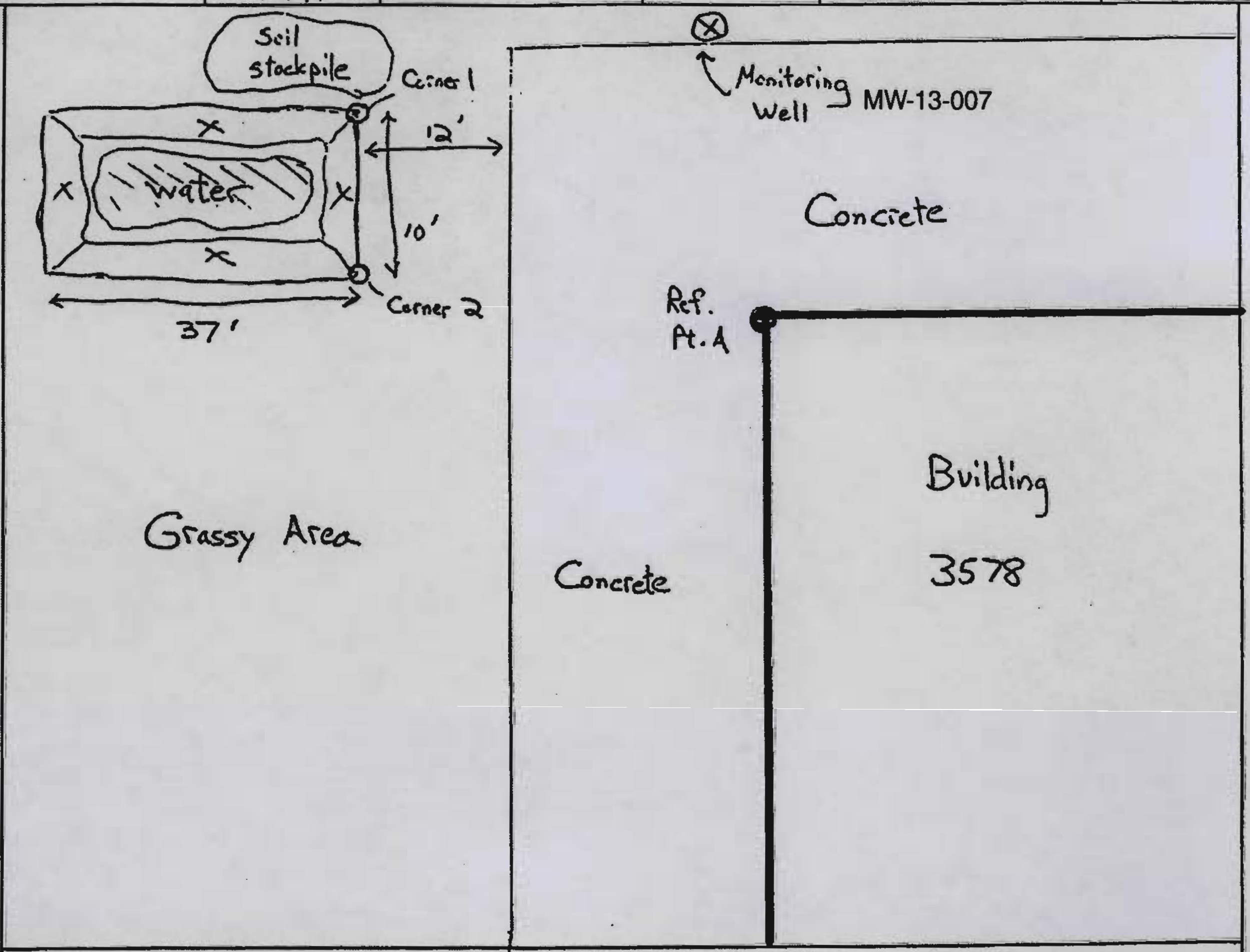
SITE CONDITIONS & SAMPLE LOCATIONS
UST-3578-A-2 REMOVAL, DECEMBER 1996

FIGURE 1-11

Page 2 of 2

Proj. No.	Client	Location	Subject
17499	AFCEE	Building 3578	Confirmation Sampling

Preparer's Initials	Date	Reviewer's Initials	Date	Approver's Initials	Date
GG	10/4/96				



Comments

- Not drawn to scale
- X denotes the sample locations for the excavation composite (EX3578SS).
- A grab sample was collected from the ~~se~~ water at the bottom of the excavation (EX3578LQSS).

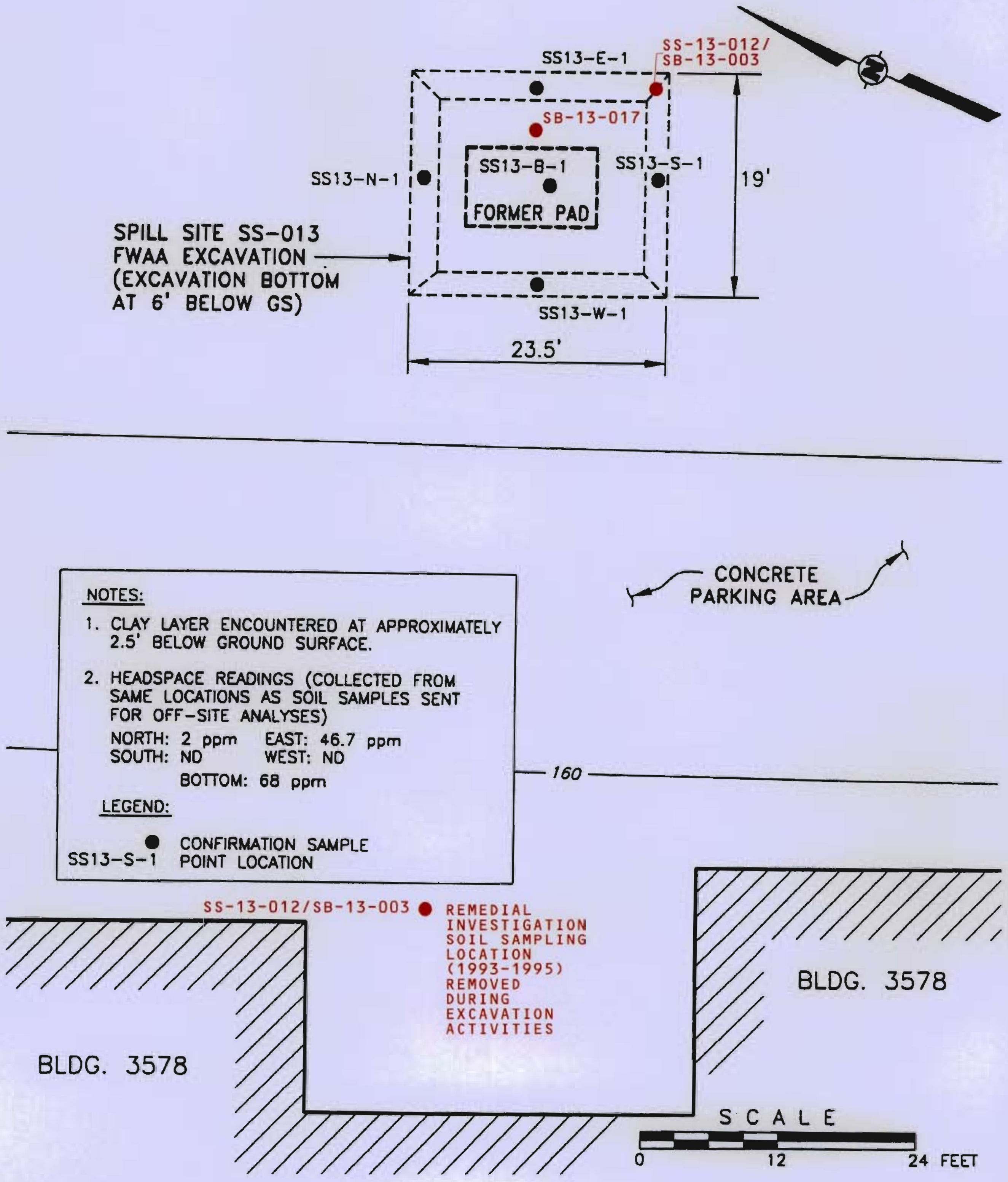
Pt A → Corner 1 : 76'
Pt → Corner 2 : 70'

Source: SPT-3578 Closure Report, OHM Remediation Services Corp., January 15, 1997.

URS

SITE CONDITIONS & SAMPLE LOCATIONS
SPT-3578 REMOVAL, OCTOBER 1996

FIGURE 1-12



NOTES:

1. CLAY LAYER ENCOUNTERED AT APPROXIMATELY 2.5' BELOW GROUND SURFACE.
2. HEADSPACE READINGS (COLLECTED FROM SAME LOCATIONS AS SOIL SAMPLES SENT FOR OFF-SITE ANALYSES)

NORTH: 2 ppm EAST: 46.7 ppm
SOUTH: ND WEST: ND
BOTTOM: 68 ppm

LEGEND:

● SS13-S-1 CONFIRMATION SAMPLE POINT LOCATION

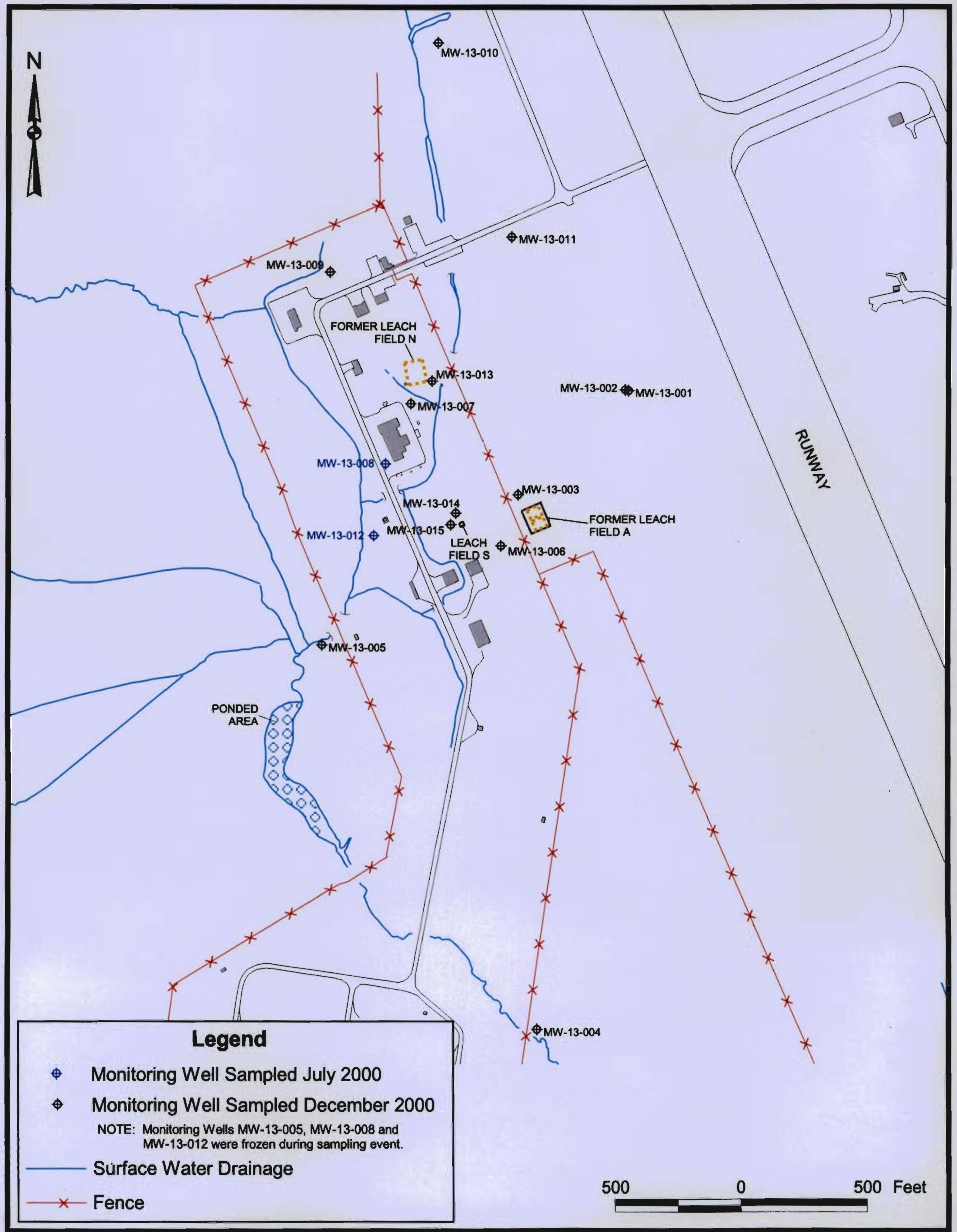
● REMEDIAL INVESTIGATION SOIL SAMPLING LOCATION (1993-1995) REMOVED DURING EXCAVATION ACTIVITIES

Source: *Final Closure Report for Removal of Contaminated Soil at the Former Waste Accumulation Area (FWAA) Spill Site SS-013, OHM Remediation Services Corp. and Parson Engineering Science Inc., March 29, 1999.*

URS

FORMER WASTE ACCUMULATION AREA SOLVENT STORAGE PAD REMOVAL EXCAVATION AND CONFIRMATORY SAMPLING LOCATIONS

FIGURE 1-13



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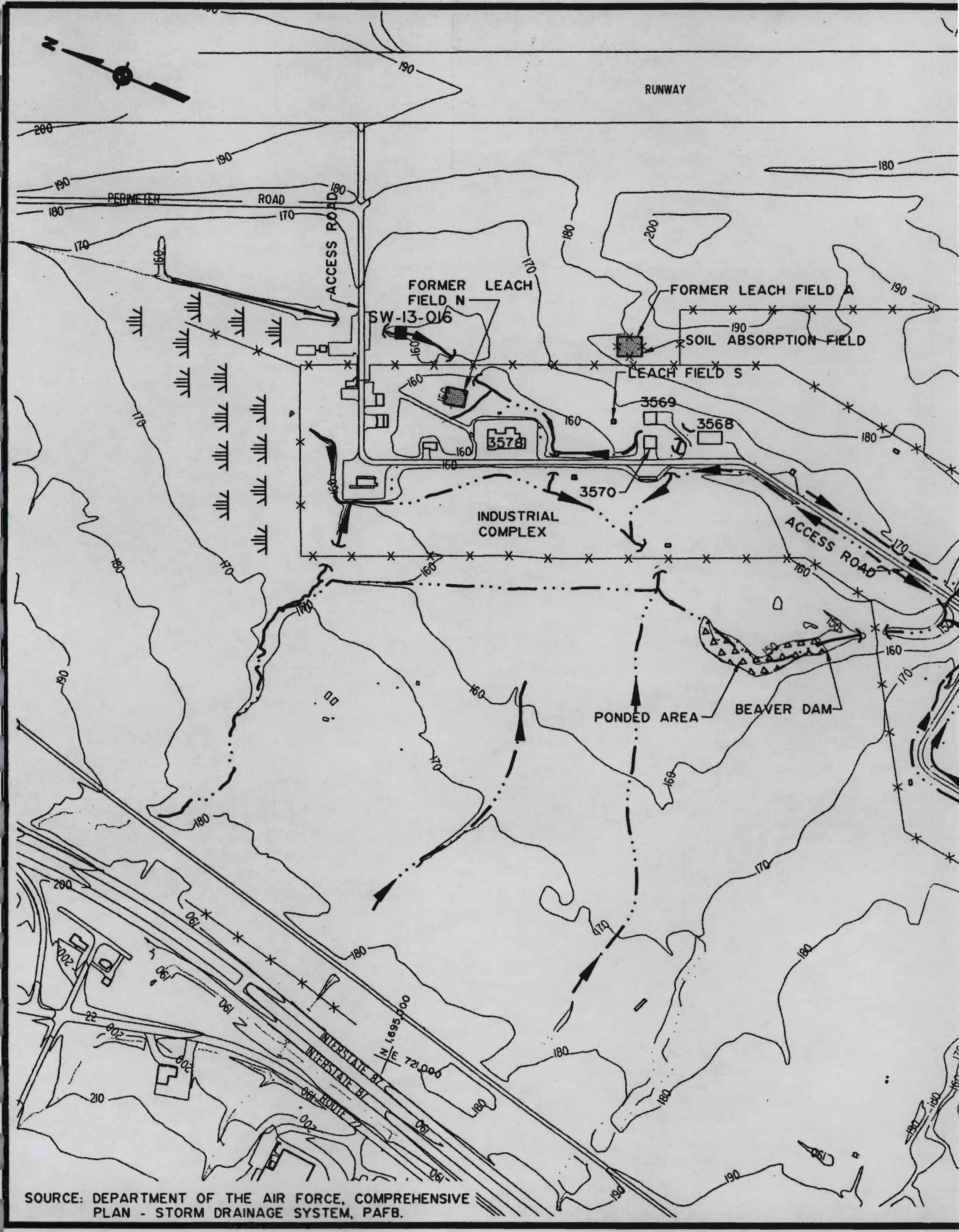
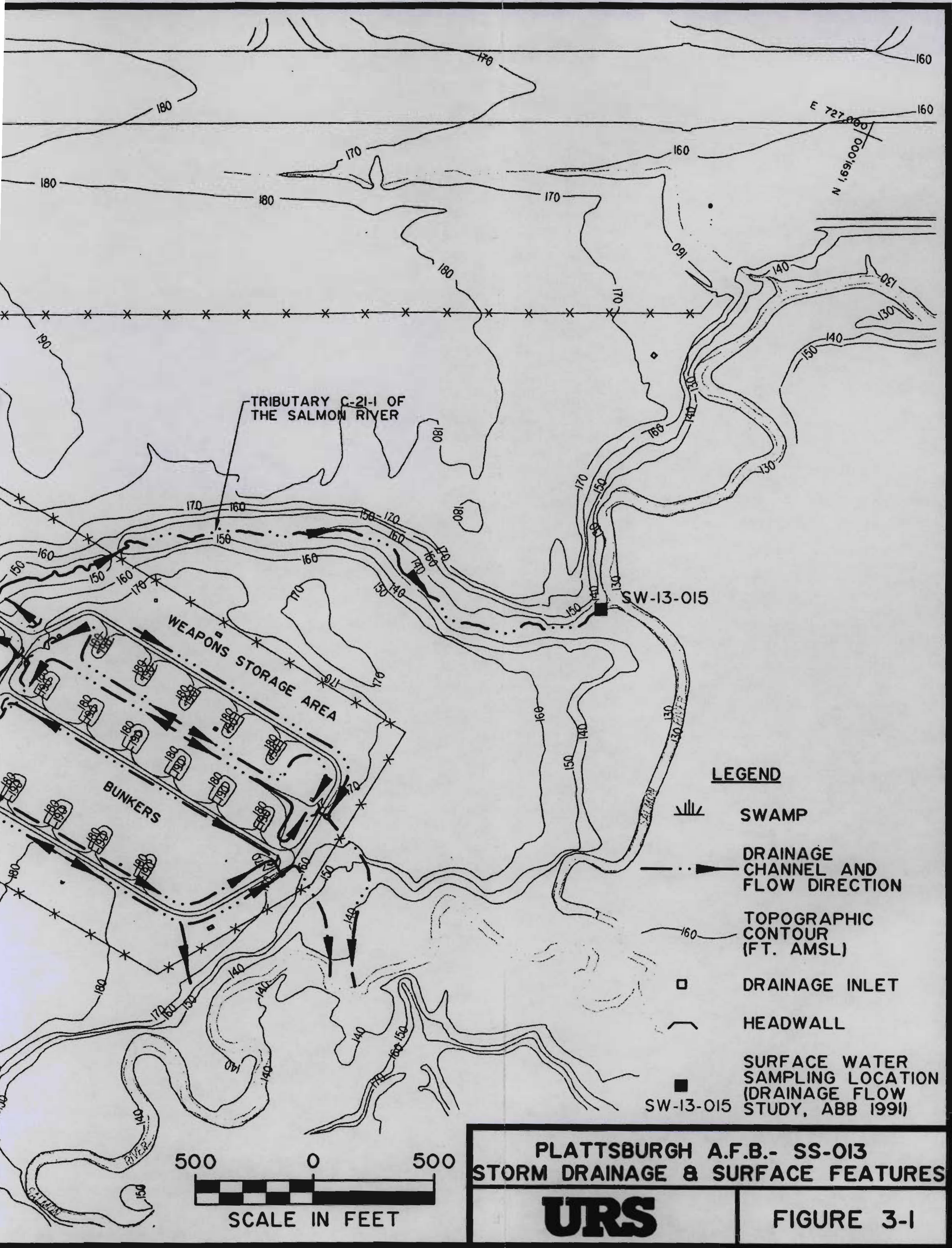
MUNITIONS MAINTENANCE SQUADRON (SS-013)
SUPPLEMENTAL REMEDIAL INVESTIGATION
GROUNDWATER SAMPLING LOCATIONS

FIGURE 2-1

J:\0100013.10\gis\Applications\ss-013.apr DEC. 2000 GROUNDWATER SAMPLING LOCATIONS
5/18/2001



SOURCE: DEPARTMENT OF THE AIR FORCE, COMPREHENSIVE PLAN - STORM DRAINAGE SYSTEM, PAFB.

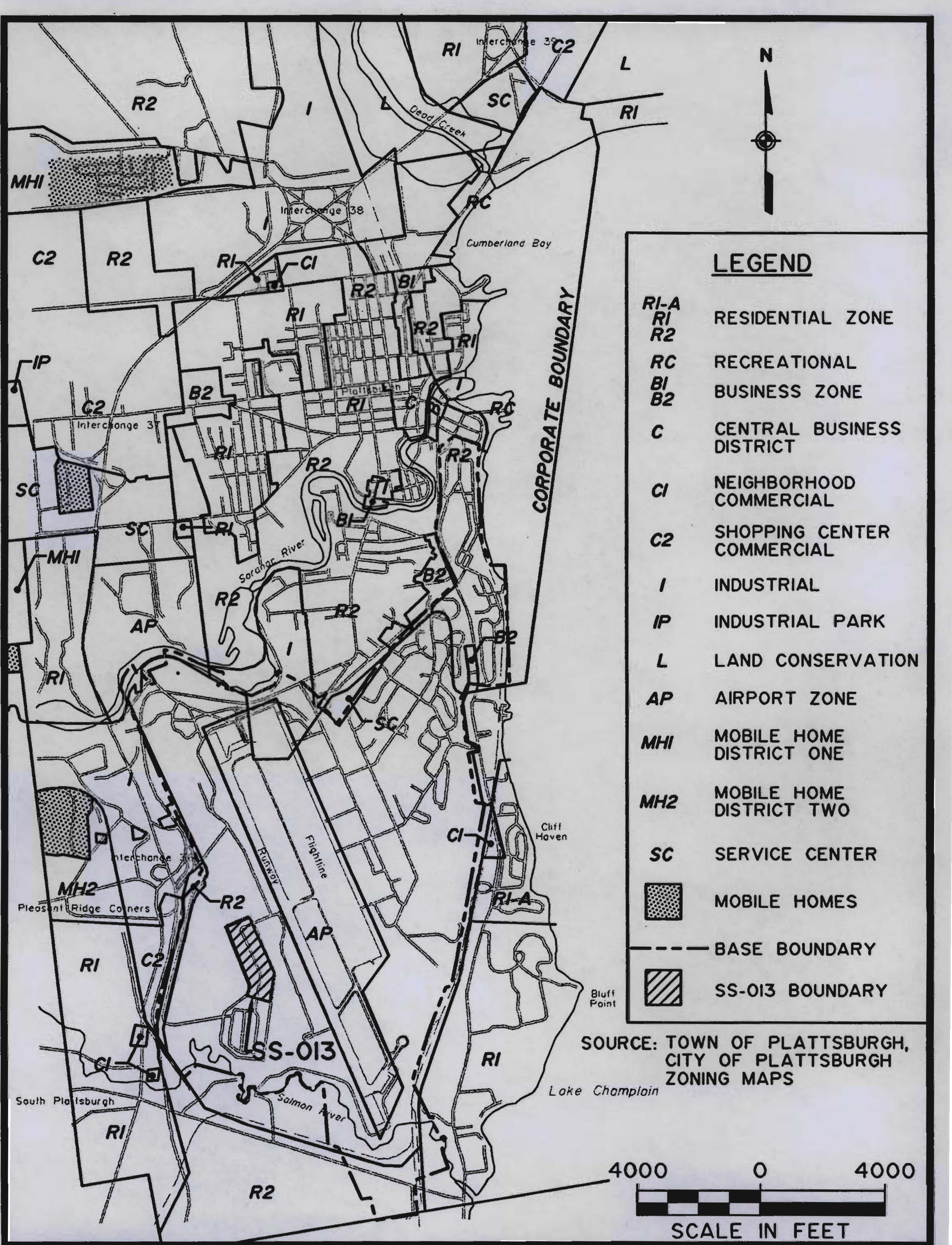


PLATTSBURGH A.F.B.- SS-013
STORM DRAINAGE & SURFACE FEATURES

URS

FIGURE 3-1

J:\35721.01\CAD\SS013 1=4000 4/9/01-1 PAL



SOURCE: TOWN OF PLATTSBURGH, CITY OF PLATTSBURGH ZONING MAPS

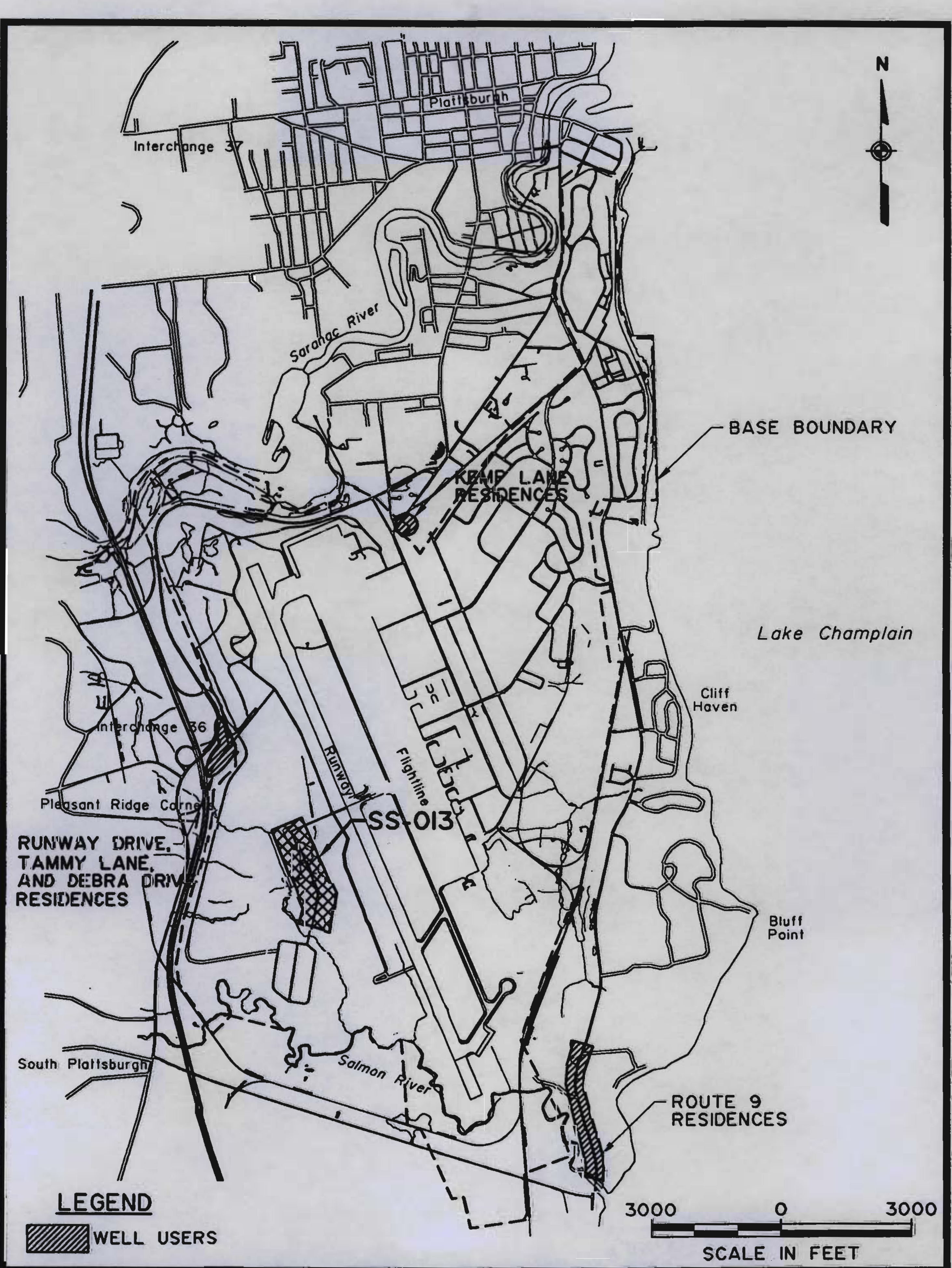
AC-9451A

URS

PLATTSBURGH A.F.B.
ZONING MAP

FIGURE 3-2

J:\35721.01\CAD\SS013\ 1=3000 4/12/01-2 RAL



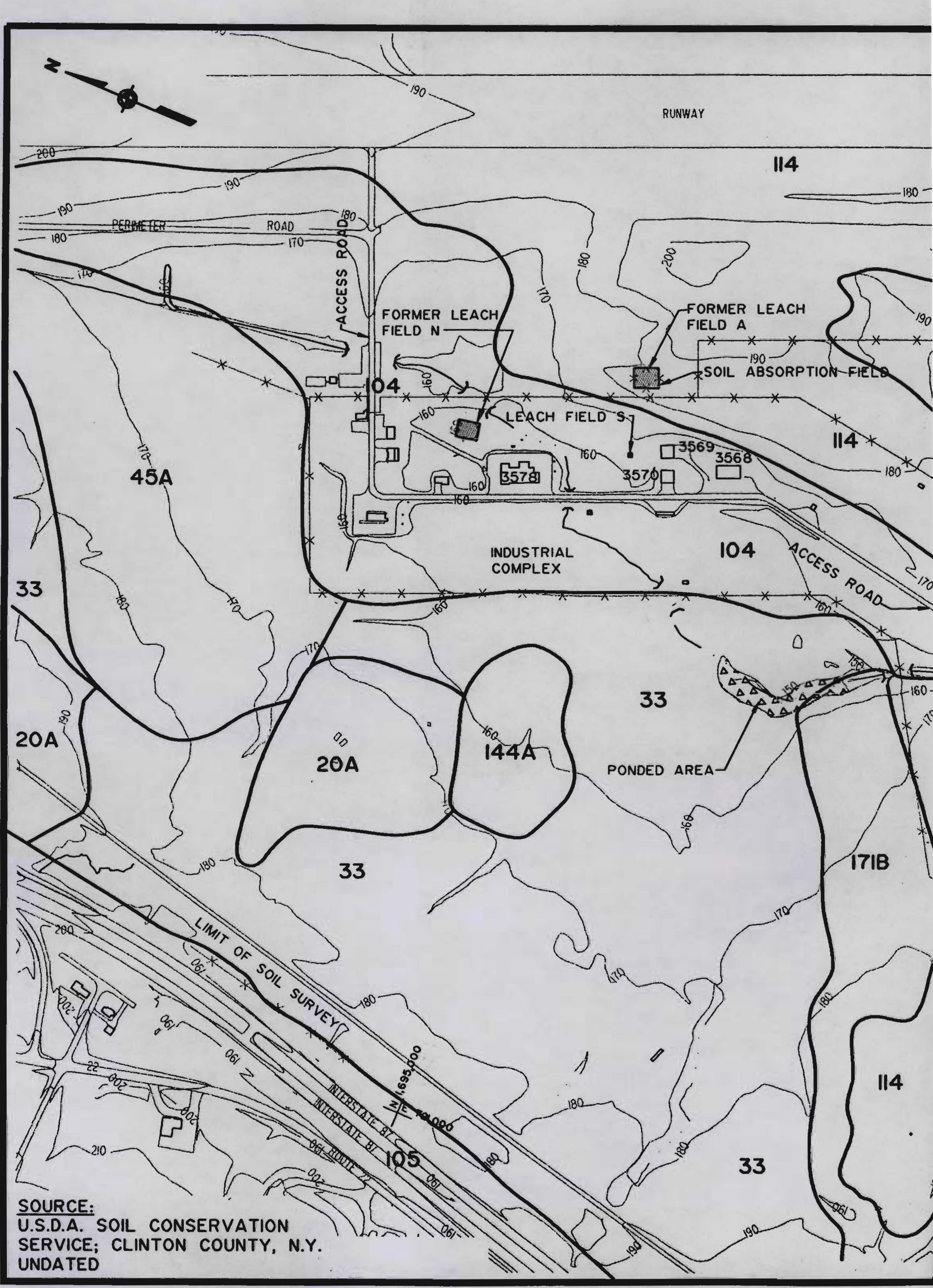
URS

PLATTSBURGH AFB
LOCATIONS OF OFF-BASE RESIDENCES UTILIZING GROUNDWATER FOR POTABLE USE

FIGURE 3-3

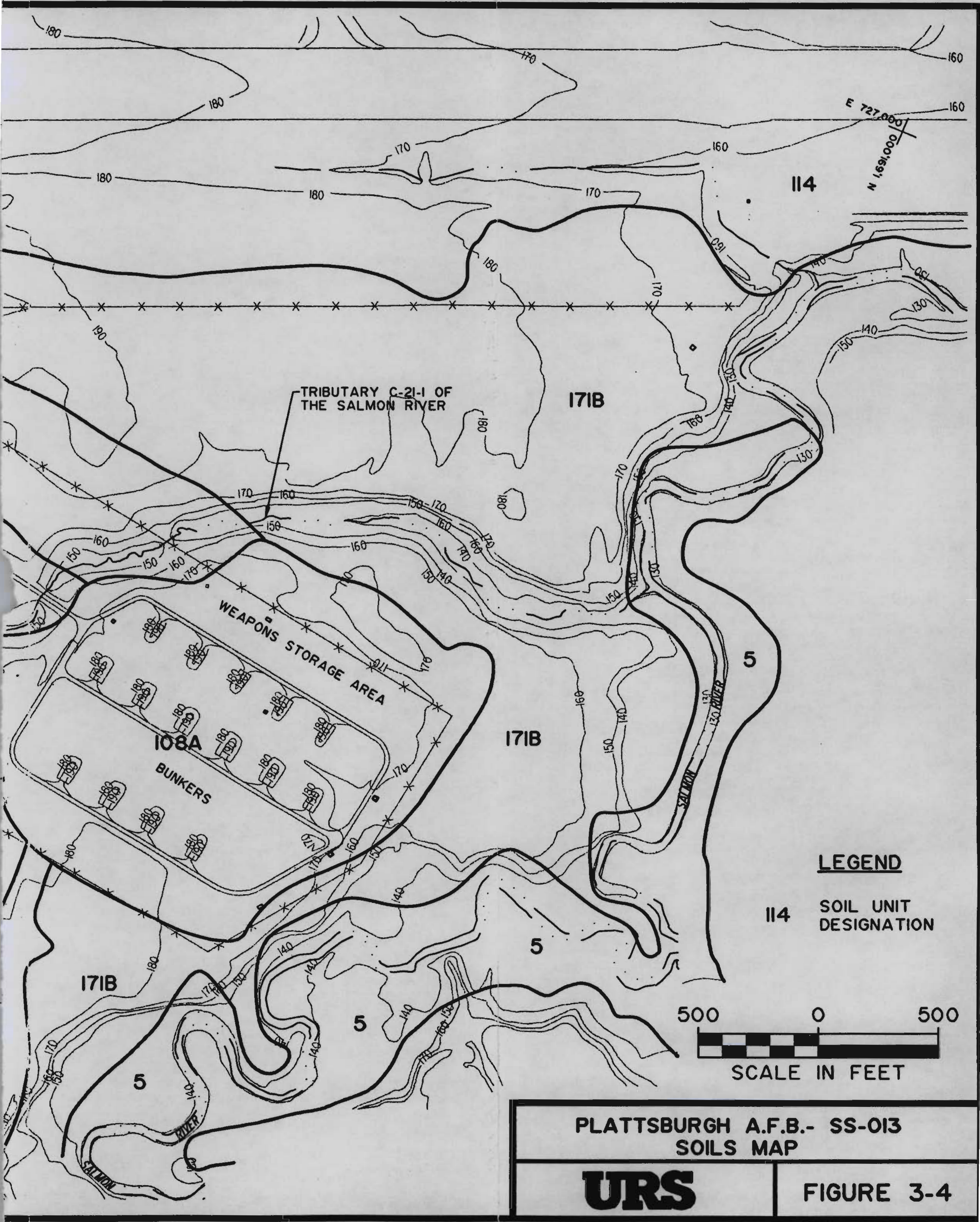
AC-9453A

J:\35721.01 1:500 4/12/01-2 RAL



SOURCE:
U.S.D.A. SOIL CONSERVATION SERVICE; CLINTON COUNTY, N.Y.
UNDATED

CC-2863A



PLATTSBURGH A.F.B.- SS-013
SOILS MAP

URS

FIGURE 3-4

J:\35721.01\ 1=500 4/9/01-1 PAL

LEGEND

TERRESTRIAL SYSTEM

RIVERINE SYSTEM

- ▨ (MS) MIDREACH STREAM
- ▨ (HW) MARSH HEADWATER STREAM
- ▨ (DS) DITCH/INTERMITTENT STREAM

FORESTED COVERTYPES

- ▨ (PH) PINE-HARDWOODS
- ▨ (HH) HEMLOCK-HARDWOODS
- ▨ (MH) MIXED HARDWOODS

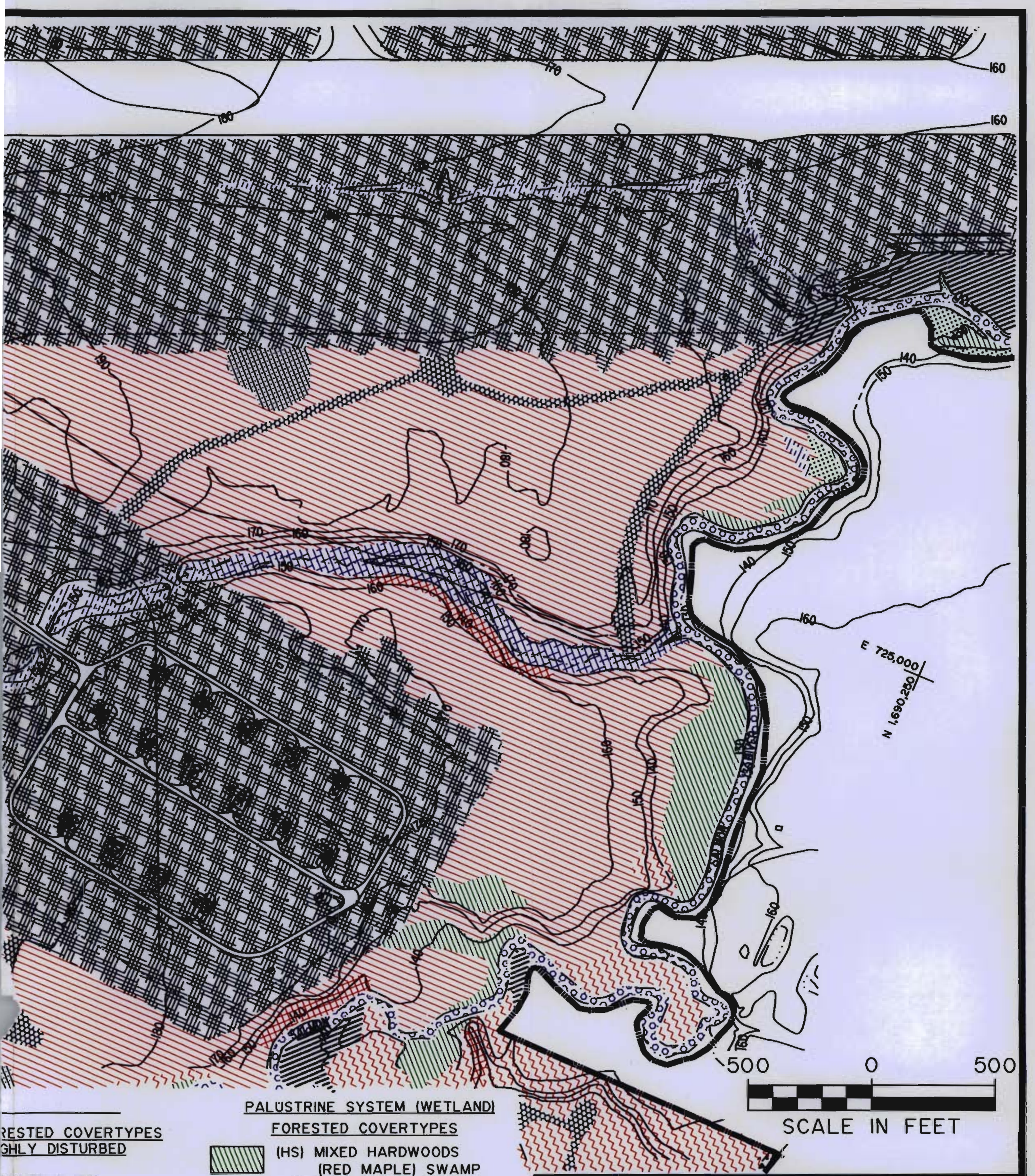
NON-FORESTED COVERTYPES MODERATELY DISTURBED

- ▨ (DM) DRY MEADOW
- ▨ (SU) SUCCESSIONAL SHRUBLAND
- ▬ LIMIT OF INVESTIGATED AREA

NON-FOR HI

- ▨ (ML) M
- ▨ (PS) U
- ▨ (UP) U

CC-2853B COLORPLOT



RESTED COVERTYPES
GHLY DISTURBED

IOWED LAWN

NVEGETATED PERMEABLE
SURFACES

NPAVED ROAD/ROADSIDE/
PATHWAY

PALUSTRINE SYSTEM (WETLAND)

FORESTED COVERTYPES

▨ (HS) MIXED HARDWOODS
(RED MAPLE) SWAMP

NON-FORESTED COVERTYPES

▨ (SH) SHRUB SWAMP

▨ (WM) WET MEADOW

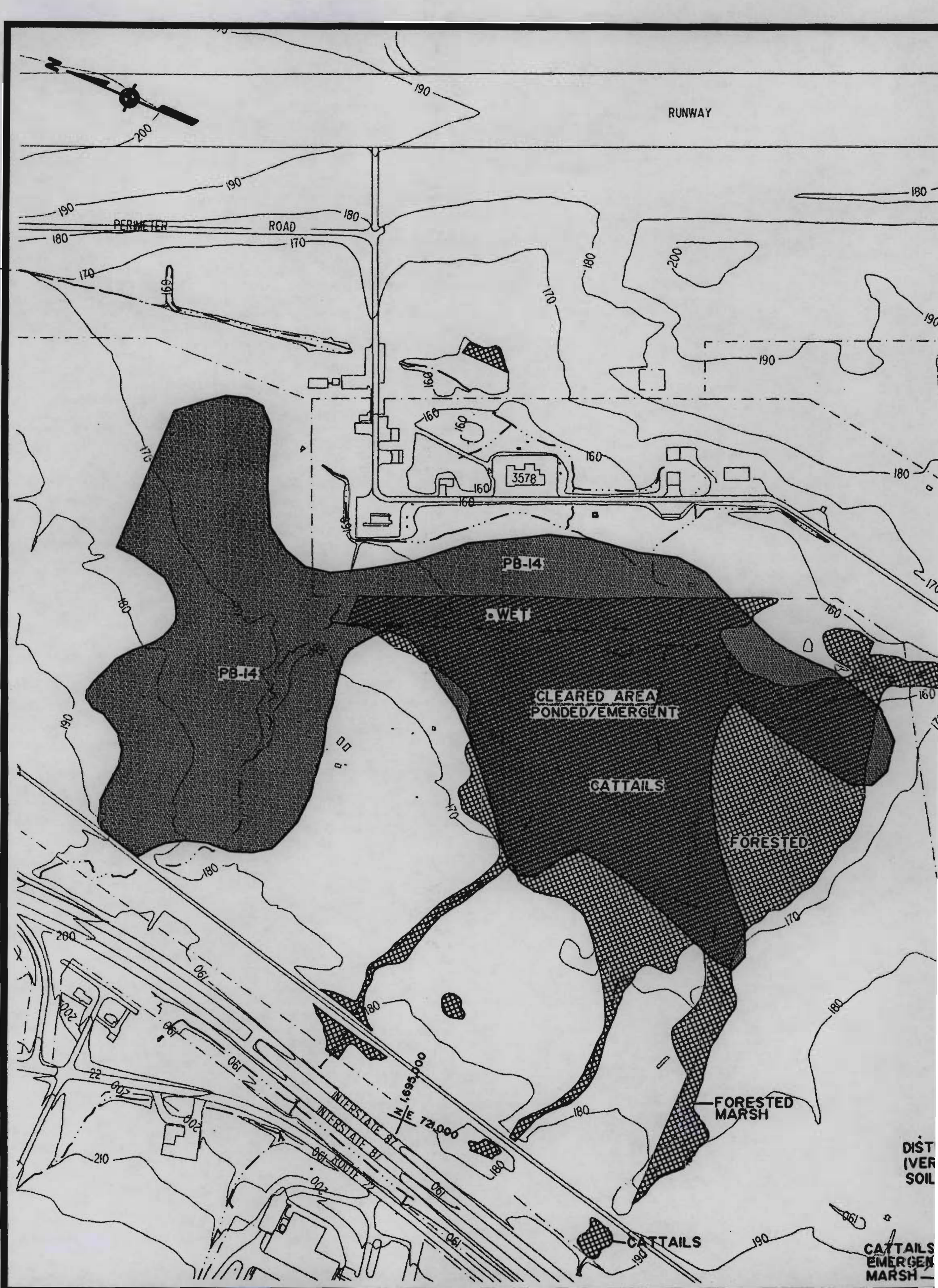
PLATTSBURGH A.F.B.- SS-013
HABITAT COVERTYPES

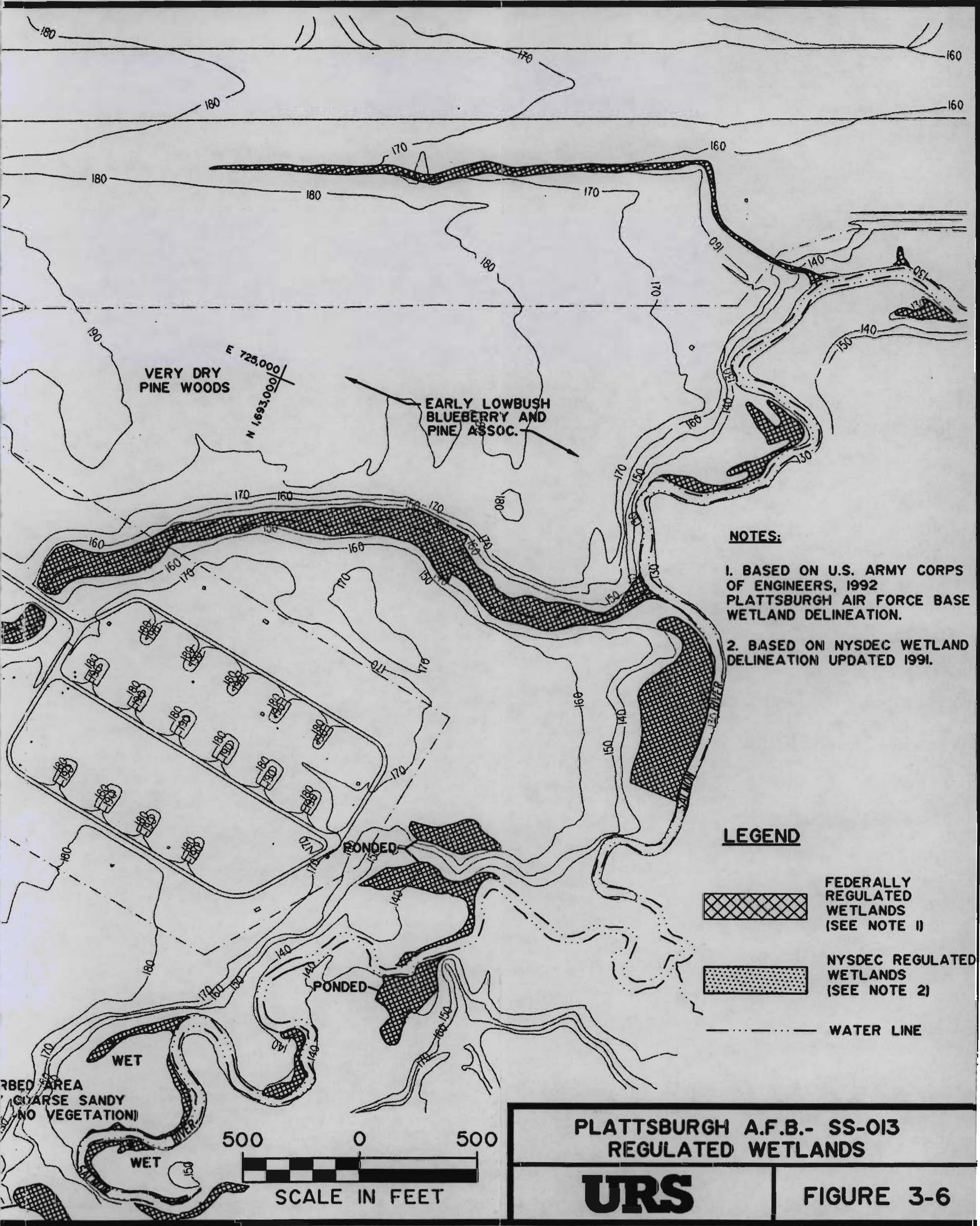
URS

FIGURE 3-5

J:\35721.01\CAD\SS013 1=500 4/12/01-1 RAL

CC-6831





NOTES:

1. BASED ON U.S. ARMY CORPS OF ENGINEERS, 1992 PLATTSBURGH AIR FORCE BASE WETLAND DELINEATION.

2. BASED ON NYSDEC WETLAND DELINEATION UPDATED 1991.

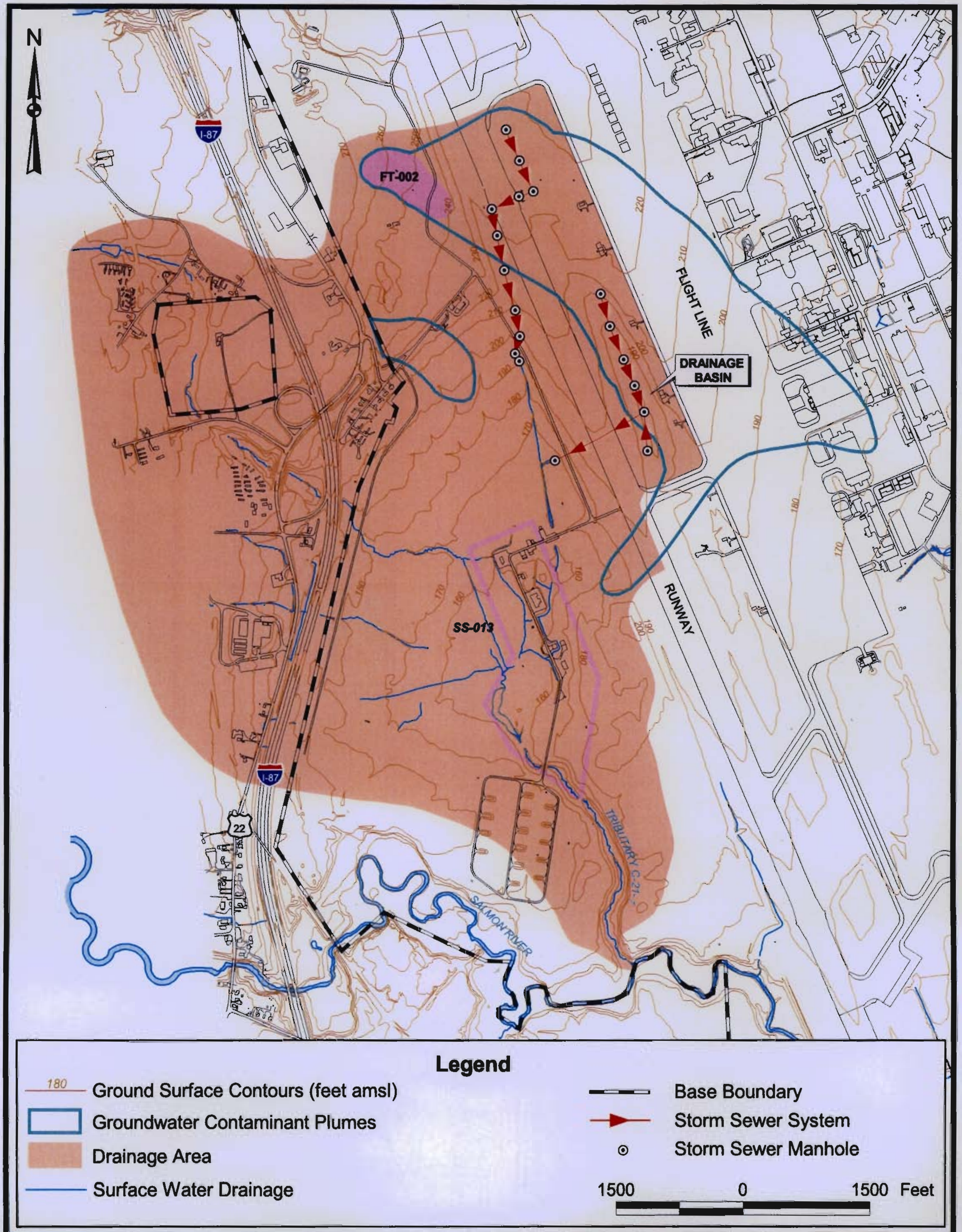
LEGEND

▨	FEDERALLY REGULATED WETLANDS (SEE NOTE 1)
░	NYSDEC REGULATED WETLANDS (SEE NOTE 2)
—··—··—	WATER LINE

PLATTSBURGH A.F.B.- SS-013
REGULATED WETLANDS

URS

FIGURE 3-6



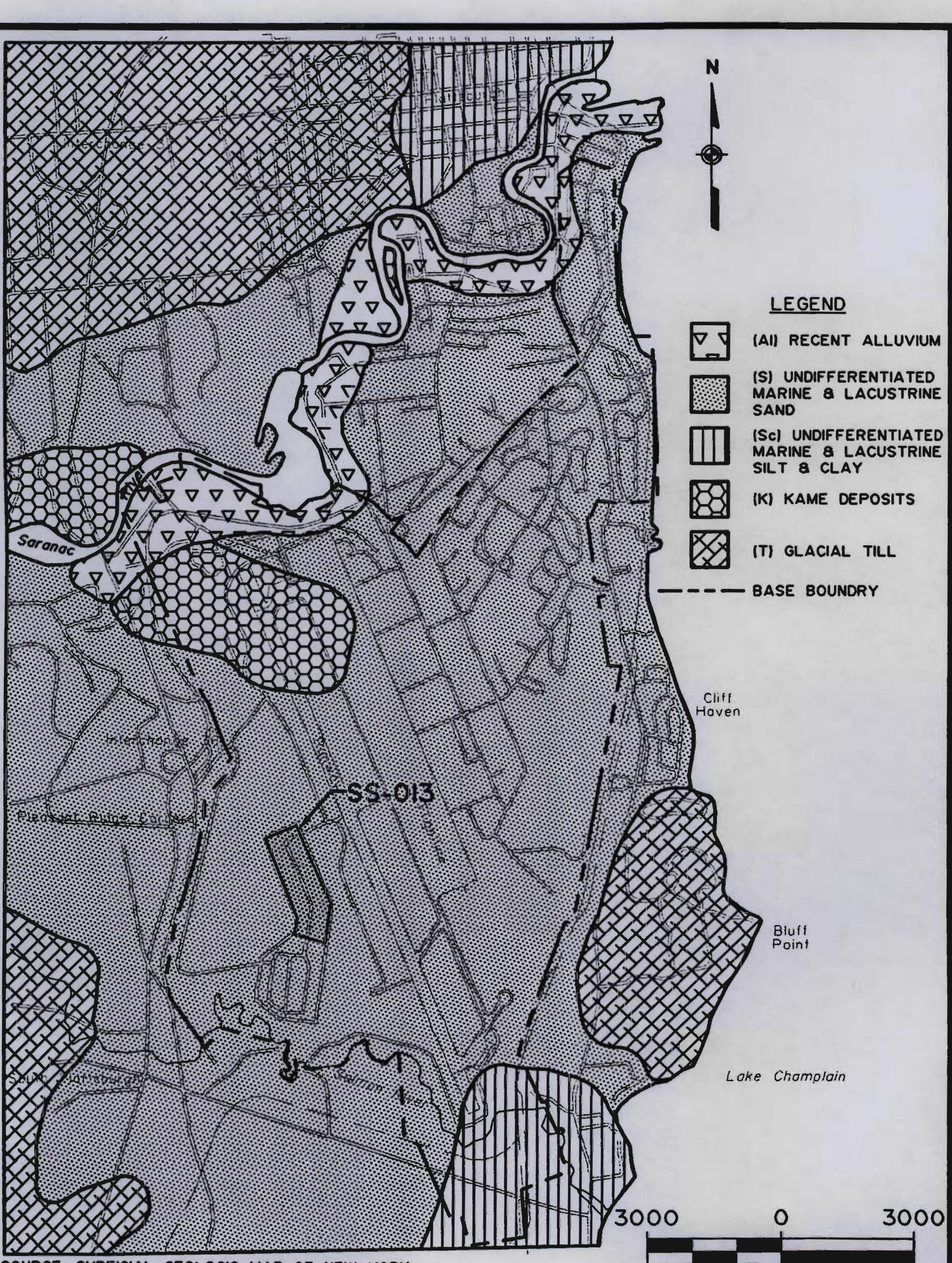
URS

MUNITIONS MAINTENANCE SQUADRON (SS-013)
SURFACE DRAINAGE FEATURES

FIGURE 3-7

J:\0100013.10\gis\Applications\ss-013.apr SURFACE DRAINAGE FEATURES
8/27/2001

J:\35721.01\CAD\SS013\ 1=3000 4/16/01-2 BJG



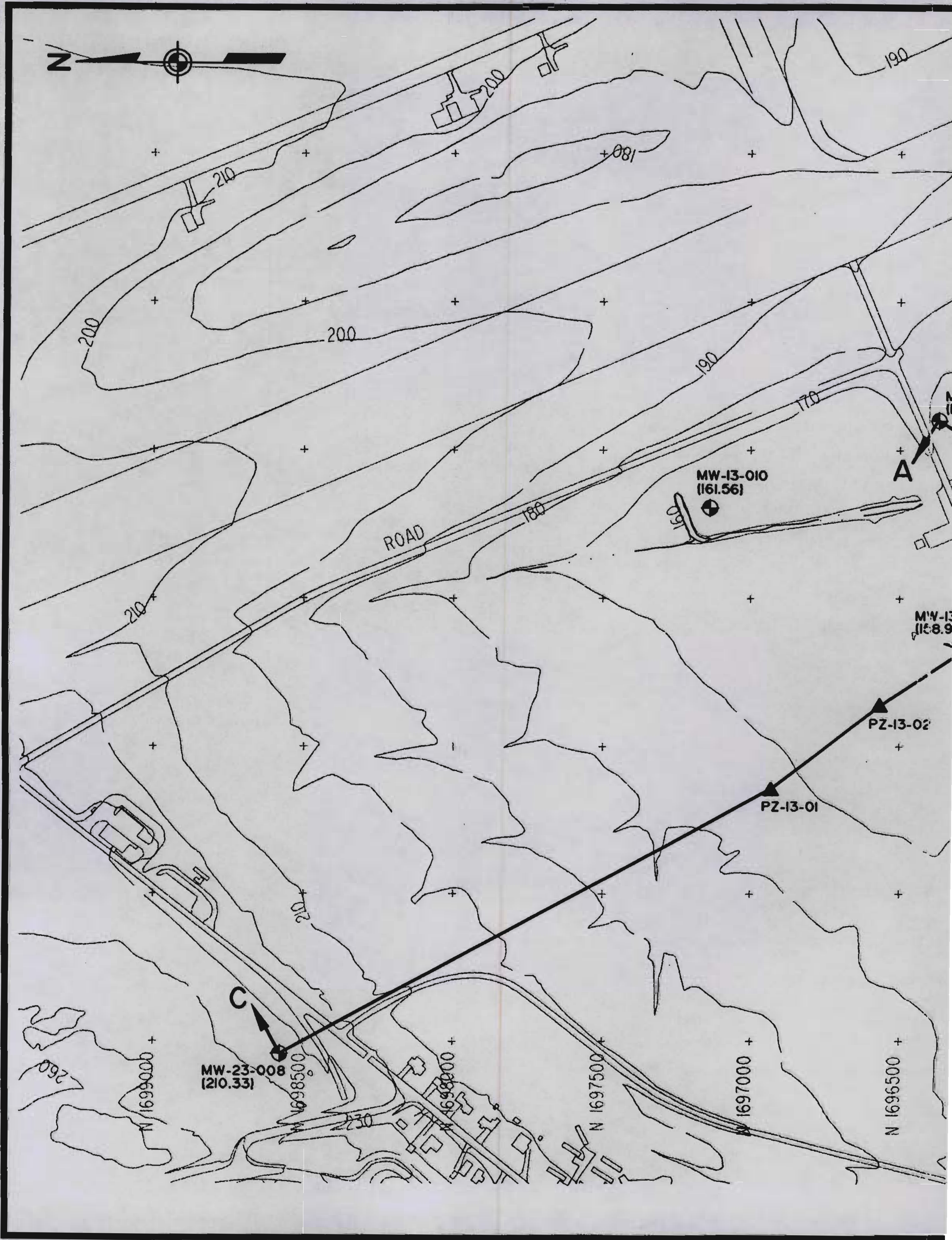
SOURCE: SURFICIAL GEOLOGIC MAP OF NEW YORK, ADIRONDAK SHEET, CADWELL, et. al. 1991

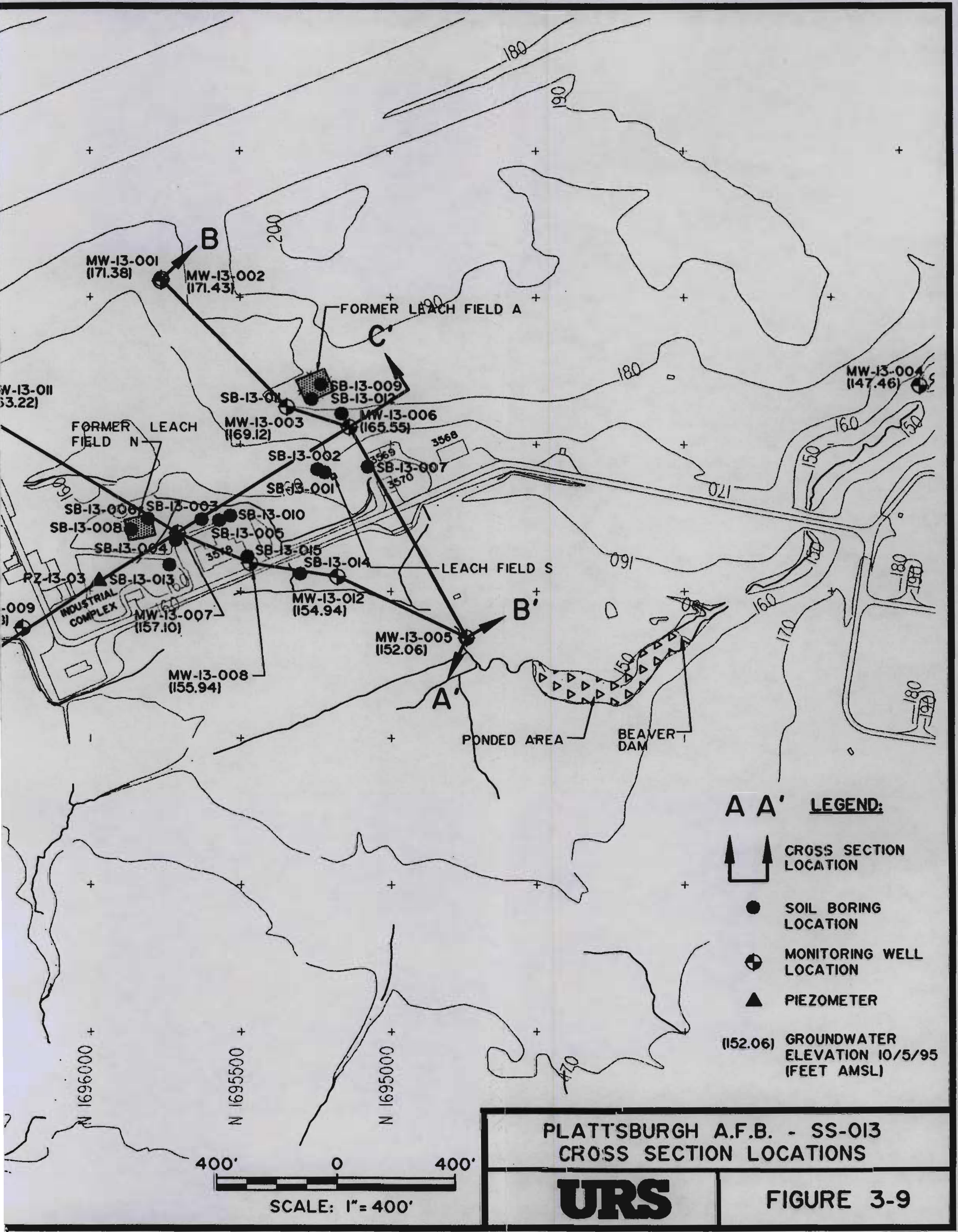
URS

PLATTSBURGH A.F.B. AND VICINITY SURFICIAL GEOLOGY

FIGURE 3-8

AC-5857B

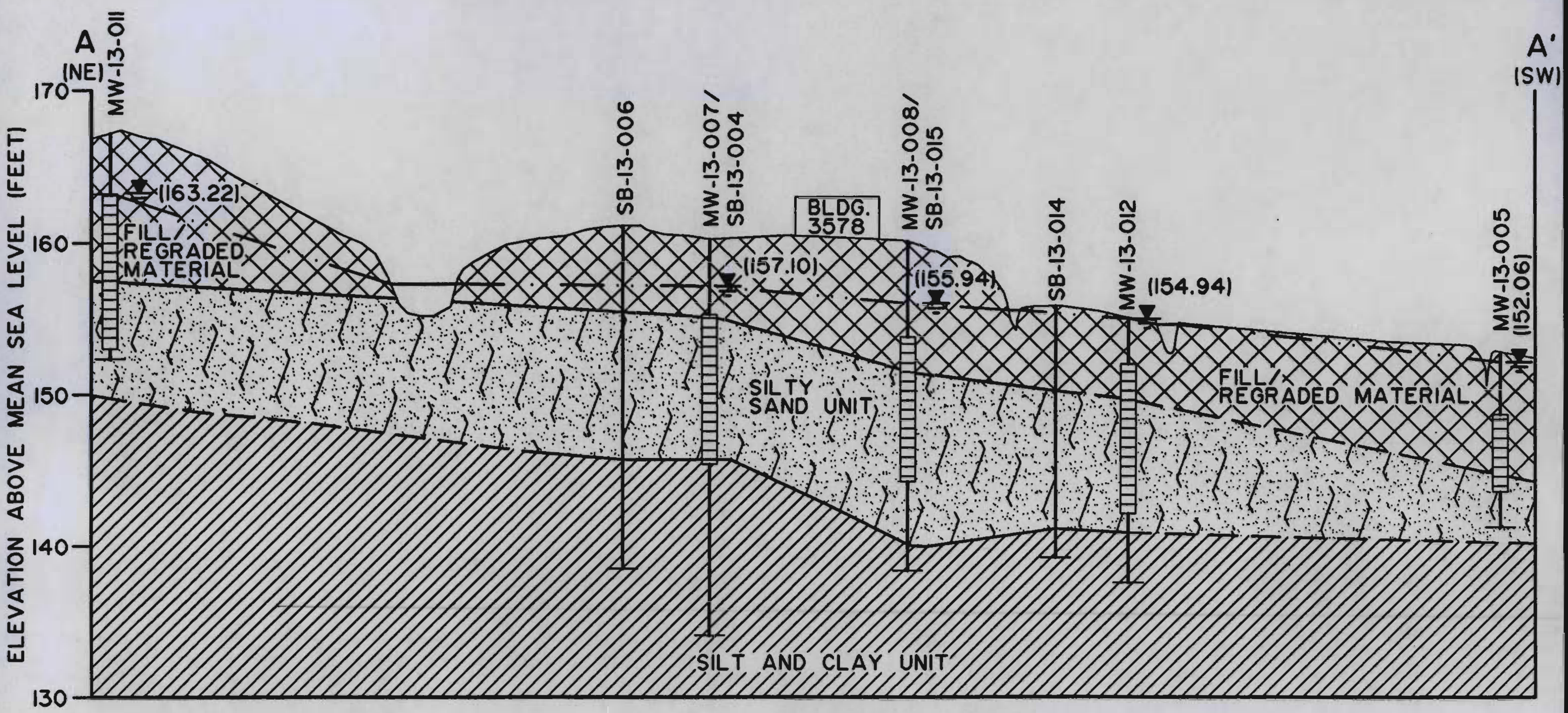

N
190
200
180
210
200
200
190
170
ROAD
180
160
210
210
MW-13-010
(161.56)
A
MW-13
(158.9
PZ-13-02
PZ-13-01
C
MW-23-008
(210.33)
260
230
N 1699000
N 1698500
N 1698000
N 1697500
N 1697000
N 1696500



PLATTSBURGH A.F.B. - SS-013
CROSS SECTION LOCATIONS

URS

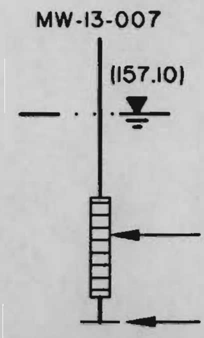
FIGURE 3-9



NOTES:

1. GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARDLY ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.
2. ELEVATIONS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.

LEGEND:



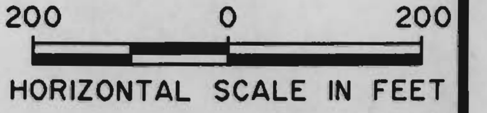
MONITORING WELL NUMBER

POTENTIOMETRIC SURFACE
(157.10) GROUNDWATER ELEVATION
(10/5/95 UNLESS OTHERWISE SPECIFIED)

SCREENED INTERVAL OF MONITORING WELL

BOREHOLE TERMINATION

VERTICAL
EXAGGERATION = 20X

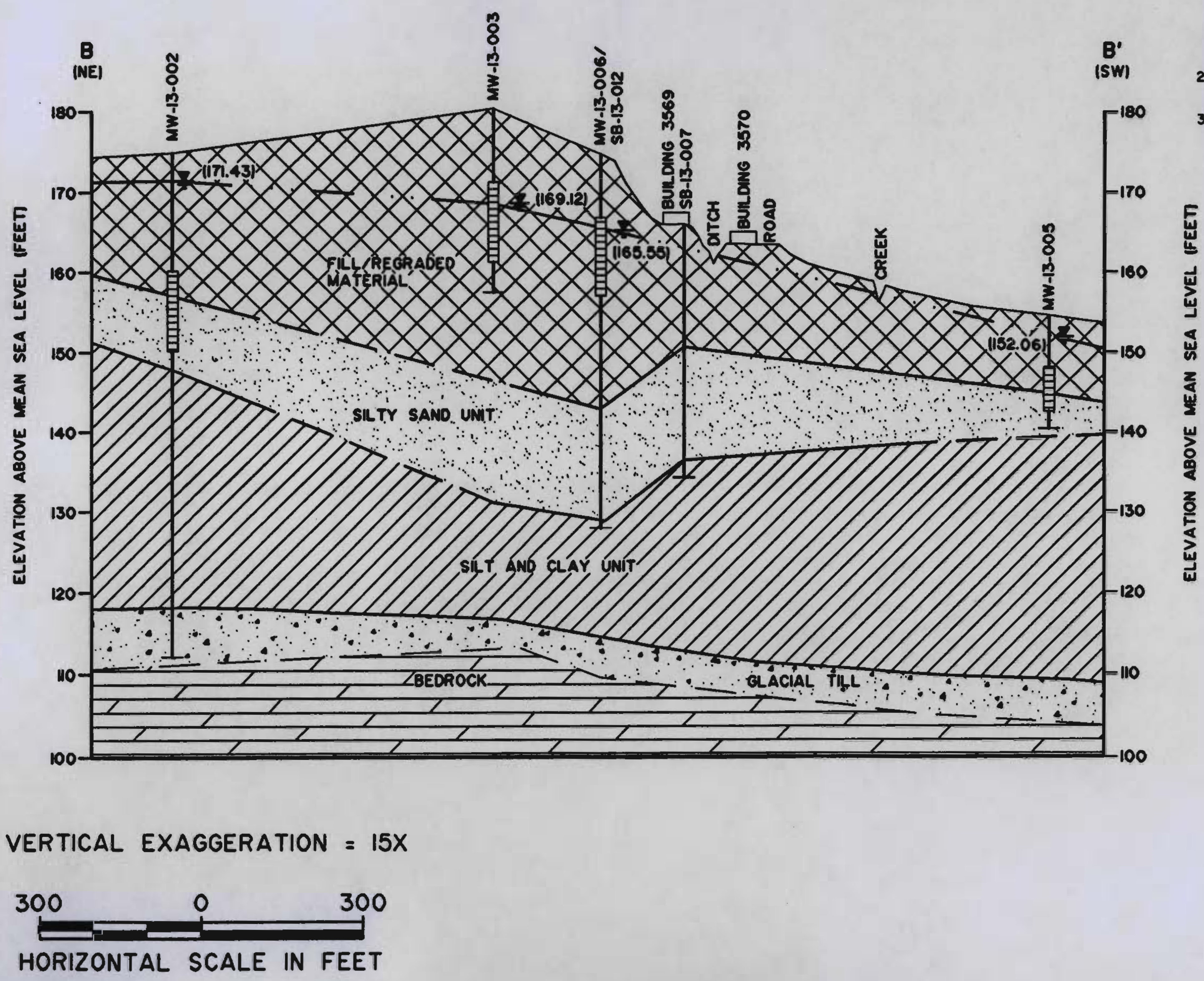


HORIZONTAL SCALE IN FEET

URS

PLATTSBURGH A.F.B. - SS-013
CROSS-SECTION A-A'

FIGURE 3-10



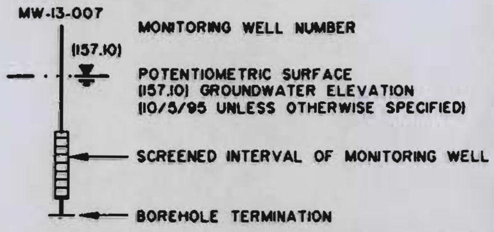
VERTICAL EXAGGERATION = 15X

HORIZONTAL SCALE IN FEET

NOTES:

1. GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARDLY ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.
2. ELEVATIONS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. BED ROCK SURFACE INFERRED FROM SEISMIC RESULTS (MALCOLM PIRNIE, 1996)

LEGEND:



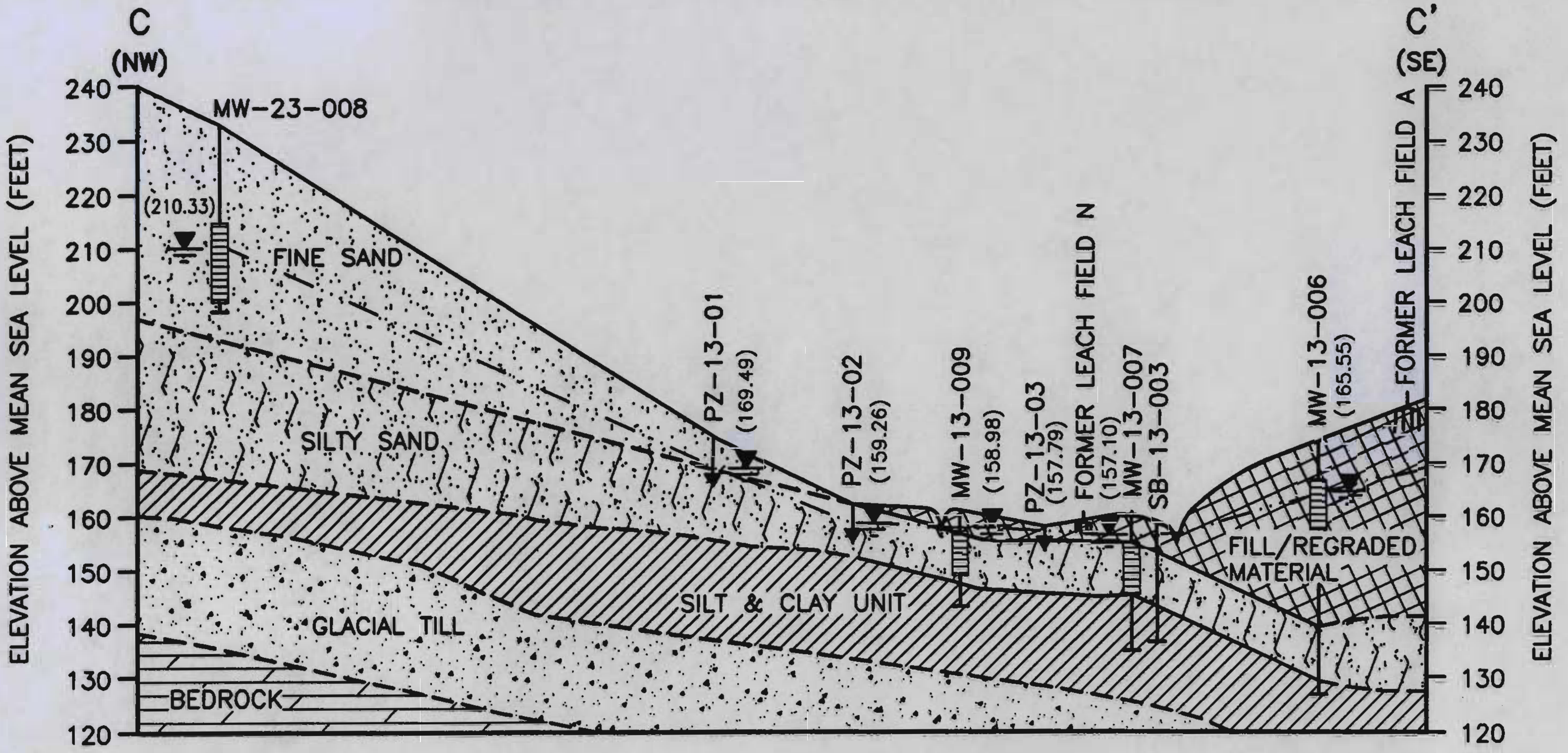
URS

PLATTSBURGH A.F.B. - SS013
CROSS-SECTION B-B'

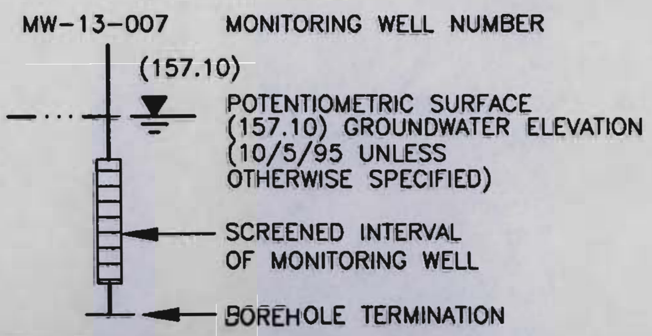
FIGURE 3-11

AC-9506A

J:\35721.01\CAD\SS013 1=60 4/16/01-3 BJG



LEGEND



↓ PIEZOMETER LOCATION

⇨ GROUNDWATER FLOW DIRECTION

⋔ LEACH FIELD

600 0 600

HORIZONTAL SCALE (FEET)

VERTICAL EXAGGERATION=20X

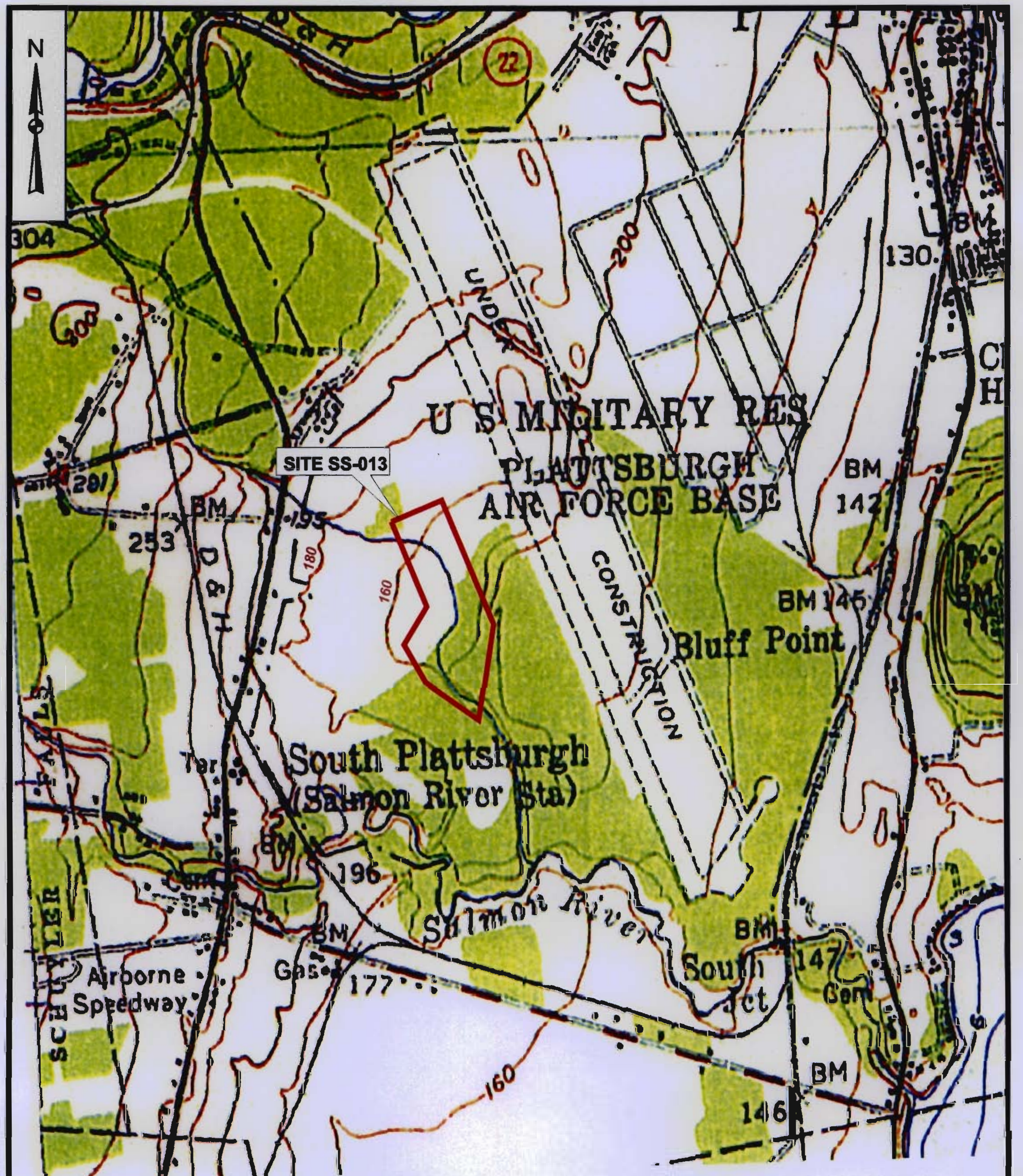
NOTES:

1. GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARDLY ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.
2. ELEVATIONS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.

URS

PLATTSBURGH A.F.B. - SS013
CROSS-SECTION C-C'

FIGURE 3-12



Contour Interval = 20 feet

SOURCE: UGSG 1956 15 minute series Topographic Map (Plattsburgh, NY-VT).

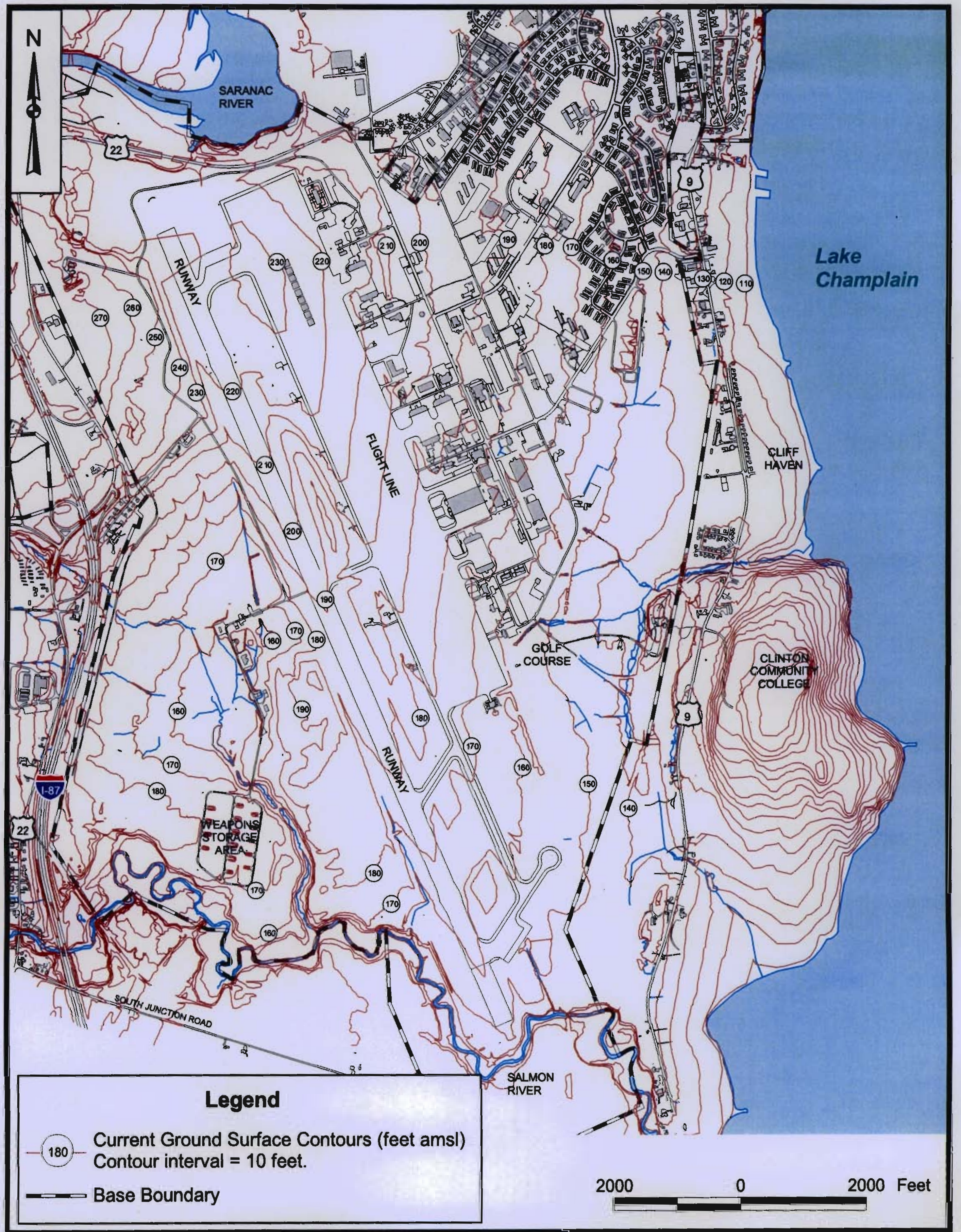
2000 0 2000 Feet

URS

MUNITIONS MAINTENANCE SQUADRON (SS-013)
PRE-BASE (1956) TOPOGRAPHIC MAP

FIGURE 3-13

J:\0100013.10\gis\Applications\ss-013.apr 1957 USGS QUAD
[illegible]

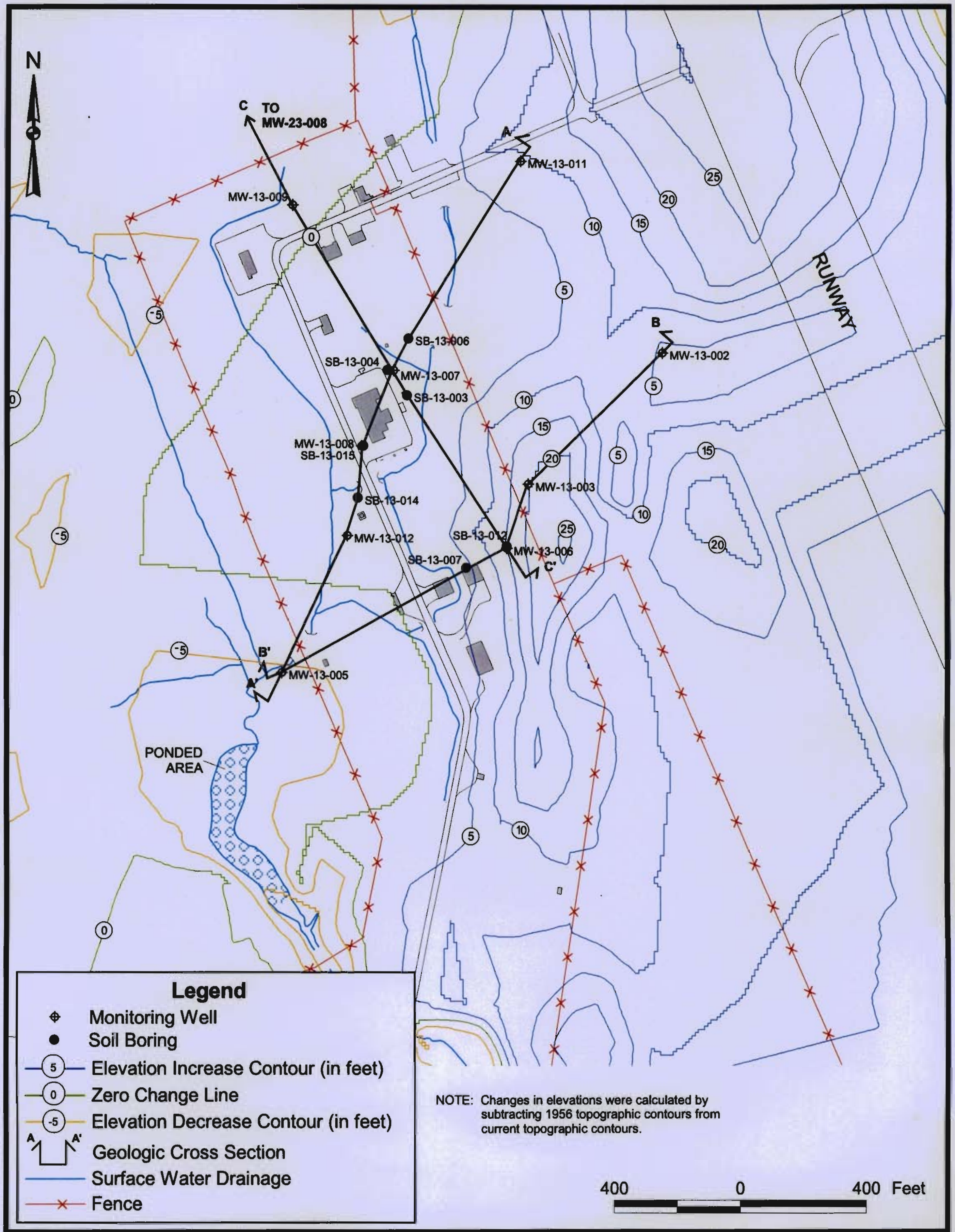


URS

MUNITIONS MAINTENANCE SQUADRON (SS-013)
CURRENT TOPOGRAPHIC MAP

FIGURE 3-14

J:\01000013.10\gis\Applications\ss-013.apr SURFACE CONTOURS
4/9/2001



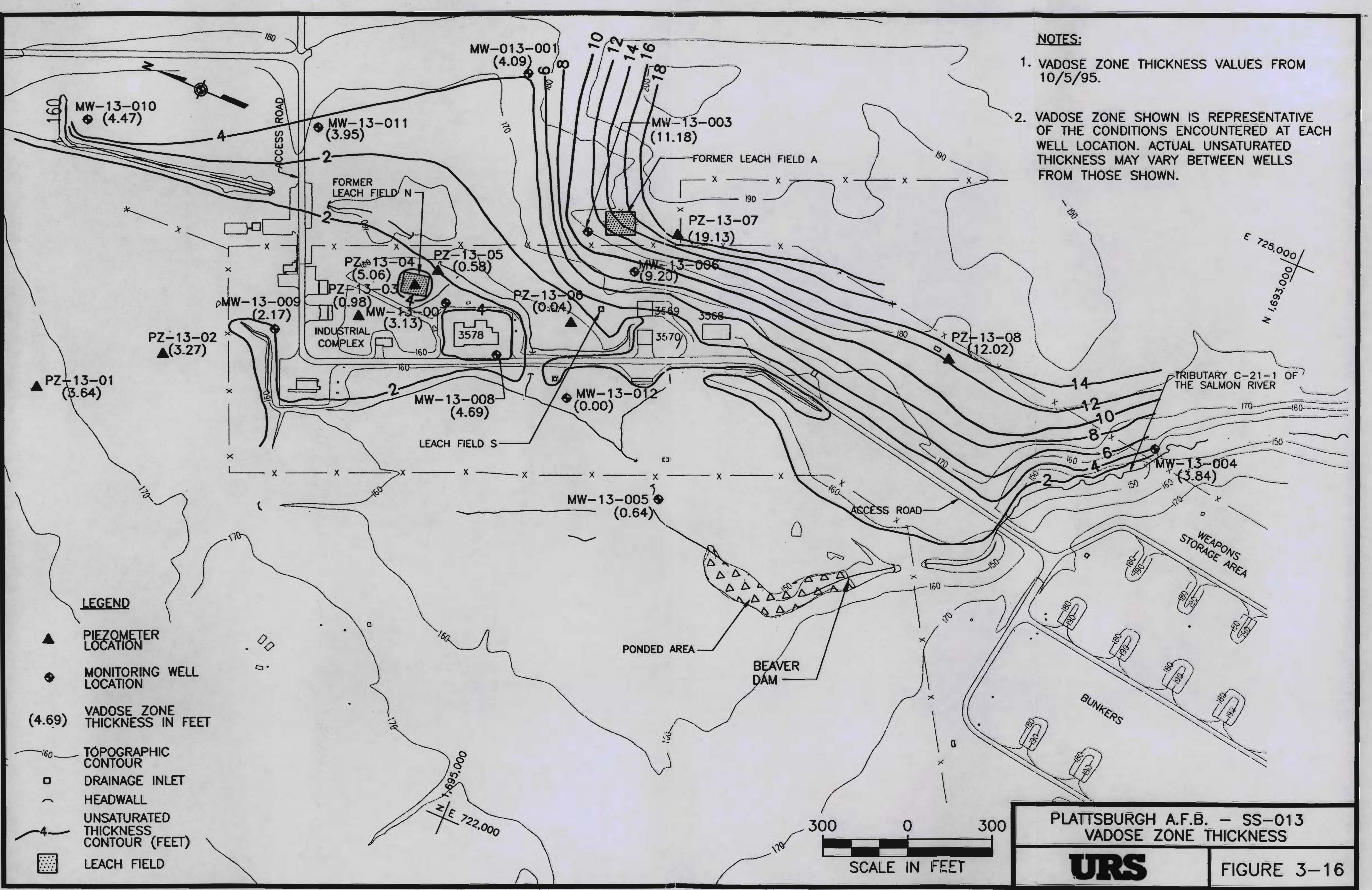
NOTE: Changes in elevations were calculated by subtracting 1956 topographic contours from current topographic contours.

J:\0100013.10\gis\Applications\ss-013.apr BASE CONSTRUCTION CUT AND FILL
4/6/2001

URS

MUNITIONS MAINTENANCE SQUADRON (SS-013)
ESTIMATED SURFACE ELEVATION CHANGES
DUE TO BASE CONSTRUCTION

FIGURE 3-15



NOTES:

1. VADOSE ZONE THICKNESS VALUES FROM 10/5/95.
2. VADOSE ZONE SHOWN IS REPRESENTATIVE OF THE CONDITIONS ENCOUNTERED AT EACH WELL LOCATION. ACTUAL UNSATURATED THICKNESS MAY VARY BETWEEN WELLS FROM THOSE SHOWN.

LEGEND

▲	PIEZOMETER LOCATION
⊕	MONITORING WELL LOCATION
(4.69)	VADOSE ZONE THICKNESS IN FEET
—160—	TOPOGRAPHIC CONTOUR
◻	DRAINAGE INLET
⌒	HEADWALL
—4—	UNSATURATED THICKNESS CONTOUR (FEET)
▨	LEACH FIELD

300 0 300

SCALE IN FEET

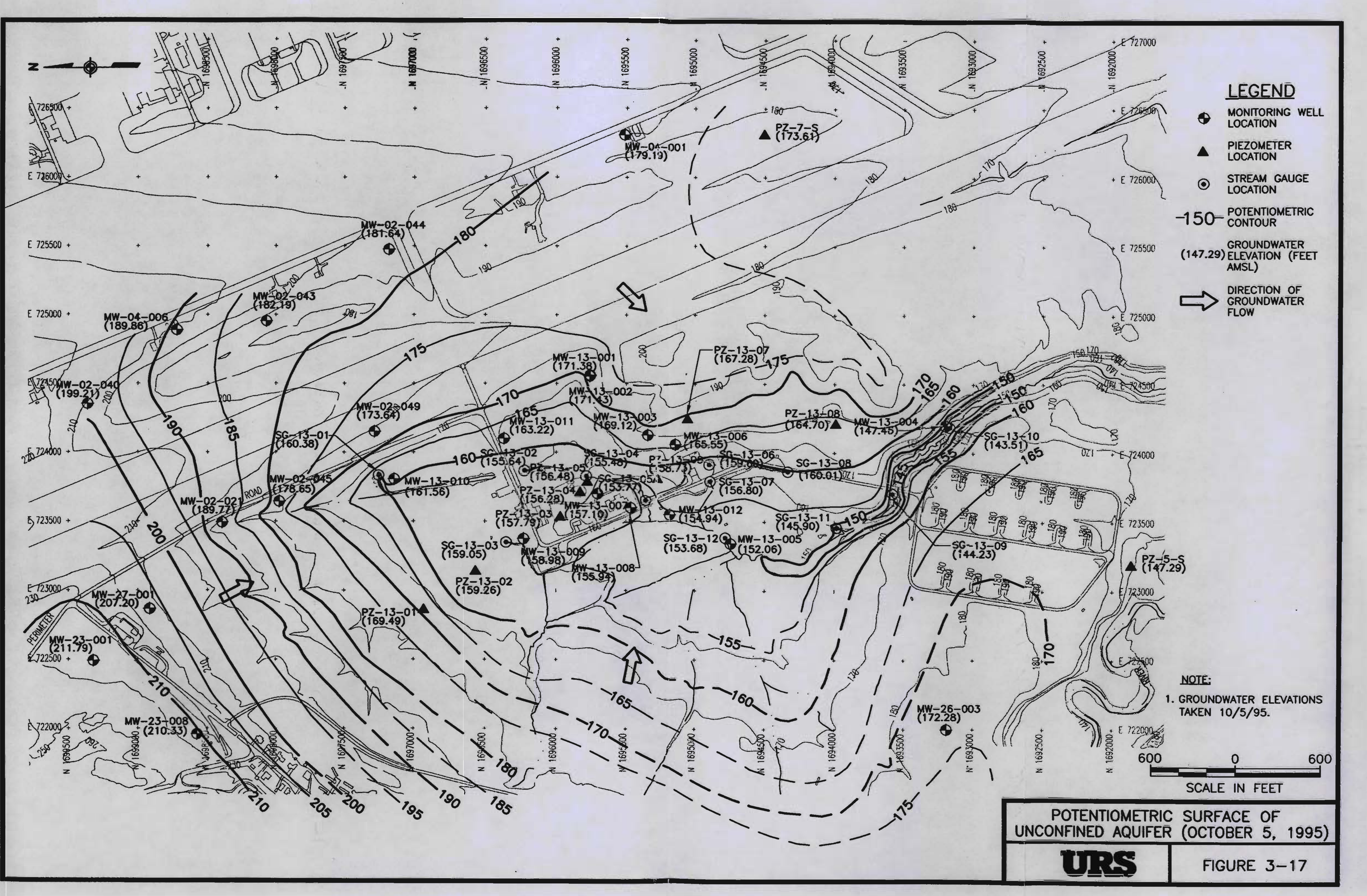
PLATTSBURGH A.F.B. – SS-013
VADOSE ZONE THICKNESS

URS

FIGURE 3-16

33721.01\CAD\SS013\ 1=300 4/19/01-2 RAL

CC-6833



NOTE:

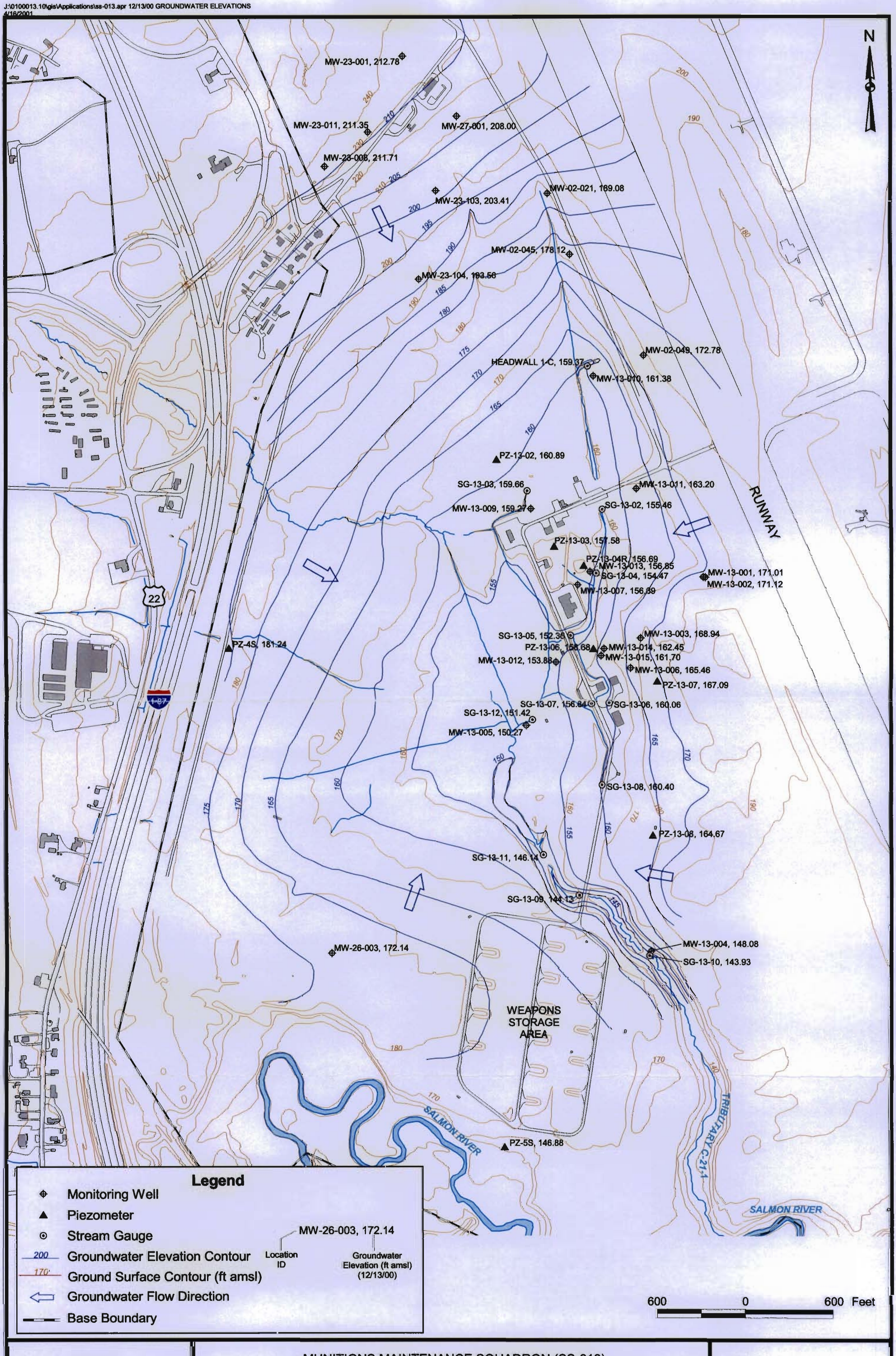
1. GROUNDWATER ELEVATIONS TAKEN 10/5/95.

URS

POTENTIOMETRIC SURFACE OF UNCONFINED AQUIFER (OCTOBER 5, 1995)

FIGURE 3-17

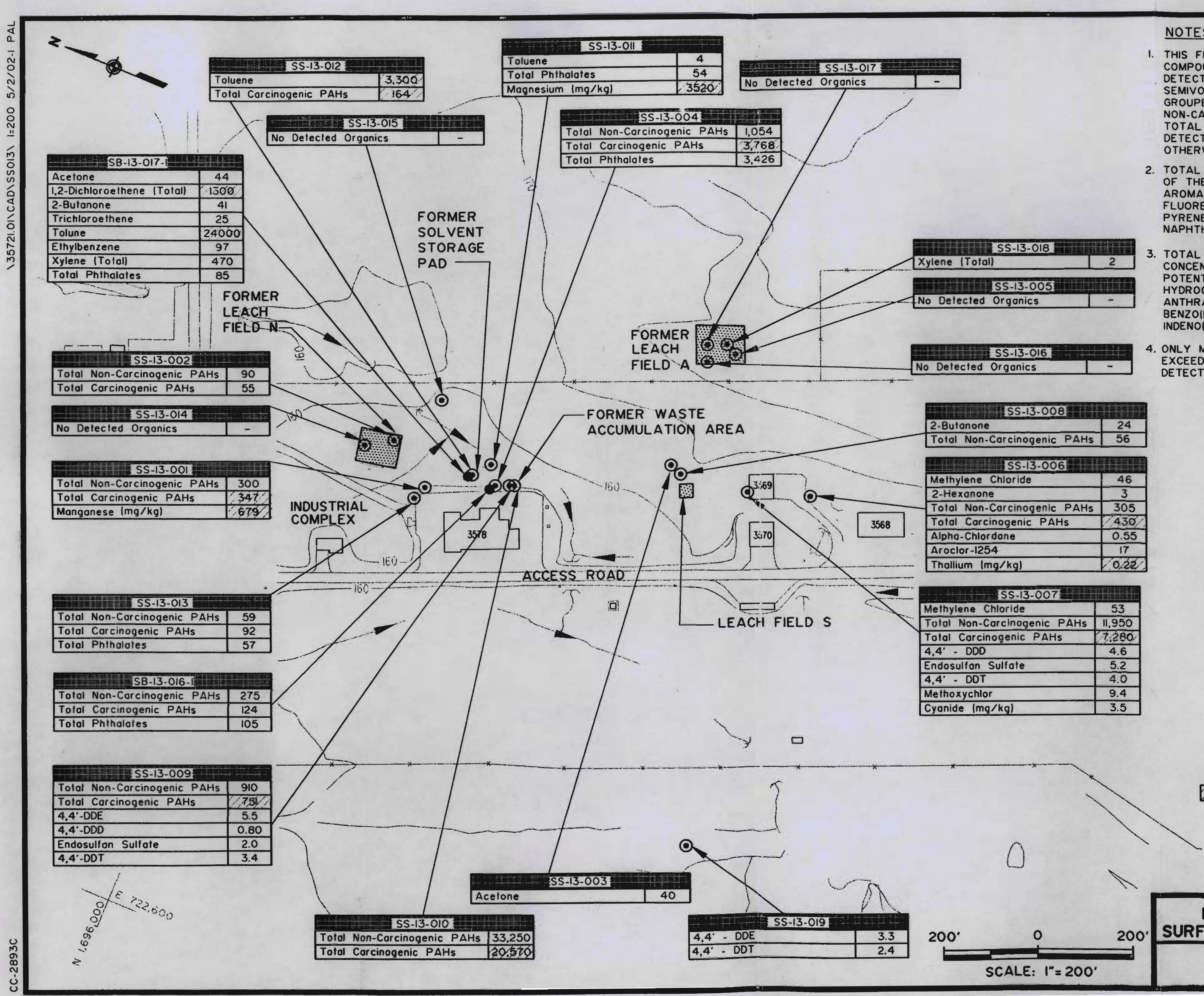
J:\0100013.10\gis\Applications\ss-013.apr 12/13/00 GROUNDWATER ELEVATIONS
4/16/2001



URS

MUNITIONS MAINTENANCE SQUADRON (SS-013)
POTENTIOMETRIC SURFACE OF THE UNCONFINED AQUIFER
(DECEMBER 13, 2000)

FIGURE 3-18



SS-13-012	
Toluene	3,300
Total Carcinogenic PAHs	164

SS-13-011	
Toluene	4
Total Phthalates	54
Magnesium (mg/kg)	3520

SS-13-017	
No Detected Organics	-

SS-13-015	
No Detected Organics	-

SS-13-004	
Total Non-Carcinogenic PAHs	1,054
Total Carcinogenic PAHs	3,768
Total Phthalates	3,426

SB-13-017-I	
Acetone	44
1,2-Dichloroethene (Total)	1300
2-Butanone	41
Trichloroethene	25
Tolune	24000
Ethylbenzene	97
Xylene (Total)	470
Total Phthalates	85

SS-13-018	
Xylene (Total)	2

SS-13-005	
No Detected Organics	-

SS-13-016	
No Detected Organics	-

SS-13-002	
Total Non-Carcinogenic PAHs	90
Total Carcinogenic PAHs	55

SS-13-014	
No Detected Organics	-

SS-13-008	
2-Butanone	24
Total Non-Carcinogenic PAHs	56

SS-13-001	
Total Non-Carcinogenic PAHs	300
Total Carcinogenic PAHs	347
Manganese (mg/kg)	679

SS-13-006	
Methylene Chloride	46
2-Hexanone	3
Total Non-Carcinogenic PAHs	305
Total Carcinogenic PAHs	430
Alpha-Chlordane	0.55
Aroclor-1254	17
Thallium (mg/kg)	0.22

SS-13-013	
Total Non-Carcinogenic PAHs	59
Total Carcinogenic PAHs	92
Total Phthalates	57

SS-13-007	
Methylene Chloride	53
Total Non-Carcinogenic PAHs	11,950
Total Carcinogenic PAHs	7,280
4,4' - DDD	4.6
Endosulfan Sulfate	5.2
4,4' - DDT	4.0
Methoxychlor	9.4
Cyanide (mg/kg)	3.5

SB-13-016-I	
Total Non-Carcinogenic PAHs	275
Total Carcinogenic PAHs	124
Total Phthalates	105

SS-13-009	
Total Non-Carcinogenic PAHs	910
Total Carcinogenic PAHs	751
4,4'-DDE	5.5
4,4'-DDD	0.80
Endosulfan Sulfate	2.0
4,4'-DDT	3.4

SS-13-003	
Acetone	40

SS-13-010	
Total Non-Carcinogenic PAHs	33,250
Total Carcinogenic PAHs	20,570

SS-13-019	
4,4' - DDE	3.3
4,4' - DDT	2.4

NOTES:

1. THIS FIGURE PRESENTS ALL VOLATILE ORGANIC COMPOUNDS, PESTICIDES, AND PCBS (SEE NOTE 4) DETECTED IN THE SURFACE SOIL SAMPLES. SEMIVOLATILE ORGANIC COMPOUNDS HAVE BEEN GROUPED INTO: TOTAL PHTHALATES, TOTAL NON-CARCINOGENIC PAHS (SEE NOTE 2); AND TOTAL CARCINOGENIC PAHS (SEE NOTE 3). ALL DETECTIONS ARE REPORTED IN µg/kg UNLESS OTHERWISE INDICATED.
2. TOTAL NON-CARCINOGENIC PAHS = THE TOTAL OF THESE NON-CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBON COMPOUNDS: ACENAPHTHENE, FLUORENE, PHENANTHRENE, ANTHRACENE, FLUORANTHENE, PYRENE, BENZO(G,H,I)PERYLENE, DIBENZOFURAN, AND NAPHTHALENE.
3. TOTAL CARCINOGENIC PAHS= THE TOTAL OF THE CONCENTRATIONS OF THESE CARCINOGENIC OR POTENTIALLY CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBON COMPOUNDS: CARBAZOLE, BENZO(A), ANTHRACENE, CHRYSENE, BENZO (B)FLUORANTHENE, BENZO(K)FLUORANTHENE, BENZO(A)PYRENE, INDENO(1,2,3-CD)PYRENE, AND DIBENZ(A,H)ANTHRACENE.
4. ONLY METALS DETECTIONS WHOSE CONCENTRATIONS EXCEEDED TBCs ARE REPORTED. ALL CYANIDE DETECTIONS ARE REPORTED.

LEGEND

⊙	SURFACE SOIL SAMPLE
●	SOIL BORING SURFICAL SOIL SAMPLE
▦	LEACH FIELDS
—190—	TOPOGRAPHIC CONTOUR
——	SURFACE DRAINAGE AND FLOW DIRECTION
▨	EXCEEDS TBC VALUE (FOR PAHs, AT LEAST ONE PAH COMPOUND DETECTION EXCEEDS TBCs)

PLATTSBURGH AFB SS-013 RI
SURFACE SOIL RESULTS (1993 & 1995)

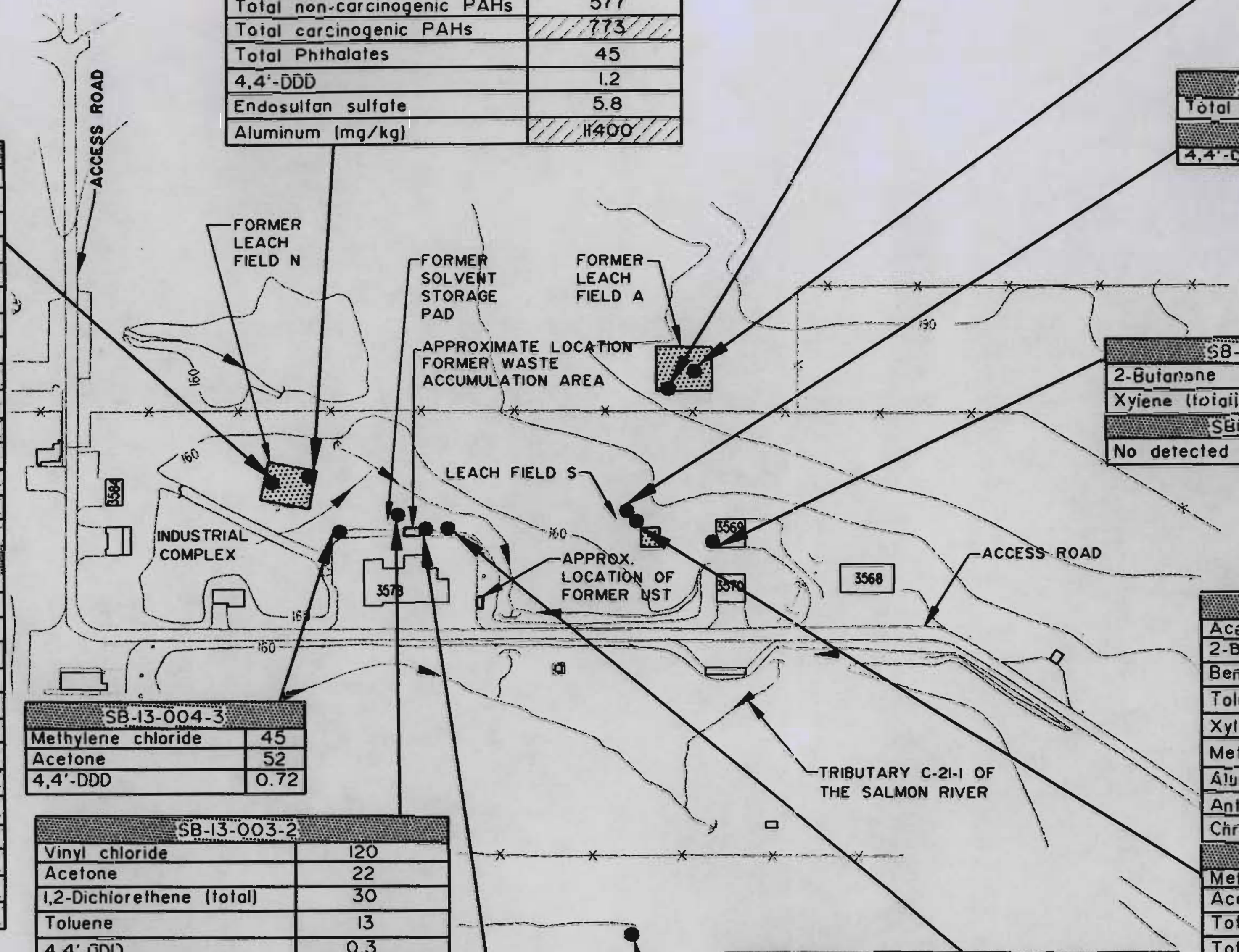
URS

FIGURE 5-1

\35721.01\CAD\SS013\ 1:200 5/2/02-1 PAL

CC-2893C

\35721.01\CAD\SS013\ 1=300 5/2/02-1 PAL



SB-13-006-2	
Ethylbenzene	6
Xylene (total)	47
Total non-carcinogenic PAHs	6,030
Total carcinogenic PAHs	▨ 8,530
4,4'-DDD	3.6
SB-13-006-4	
2-Butanone	11
Total non-carcinogenic PAHs	577
Total carcinogenic PAHs	▨ 773
Total Phthalates	45
4,4'-DDD	1.2
Endosulfan sulfate	5.8
Aluminum (mg/kg)	▨ 11400

SB-13-011-10	
Total Phthalates	29
SB-13-011-12	
Total Phthalates	10

SB-13-009-2	
1,2,4-Trichlorobenzene	12
1,2-Dichlorobenzene	23
Total Phthalates	35
SB-13-009-10	
Total Phthalates	46

SB-13-002-2	
Total Phthalates	13
SB13-002-3	
4,4'-DDD	0.29

SB-13-008-2	
Toluene	4
Xylene	3
Total non-carcinogenic PAHs	11
Total Phthalates	41
4,4'-DDE	4.8
4,4'-DDD	1.8
4,4'-DDT	5.8
Alpha-chlordane	0.30
Arsenic (mg/kg)	▨ 27.7
Calcium (mg/kg)	▨ 57,700
Lead (mg/kg)	▨ 162
Magnesium (mg/kg)	▨ 9740
Nickel (mg/kg)	▨ 16.9
Potassium (mg/kg)	▨ 1090
Zinc (mg/kg)	▨ 66.4
SB-13-008-4	
Total non-carcinogenic PAHs	33
Total Phthalates	44
4,4'-DDE	11
4,4'-DDD	2.4
4,4'-DDT	7.6
Aluminum (mg/kg)	▨ 10100
Arsenic (mg/kg)	▨ 27.2
Calcium (mg/kg)	▨ 60,200
Copper (mg/kg)	▨ 43.1
Lead (mg/kg)	▨ 1,370
Magnesium (mg/kg)	▨ 6830
Nickel (mg/kg)	▨ 20.8
Potassium (mg/kg)	▨ 1680
Zinc (mg/kg)	▨ 116

SB-13-007-3	
2-Butanone	16
Xylene (total)	13
SB13-007-5	
No detected organics	—

SB-13-004-3	
Methylene chloride	45
Acetone	52
4,4'-DDD	0.72

SB-13-003-2	
Vinyl chloride	120
Acetone	22
1,2-Dichlorethene (total)	30
Toluene	13
4,4'-DDD	0.3
Aluminum (mg/kg)	▨ 15500
Chromium (mg/kg)	▨ 23
Magnesium (mg/kg)	▨ 3430
Nickel (mg/kg)	▨ 14.9
Potassium (mg/kg)	▨ 1090
SB-13-03-5	
1,2-Dichloroethene (total)	97
Toluene	14
Total Phthalates	9

SB-13-001-2	
Acetone	▨ 610
2-Butanone	170
Benzene	10
Toluene	110
Xylene (total)	25
Methoxychlor	5.3
Aluminum (mg/kg)	▨ 13700
Antimony (mg/kg)	▨ 15.7
Chromium (mg/kg)	▨ 128
SB-13-001-3	
Methylene chloride	24
Acetone	150
Total non-carcinogenic PAHs	1,763
Total carcinogenic PAHs	130
Total Phthalates	54
Endrin ketone	20
4,4'-DDE (mg/kg)	1.4
Antimony (mg/kg)	▨ 23.6
Chromium (mg/kg)	▨ 92
Selenium (mg/kg)	▨ 5.6

SB-13-010-2	
Total non-carcinogenic PAHs	1,252
Total carcinogenic PAHs	▨ 1,026
4,4'-DDE	1.8
4,4'-DDD	0.82
4,4'-DDT	2.9
Methoxychlor	0.89
SB-13-010-4	
Total non-carcinogenic PAHs	37,930
Total carcinogenic PAHs	▨ 24,100
Dieldrin	1.8

SB-13-005-3	
Toluene	0.9
Total non-carcinogenic PAHs	117
Total Phthalates	80
4,4'-DDE	1.1
4,4'-DDD	3.4

SS-13-019-3	
Total Phthalates	10
Aluminum (mg/kg)	▨ 9340
Potassium (mg/kg)	▨ 1190

NOTES:

1. THIS FIGURE PRESENTS ALL VOLATILE ORGANIC COMPOUNDS, PESTICIDES, AND PCBs (SEE NOTE 4) DETECTED IN THE SUBSURFACE SOIL SAMPLES. SEMIVOLATILE ORGANIC COMPOUNDS HAVE BEEN GROUPED INTO: TOTAL PHTHALATES, TOTAL NON-CARCINOGENIC PAHS (SEE NOTE 2); AND TOTAL CARCINOGENIC PAHS (SEE NOTE 3). ALL DETECTIONS ARE REPORTED IN ug/kg UNLESS OTHERWISE INDICATED.
2. TOTAL NON-CARCINOGENIC PAHs = THE TOTAL OF THESE NON-CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBON COMPOUNDS: ACENAPHTHENE, FLUORENE, PHENANTHRENE, ANTHRACENE, FLUORATHENE, PYRENE, BENZO(G,H,I)PERYLENE, NAPHTHALENE, 2-METHYLNAPHTHALENE, ACENAPHTHYLENE, AND DIBENZOFURAN.
3. TOTAL CARCINOGENIC PAHS= THE TOTAL OF THE CONCENTRATIONS OF THESE CARCINOGENIC OR POTENTIALLY CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBON COMPOUNDS: CARBAZOLE, BENZO(A), ANTHRACENE, CHRYSENE, BENZO(B)FLUORANTHENE, BENZO(K) FLUORANTHENE, BENZO(A)PYRENE, INDENO(1,2,3-CD)PYRENE, AND DIBENZ(A,H)ANTHRACENE.
4. ONLY METALS DETECTIONS WHOSE CONCENTRATIONS EXCEEDED TBCs ARE REPORTED.
5. NOT ALL SAMPLES WERE ANALYZED FOR ALL CLASSES OF COMPOUNDS.

LEGEND:

——►	DRAINAGE CHANNEL AND DIRECTION OF FLOW
)(	CONCRETE HEADWALL
▨	EXCEEDS TBC (FOR PAHs, AT LEAST ONE PAH COMPOUND DETECTION EXCEEDS TBCs)
SB-13-6-2 ●	SOIL BORING
░	LEACH FIELD

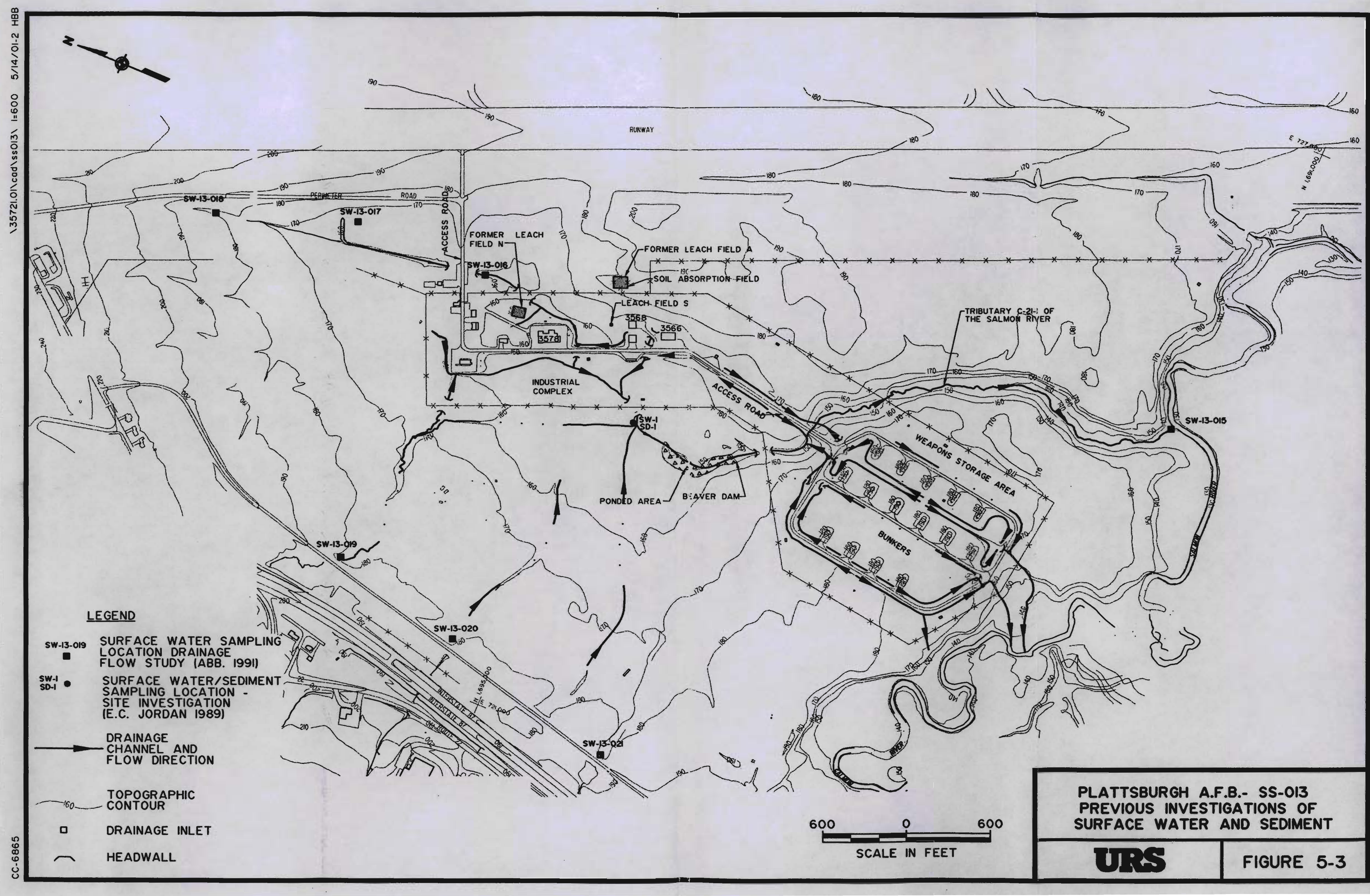
300 0 300
SCALE IN FEET

PLATTSBURGH A.F.B. - SS-013 RI
SUBSURFACE SOIL RESULTS (1993)

URS

FIGURE 5-2

CC-2904C

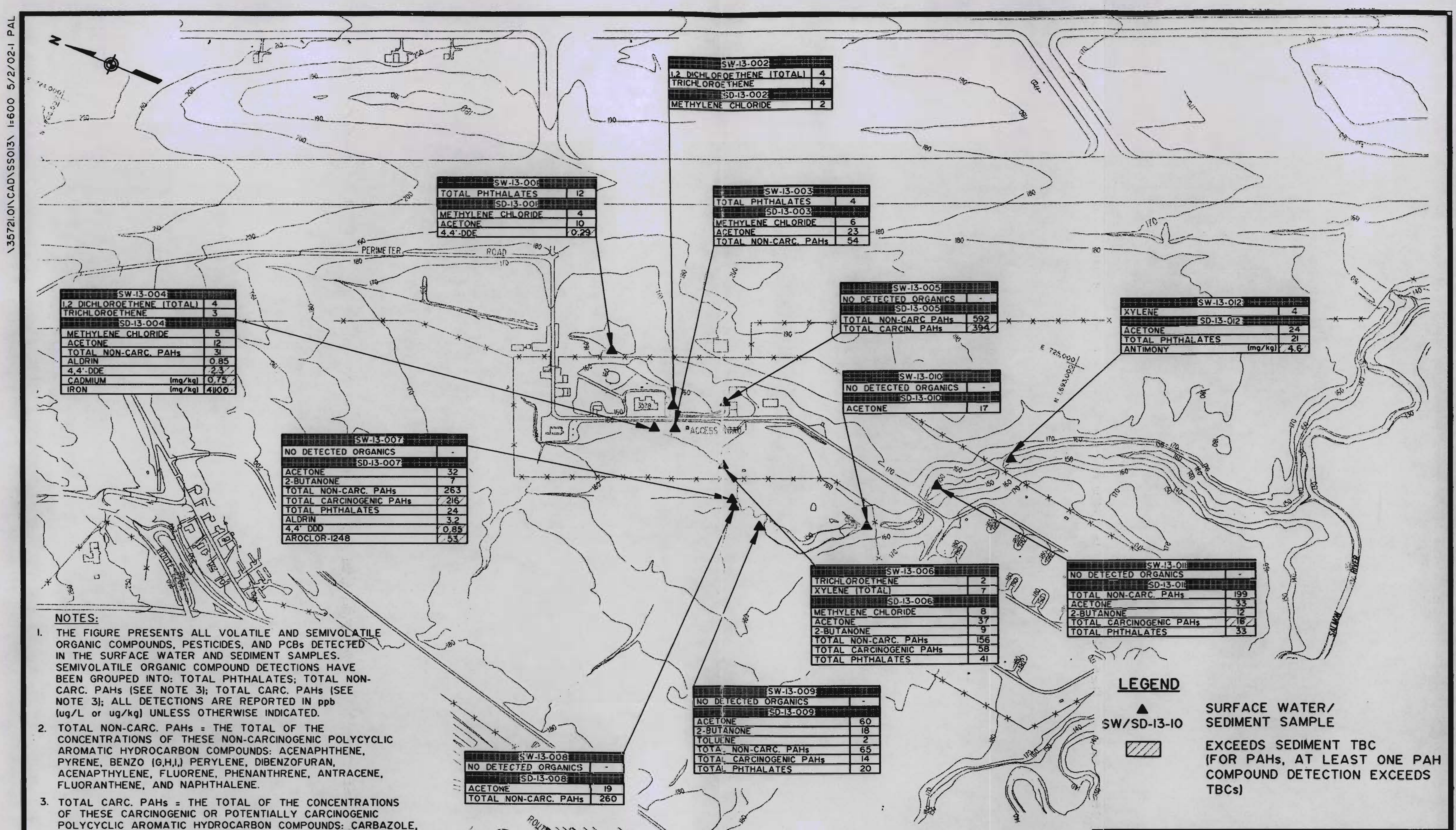


PLATTSBURGH A.F.B.- SS-013
PREVIOUS INVESTIGATIONS OF
SURFACE WATER AND SEDIMENT

URS

FIGURE 5-3

\35721.01\CAD\SS013\ 1-600 5/2/02-1 PAL



SW-13-001	
TOTAL PHTHALATES	12
SD-13-001	
METHYLENE CHLORIDE	4
ACETONE	10
4,4'-DDE	0.29

SW-13-002	
1,2 DICHLOROETHENE (TOTAL)	4
TRICHLOROETHENE	4
SD-13-002	
METHYLENE CHLORIDE	2

SW-13-003	
TOTAL PHTHALATES	4
SD-13-003	
METHYLENE CHLORIDE	6
ACETONE	23
TOTAL NON-CARC. PAHs	54

SW-13-004	
1,2 DICHLOROETHENE (TOTAL)	4
TRICHLOROETHENE	3
SD-13-004	
METHYLENE CHLORIDE	5
ACETONE	12
TOTAL NON-CARC. PAHs	31
ALDRIN	0.85
4,4'-DDE	2.3
CADMIUM (mg/kg)	0.75
IRON (mg/kg)	4100

SW-13-005	
NO DETECTED ORGANICS	-
SD-13-005	
TOTAL NON-CARC PAHs	592
TOTAL CARCIN. PAHs	394

SW-13-006	
TRICHLOROETHENE	2
XYLENE (TOTAL)	7
SD-13-006	
METHYLENE CHLORIDE	8
ACETONE	37
2-BUTANONE	9
TOTAL NON-CARC. PAHs	156
TOTAL CARCINOGENIC PAHs	58
TOTAL PHTHALATES	41

SW-13-007	
NO DETECTED ORGANICS	-
SD-13-007	
ACETONE	32
2-BUTANONE	7
TOTAL NON-CARC. PAHs	263
TOTAL CARCINOGENIC PAHs	216
TOTAL PHTHALATES	24
ALDRIN	3.2
4,4' DDD	0.85
AROCLOR-1248	53

SW-13-008	
NO DETECTED ORGANICS	-
SD-13-008	
ACETONE	19
TOTAL NON-CARC. PAHs	260

SW-13-009	
NO DETECTED ORGANICS	-
SD-13-009	
ACETONE	60
2-BUTANONE	18
TOLUENE	2
TOTAL NON-CARC. PAHs	65
TOTAL CARCINOGENIC PAHs	14
TOTAL PHTHALATES	20

SW-13-010	
NO DETECTED ORGANICS	-
SD-13-010	
ACETONE	17

SW-13-011	
NO DETECTED ORGANICS	-
SD-13-011	
TOTAL NON-CARC. PAHs	199
ACETONE	33
2-BUTANONE	12
TOTAL CARCINOGENIC PAHs	16
TOTAL PHTHALATES	33

SW-13-012	
XYLENE	4
SD-13-012	
ACETONE	24
TOTAL PHTHALATES	21
ANTIMONY (mg/kg)	4.6

NOTES:

1. THE FIGURE PRESENTS ALL VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS, PESTICIDES, AND PCBs DETECTED IN THE SURFACE WATER AND SEDIMENT SAMPLES. SEMIVOLATILE ORGANIC COMPOUND DETECTIONS HAVE BEEN GROUPED INTO: TOTAL PHTHALATES; TOTAL NON-CARC. PAHs (SEE NOTE 3); TOTAL CARC. PAHs (SEE NOTE 3); ALL DETECTIONS ARE REPORTED IN ppb (ug/L or ug/kg) UNLESS OTHERWISE INDICATED.
2. TOTAL NON-CARC. PAHs = THE TOTAL OF THE CONCENTRATIONS OF THESE NON-CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBON COMPOUNDS: ACENAPHTHENE, PYRENE, BENZO (G,H,I,) PERYLENE, DIBENZOFURAN, ACENAPTHYLENE, FLUORENE, PHENANTHRENE, ANTRACENE, FLUORANTHENE, AND NAPHTHALENE.
3. TOTAL CARC. PAHs = THE TOTAL OF THE CONCENTRATIONS OF THESE CARCINOGENIC OR POTENTIALLY CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBON COMPOUNDS: CARBAZOLE, BENZO (A) ANTHRACENE, CHRYSENE, BENZO(B) FLUORANTHENE, BENZO (K) FLUORANTHENE, BENZO(A)PYRENE, INDENO (1,2,3-CD)PYRENE AND DIBENZ(A,H) ANTHRACENE.
4. NOT ALL SAMPLES WERE ANALYZED FOR ALL CLASSES OF COMPOUNDS.
5. ONLY METALS DETECTIONS THAT EXCEEDED TBCs ARE SHOWN. THE LOWEST EFFECT LEVEL TBC WAS USED FOR METALS IN SEDIMENT (SEE TABLE 4-5).

LEGEND

▲ SW/SD-13-10	SURFACE WATER/ SEDIMENT SAMPLE
▨	EXCEEDS SEDIMENT TBC (FOR PAHs, AT LEAST ONE PAH COMPOUND DETECTION EXCEEDS TBCs)

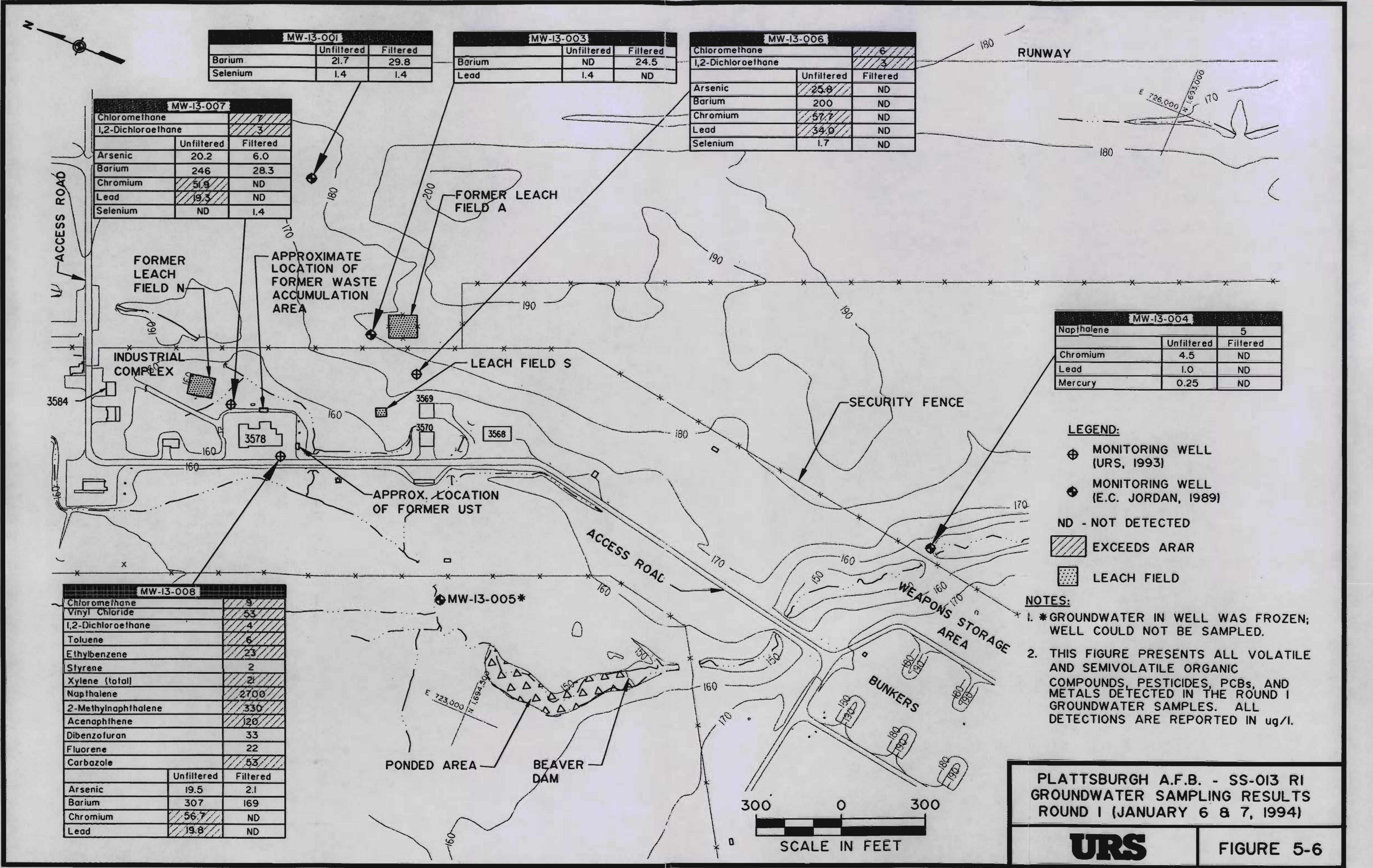
600 0 600
SCALE IN FEET

PLATTSBURGH A.F.B. - SS-013 RI
SURFACE WATER / SEDIMENT
RESULTS (1993 & 1995)

URS

FIGURE 5-4

CC-2887C



MW-13-001

	Unfiltered	Filtered
Barium	21.7	29.8
Selenium	1.4	1.4

MW-13-003

	Unfiltered	Filtered
Barium	ND	24.5
Lead	1.4	ND

MW-13-006

	Unfiltered	Filtered
Chloromethane	▨ 6	
1,2-Dichloroethane	▨ 3	
Arsenic	▨ 25.8	ND
Barium	200	ND
Chromium	▨ 57.7	ND
Lead	▨ 34.0	ND
Selenium	1.7	ND

MW-13-007

	Unfiltered	Filtered
Chloromethane	▨ 7	
1,2-Dichloroethane	▨ 3	
Arsenic	20.2	6.0
Barium	246	28.3
Chromium	▨ 51.9	ND
Lead	▨ 19.3	ND
Selenium	ND	1.4

MW-13-004

	Unfiltered	Filtered
Napthalene	5	
Chromium	4.5	ND
Lead	1.0	ND
Mercury	0.25	ND

MW-13-008

	Unfiltered	Filtered
Chloromethane	▨ 9	
Vinyl Chloride	▨ 53	
1,2-Dichloroethane	▨ 4	
Toluene	▨ 6	
Ethylbenzene	▨ 23	
Styrene	2	
Xylene (total)	▨ 21	
Napthalene	▨ 2700	
2-Methylnaphthalene	▨ 330	
Acenaphthene	▨ 120	
Dibenzofuran	33	
Fluorene	22	
Carbazole	▨ 53	
Arsenic	19.5	2.1
Barium	307	169
Chromium	▨ 56.7	ND
Lead	▨ 19.8	ND

LEGEND:

- ⊕ MONITORING WELL (URS, 1993)
- ● MONITORING WELL (E.C. JORDAN, 1989)
- ND - NOT DETECTED
- ▨ EXCEEDS ARAR
- ▒ LEACH FIELD

NOTES:

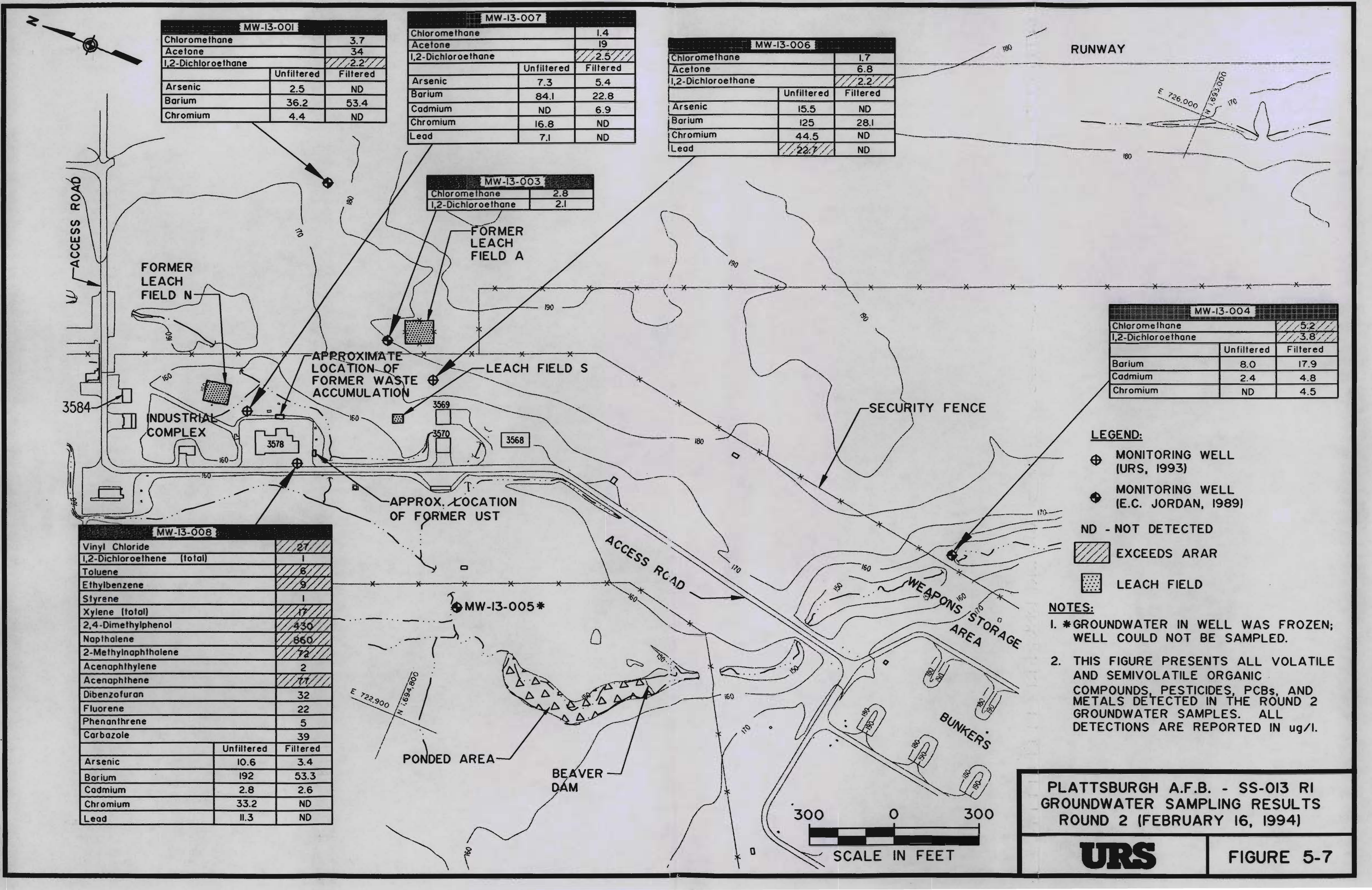
1. * GROUNDWATER IN WELL WAS FROZEN; WELL COULD NOT BE SAMPLED.
2. THIS FIGURE PRESENTS ALL VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS, PESTICIDES, PCBs, AND METALS DETECTED IN THE ROUND I GROUNDWATER SAMPLES. ALL DETECTIONS ARE REPORTED IN ug/l.

PLATTSBURGH A.F.B. - SS-013 RI
GROUNDWATER SAMPLING RESULTS
ROUND I (JANUARY 6 & 7, 1994)

URS

FIGURE 5-6

\35721.01\CAD\SS013\ 1=300 5/14/01-3 HBB



MW-13-001		
Chloromethane		3.7
Acetone		34
1,2-Dichloroethane		2.2 ▨
	Unfiltered	Filtered
Arsenic	2.5	ND
Barium	36.2	53.4
Chromium	4.4	ND

MW-13-007		
Chloromethane		1.4
Acetone		19
1,2-Dichloroethane		2.5 ▨
	Unfiltered	Filtered
Arsenic	7.3	5.4
Barium	84.1	22.8
Cadmium	ND	6.9
Chromium	16.8	ND
Lead	7.1	ND

MW-13-006		
Chloromethane		1.7
Acetone		6.8
1,2-Dichloroethane		2.2 ▨
	Unfiltered	Filtered
Arsenic	15.5	ND
Barium	125	28.1
Chromium	44.5	ND
Lead	22.7 ▨	ND

MW-13-003	
Chloromethane	2.8
1,2-Dichloroethane	2.1

MW-13-004		
Chloromethane		5.2 ▨
1,2-Dichloroethane		3.8 ▨
	Unfiltered	Filtered
Barium	8.0	17.9
Cadmium	2.4	4.8
Chromium	ND	4.5

MW-13-008		
Vinyl Chloride		27 ▨
1,2-Dichloroethene (total)		1
Toluene		6 ▨
Ethylbenzene		9 ▨
Styrene		1
Xylene (total)		17 ▨
2,4-Dimethylphenol		430 ▨
Napthalene		860 ▨
2-Methylnaphthalene		72 ▨
Acenaphthylene		2
Acenaphthene		77 ▨
Dibenzofuran		32
Fluorene		22
Phenanthrene		5
Carbazole		39
	Unfiltered	Filtered
Arsenic	10.6	3.4
Barium	192	53.3
Cadmium	2.8	2.6
Chromium	33.2	ND
Lead	11.3	ND

LEGEND:

⊕ MONITORING WELL (URS, 1993)

⊕ MONITORING WELL (E.C. JORDAN, 1989)

ND - NOT DETECTED

▨ EXCEEDS ARAR

▩ LEACH FIELD

NOTES:

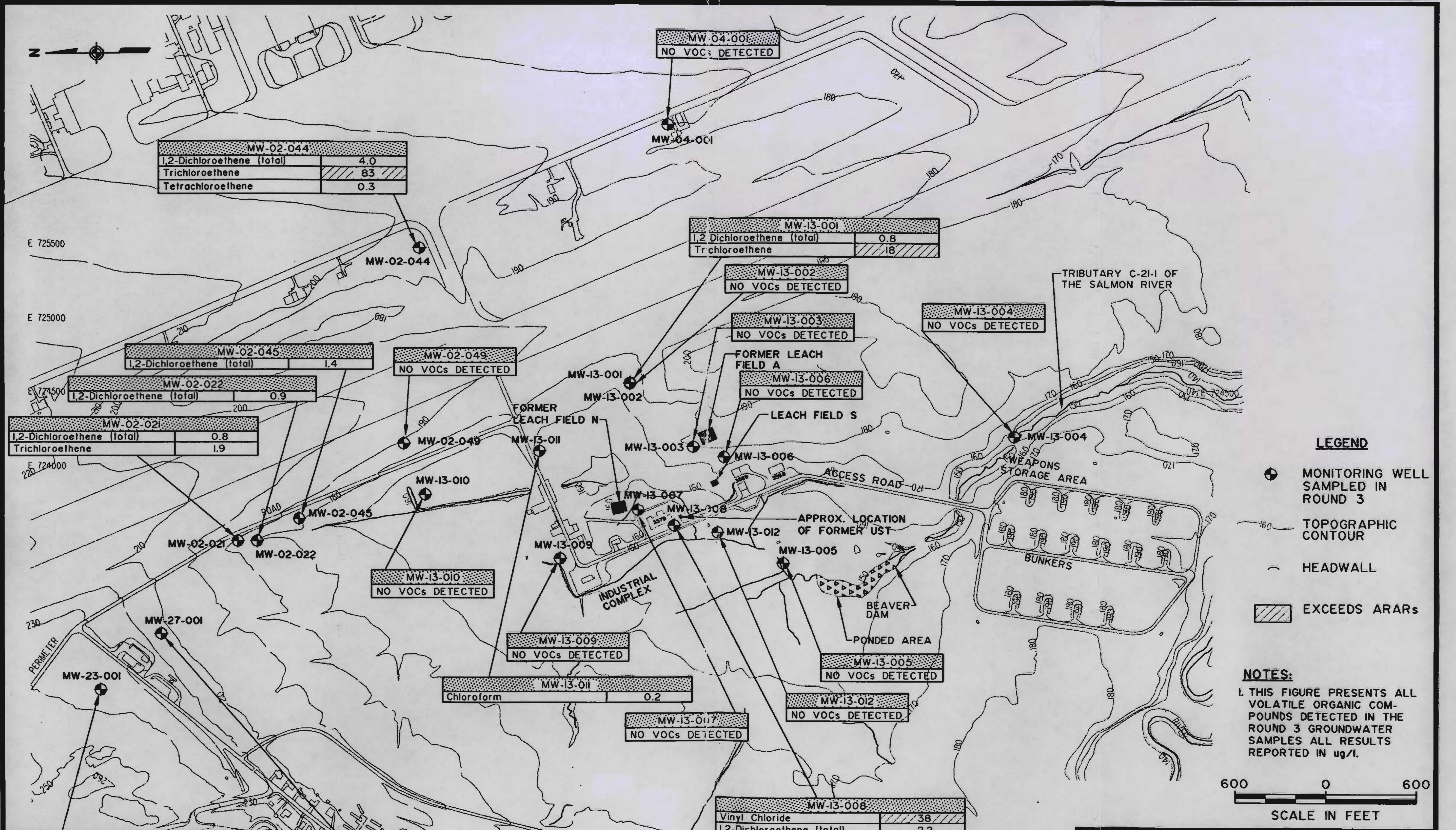
1. * GROUNDWATER IN WELL WAS FROZEN; WELL COULD NOT BE SAMPLED.
2. THIS FIGURE PRESENTS ALL VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS, PESTICIDES, PCBs, AND METALS DETECTED IN THE ROUND 2 GROUNDWATER SAMPLES. ALL DETECTIONS ARE REPORTED IN ug/l.

PLATTSBURGH A.F.B. - SS-013 RI
GROUNDWATER SAMPLING RESULTS
ROUND 2 (FEBRUARY 16, 1994)

URS

FIGURE 5-7

CC-2900B



MW-04-001
NO VOCs DETECTED

MW-02-044	
1,2-Dichloroethene (total)	4.0
Trichloroethene	▨ 83
Tetrachloroethene	0.3

MW-13-001	
1,2 Dichloroethene (total)	0.8
Trichloroethene	▨ 18

MW-13-002
NO VOCs DETECTED

MW-13-003
NO VOCs DETECTED

MW-13-004
NO VOCs DETECTED

MW-13-006
NO VOCs DETECTED

MW-02-045	
1,2-Dichloroethene (total)	1.4

MW-02-049
NO VOCs DETECTED

MW-02-022	
1,2-Dichloroethene (total)	0.9

MW-02-021	
1,2-Dichloroethene (total)	0.8
Trichloroethene	1.9

MW-13-010
NO VOCs DETECTED

MW-13-009
NO VOCs DETECTED

MW-13-011	
Chloroform	0.2

MW-13-007
NO VOCs DETECTED

MW-13-005
NO VOCs DETECTED

MW-13-012
NO VOCs DETECTED

MW-13-008	
Vinyl Chloride	▨ 38
1,2-Dichloroethene (total)	2.2
Benzene	▨ 4.1
Toluene	4.7
Ethylbenzene	4.4
Styrene	1.0
Xylene (total)	▨ 15

MW-23-001	
1,2-Dichloroethene (total)	0.3
Trichloroethene	0.6
Benzene	0.5
Chlorobenzene	1.5

MW-27-001	
1,2-Dichloroethene (total)	0.3
Trichloroethene	2.3

NOTES:

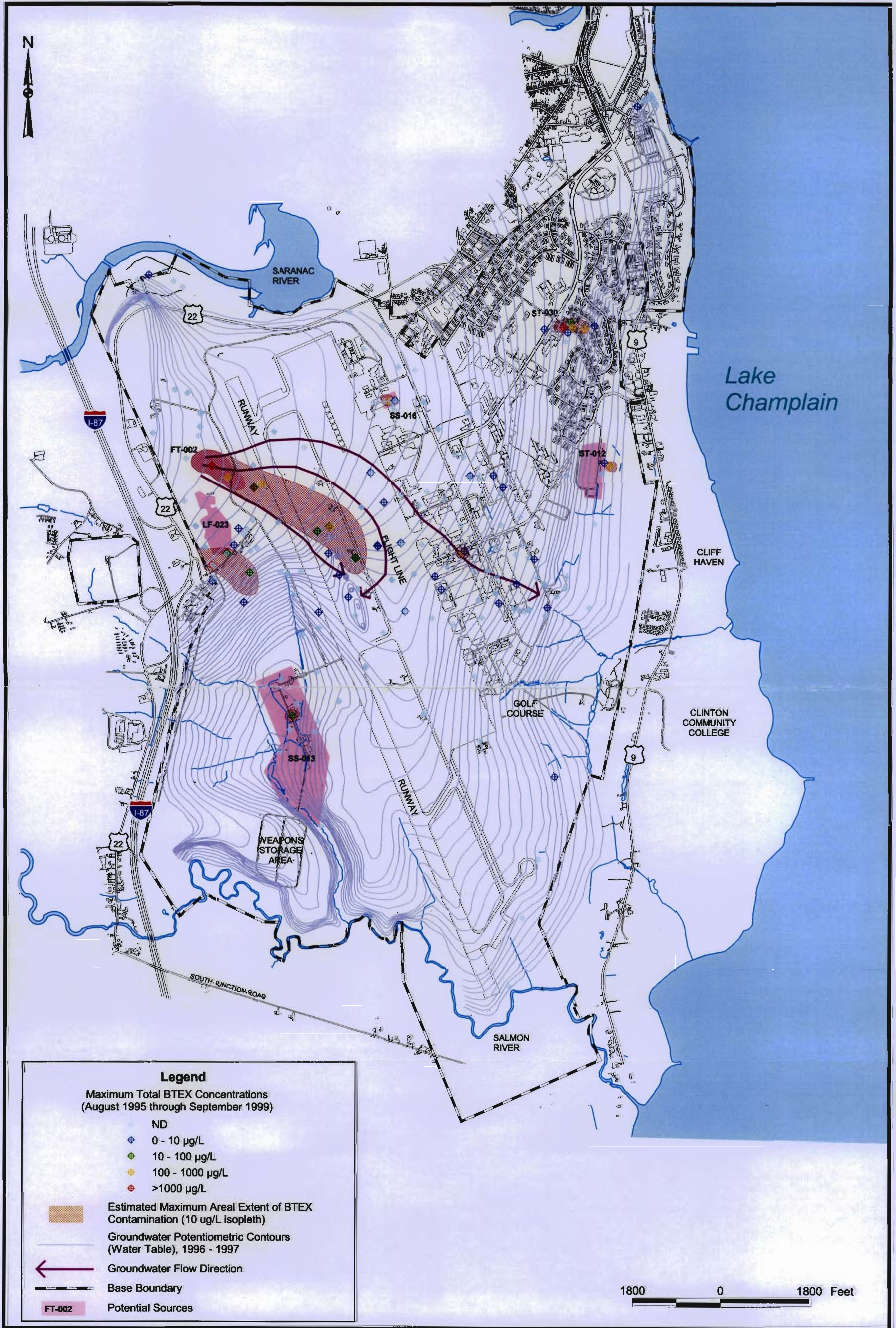
1. THIS FIGURE PRESENTS ALL VOLATILE ORGANIC COMPOUNDS DETECTED IN THE ROUND 3 GROUNDWATER SAMPLES ALL RESULTS REPORTED IN ug/l.

PLATTSBUGH A.F.B. - SS-013 RI
GROUNDWATER SAMPLING RESULTS
ROUND 3 (OCTOBER 3 & 4, 1995)

URS

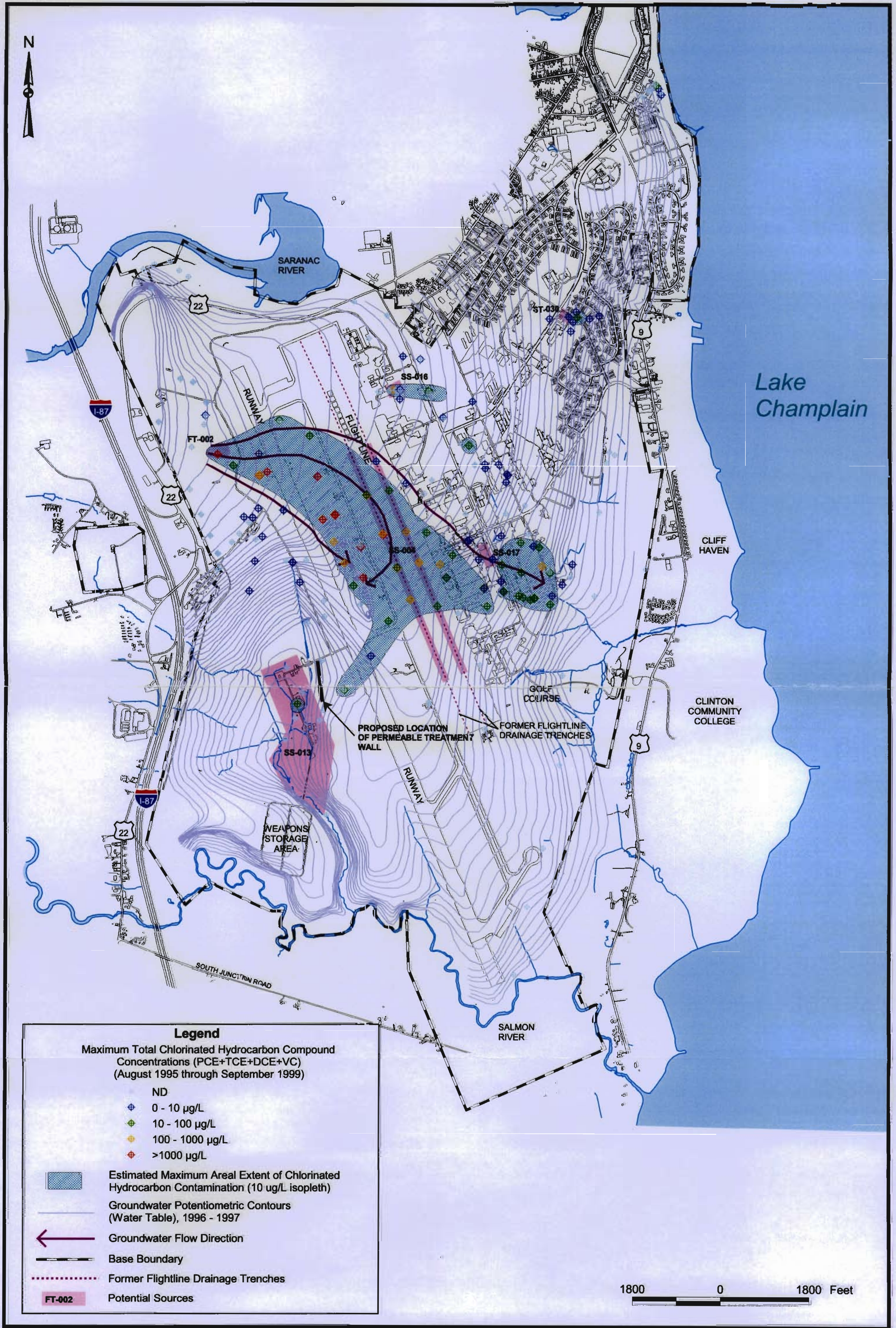
FIGURE 5-8

J:\0100013.10\gis\Applications\ss-013.apr MAXIMUM BTEX EXTENT
5/17/2001



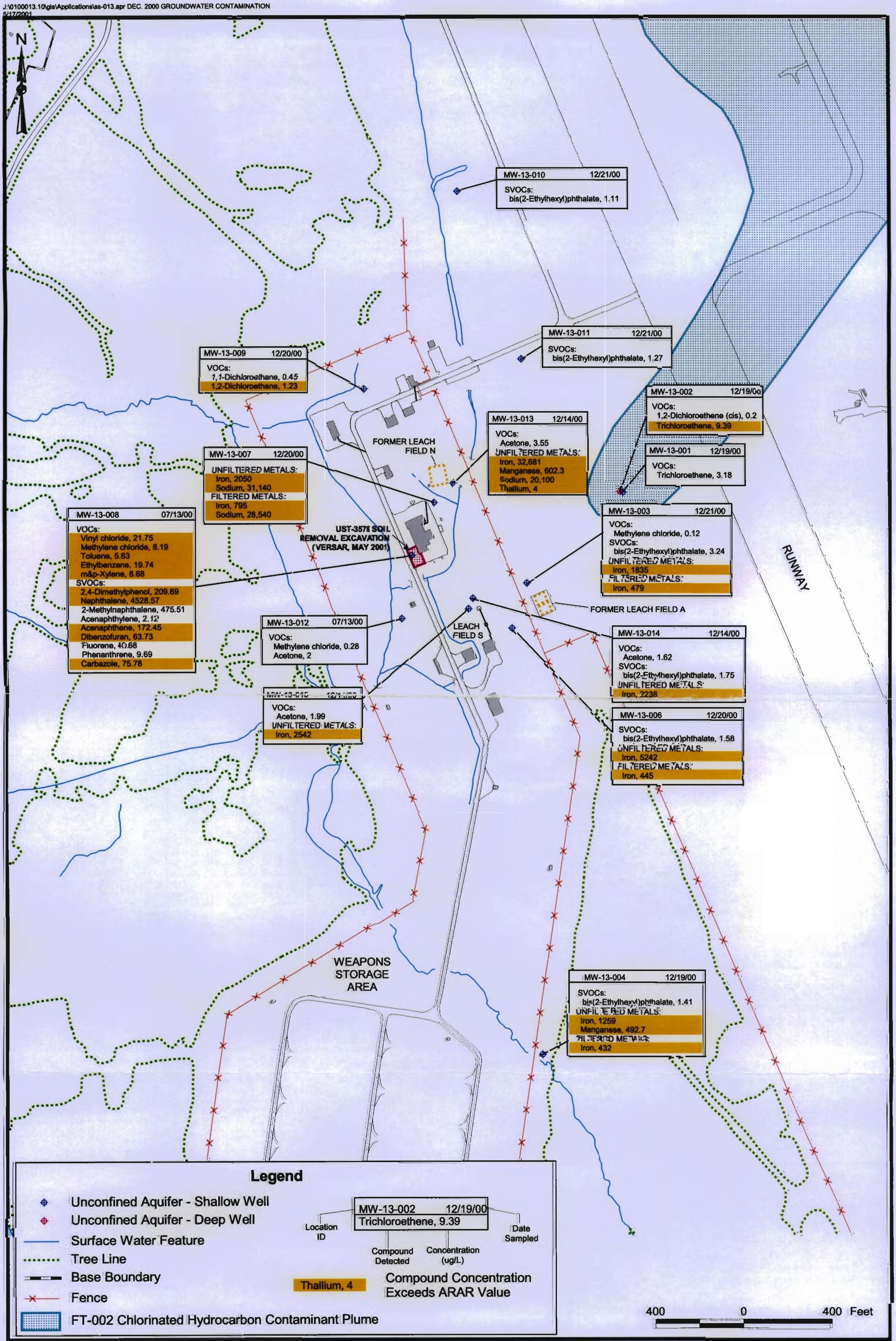
URS	FT-002/INDUSTRIAL AREA GROUNDWATER OPERABLE UNIT RI EXTENT OF MAXIMUM TOTAL BTEX DETECTIONS IN UNCONFINED AQUIFER GROUNDWATER	FIGURE 5-9

J:\0100013.10\gis\Applications\ss-013.apr MAXIMUM CHL EXTENT
5/17/2001



URS	FT-002/INDUSTRIAL AREA GROUNDWATER OPERABLE UNIT RI EXTENT OF MAXIMUM TOTAL CHLORINATED HYDROCARBON COMPOUND DETECTIONS IN UNCONFINED AQUIFER GROUNDWATER	FIGURE 5-10

J:\0100013.10\gis\Applications\ss-013.apr DEC. 2000 GROUNDWATER CONTAMINATION
5/17/2001



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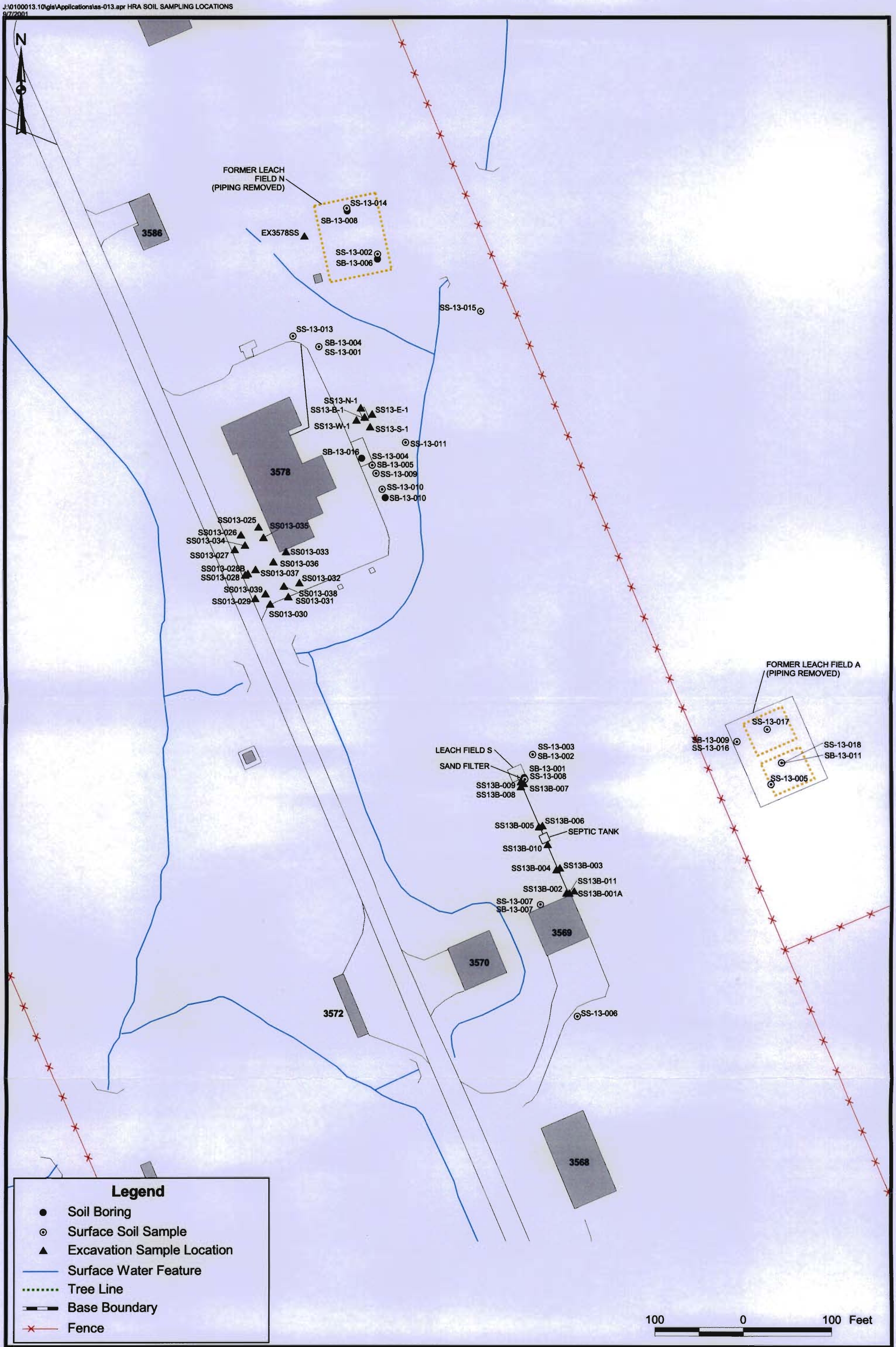
MUNITIONS MAINTENANCE SQUADRON (SS-013)
2000 SUPPLEMENTAL REMEDIAL INVESTIGATION
DETECTED ANALYTES IN GROUNDWATER SAMPLES

FIGURE 5-11

J:\0100013.10\gis\Applications\ss-013.apr HRA SOIL SAMPLING LOCATIONS
9/7/2001



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MUNITIONS MAINTENANCE SQUADRON (SS-013)
SOIL SAMPLE LOCATIONS USED IN THE HRA

FIGURE 6-1

SS-013 MUNITIONS MAINTENANCE SQUADRON

Photo 1: OHM UST-3578-A-2 removal excavation, northward view, September 1996.

SS-013 MUNITIONS MAINTENANCE SQUADRON

Photo 2: Asphalt pavement patch at completion of OHM UST-3578-A-2 soil removal.

SS-013 MUNITIONS MAINTENANCE SQUADRON

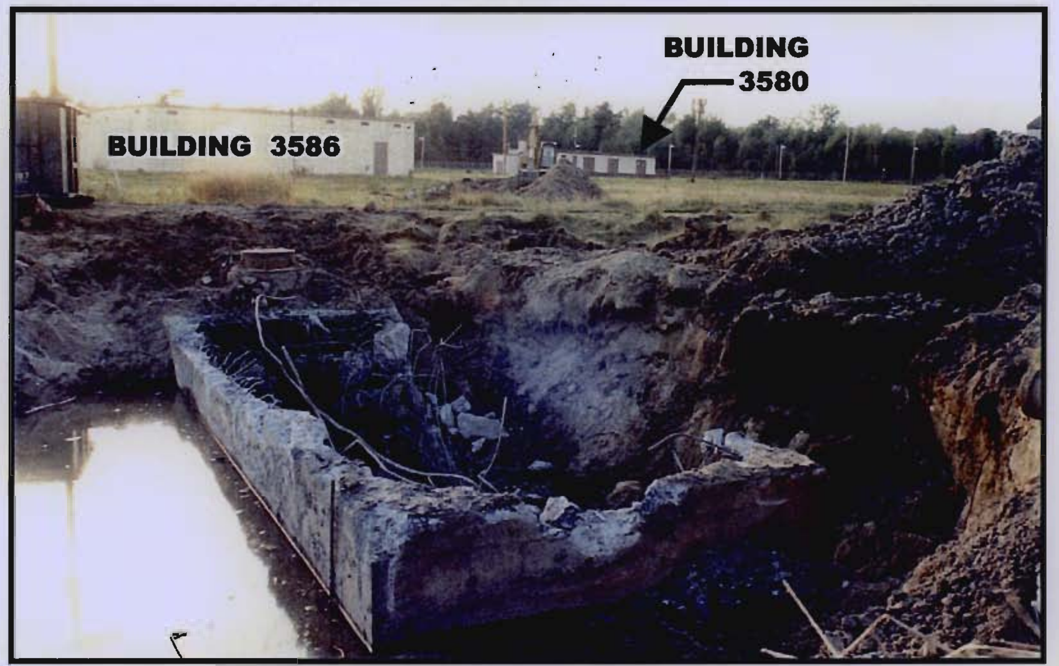


Photo 3: Westward view of excavated 7,500 gallon septic tank and excavation of piping leading from septic tank to Building 3580 (September 1996).

Photo 4: View of the lift station sump removed by OHM in September 1996.

SS-013 MUNITIONS MAINTENANCE SQUADRON

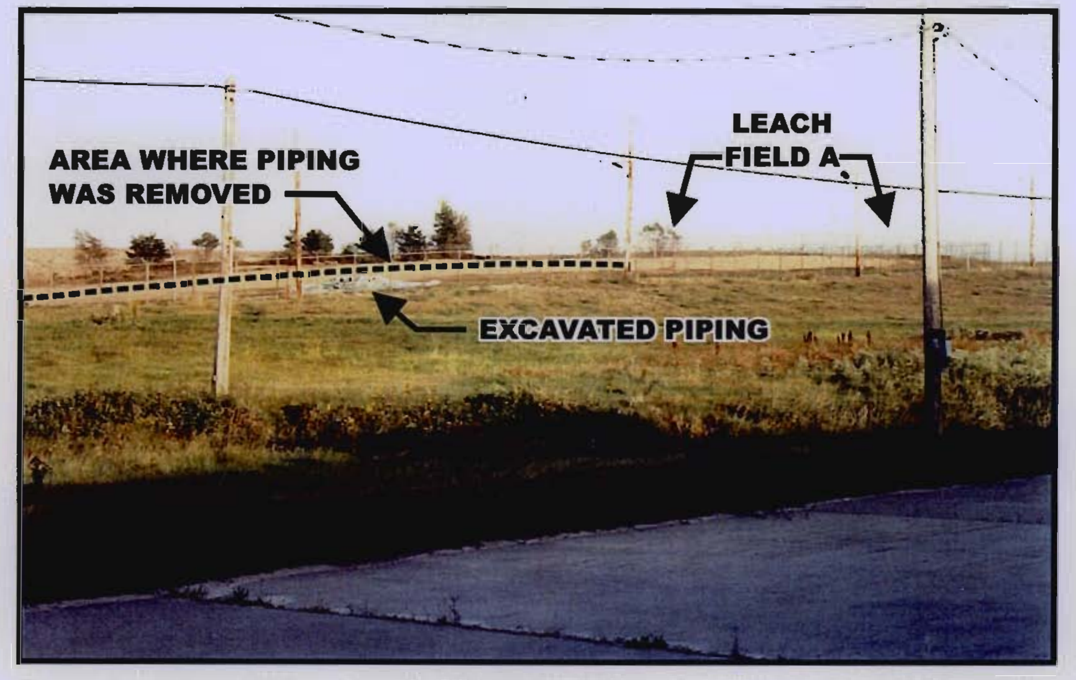


Photo 5: Eastward View from Building 3578 showing area excavated to remove piping leading from the lift station to former leach field A (September 1996).

Photo 6: Northwestward view from former leach field A showing removed piping and septic system equipment removals north of Building 3578 (September 1996).

Photo 7: Eastward view from paved access road of vitrified clay pipe removal between septic tank and Building 3580 (September 1996).

SS-013 MUNITIONS MAINTENANCE SQUADRON

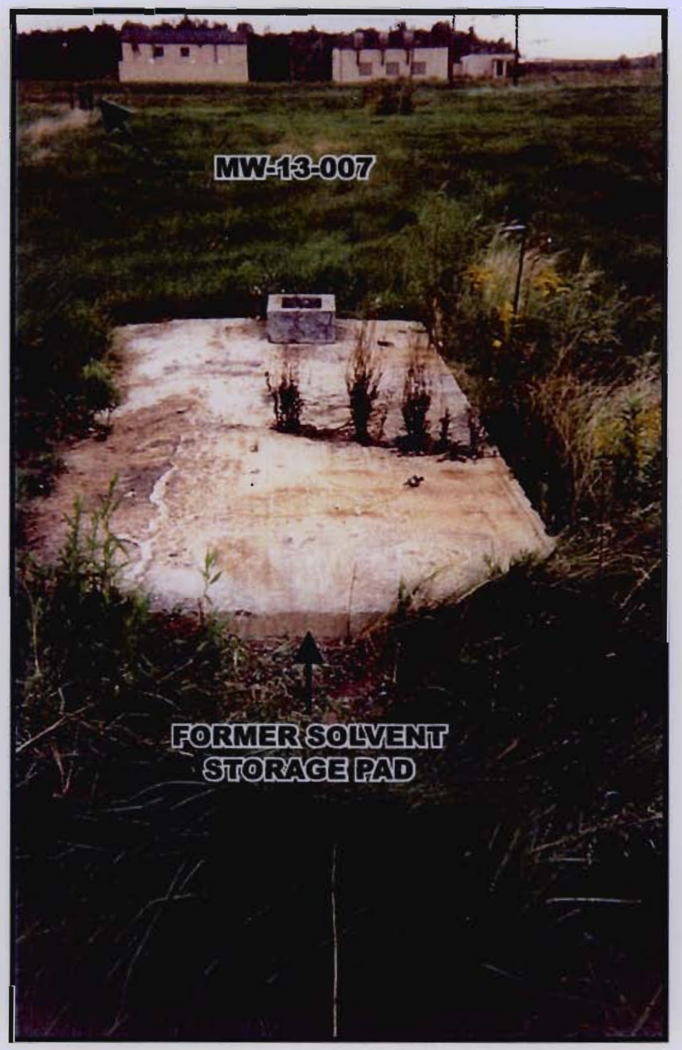


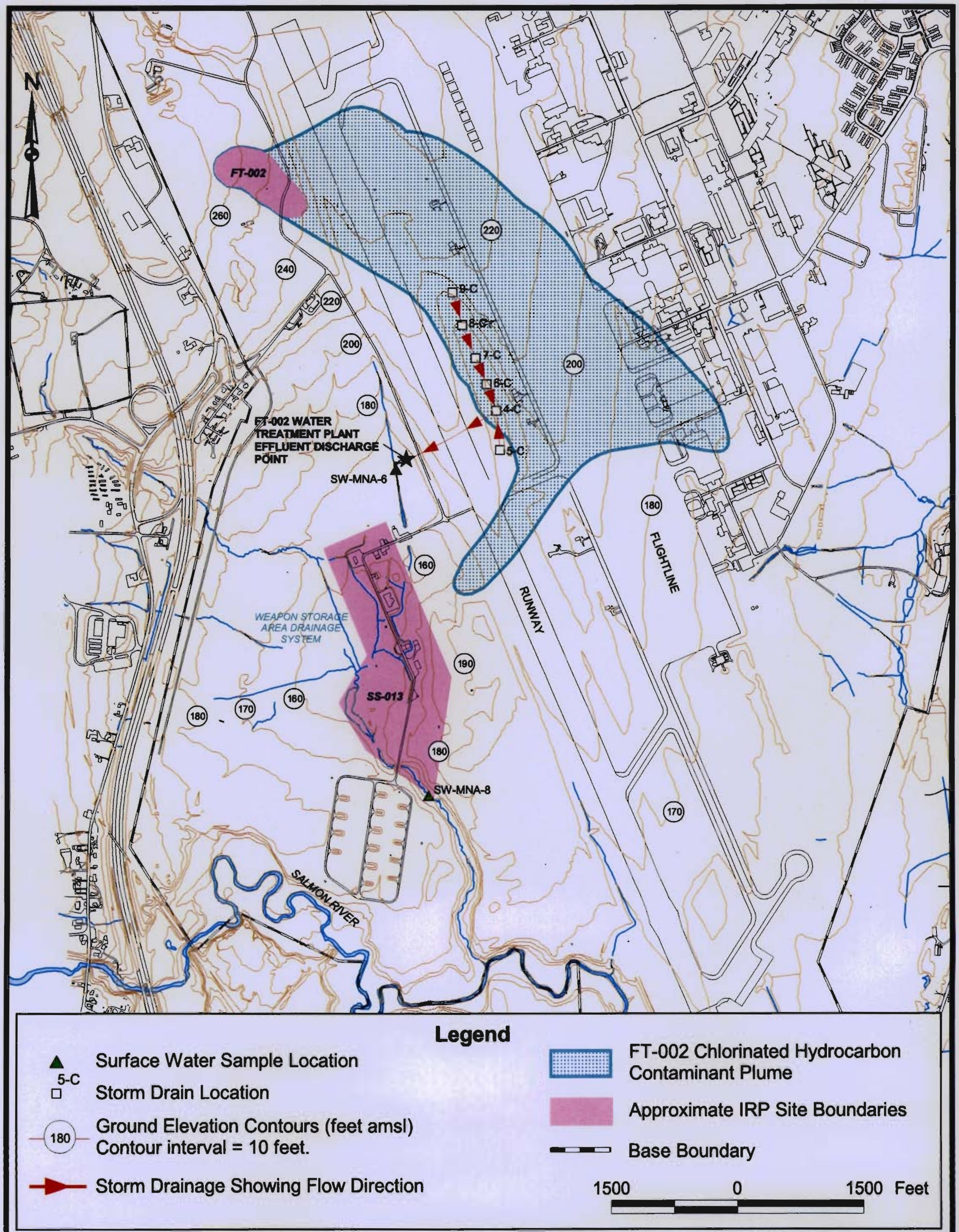
Photo 8: Northwestward view of former solvent storage pad.

Photo 9: Southeastward view of Versar soil removal excavation at Building 3578 (December 2000).

Photo 10: Northwestward view of Versar soil removal excavation at Building 3578 (December 2000).

Photo 11: Southeastward view of Versar soil removal excavation on northern end of Building 3569 (December 2000).

Photo 12: Southeastward view of Versar soil removal excavation on northern end of Building 3569 (December 2000).



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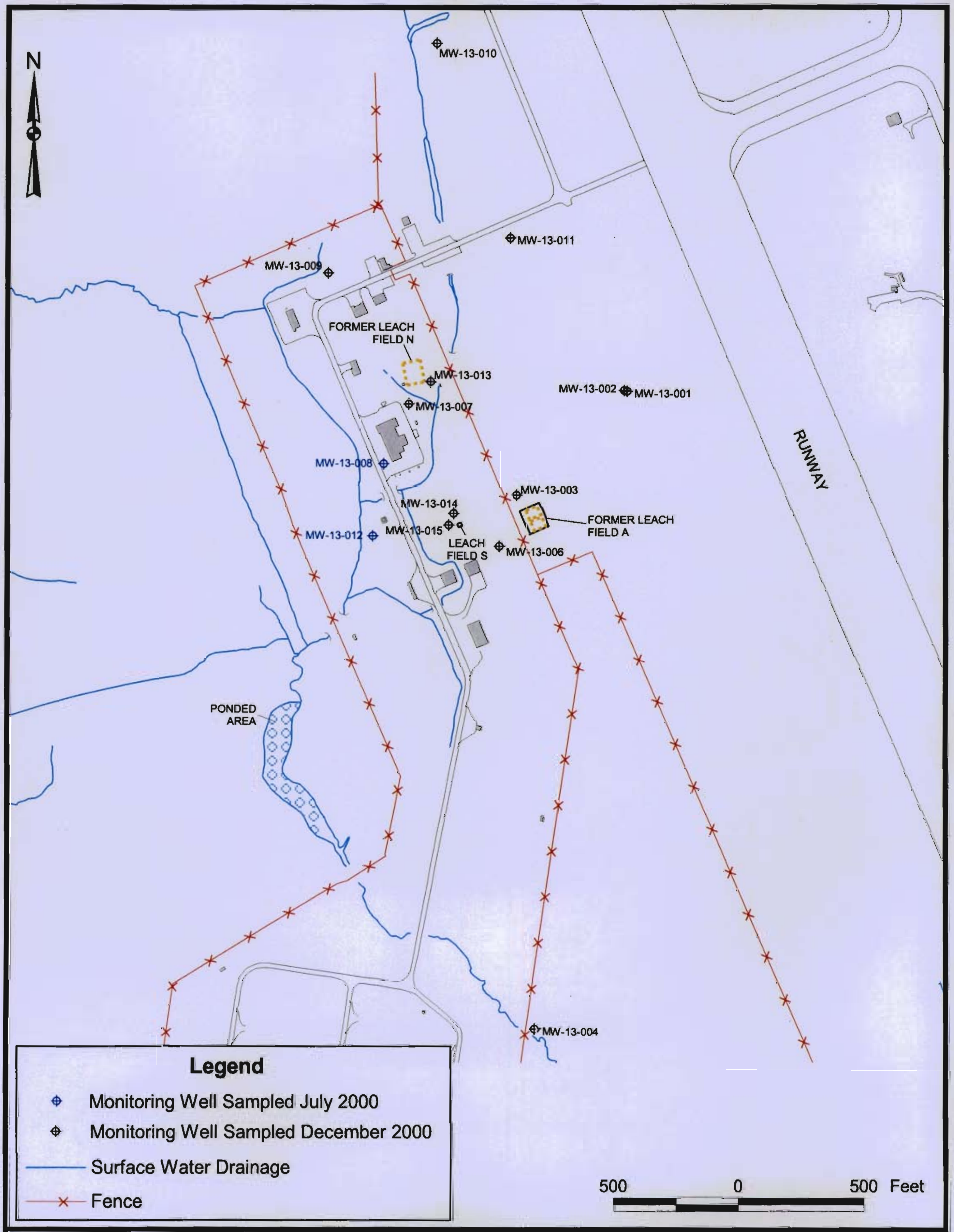
PLATTSBURGH AIR FORCE BASE
FT-002 SURFACE WATER SAMPLING LOCATIONS

FIGURE 5-5

J:\0100013.10\gis\Applications\ss-013.apr FT-002 SURFACE WATER SAMPLE LOCATIONS
5/11/2001



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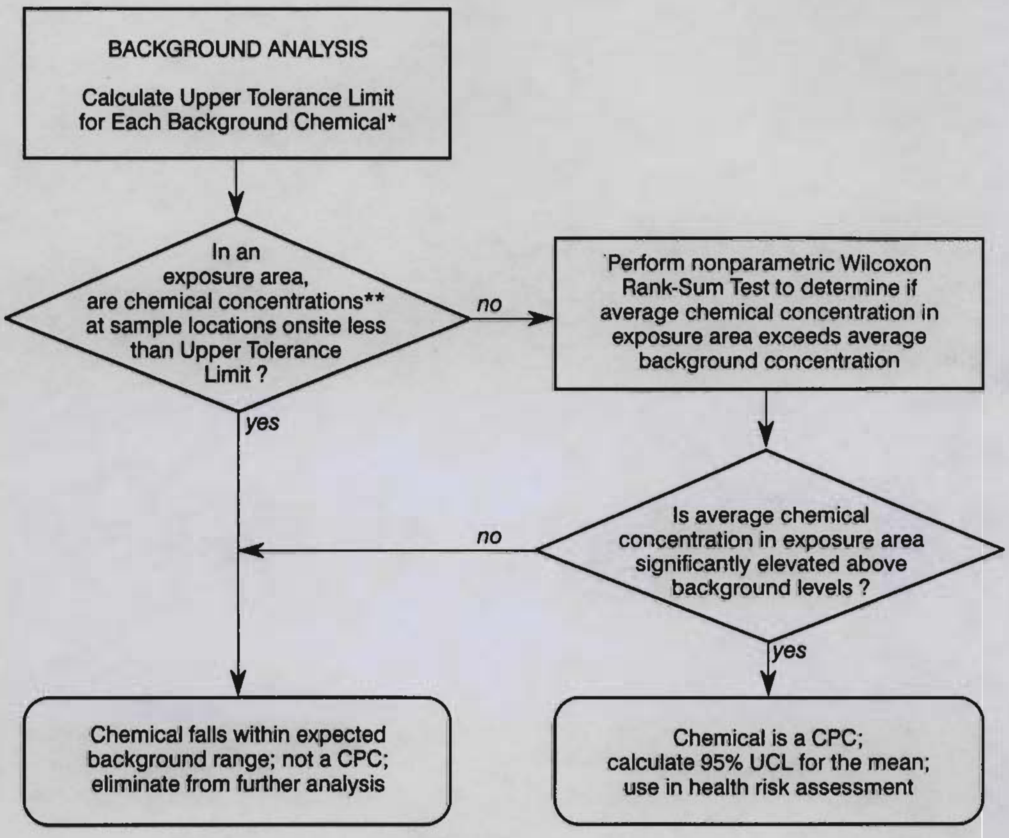
MUNITIONS MAINTENANCE SQUADRON (SS-013)
GROUNDWATER SAMPLE LOCATIONS
USED IN THE HRA

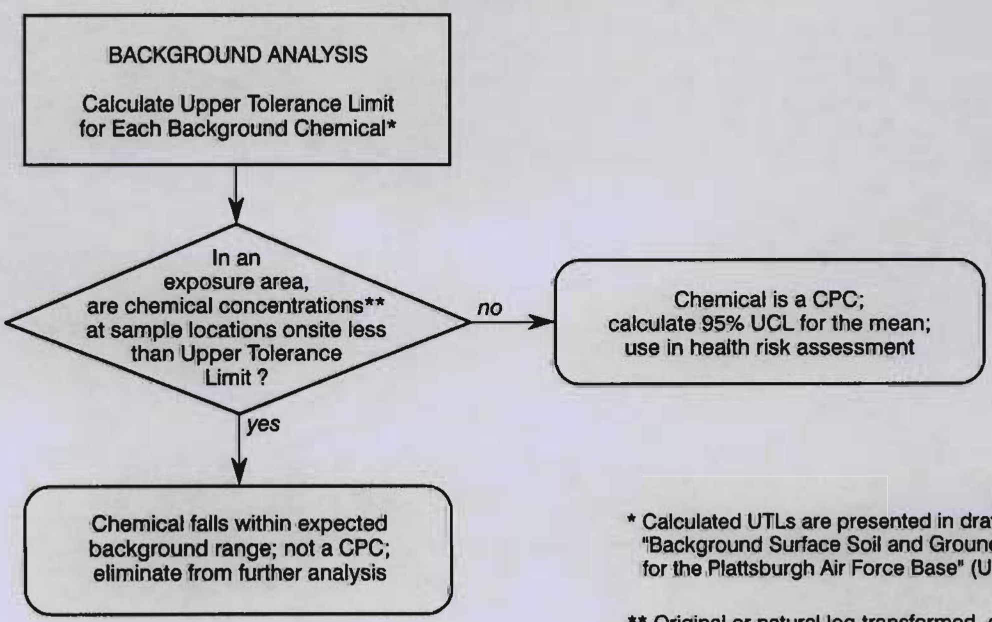
FIGURE 6-2

J:\0100013.10\gis\Applications\ss-013.apr HRA GROUNDWATER SAMPLE LOCATIONS
8/14/2001

SOIL SCREENING



GROUNDWATER SCREENING



* Calculated UTLs are presented in draft report "Background Surface Soil and Groundwater Survey for the Plattsburgh Air Force Base" (URS 1995)

** Original or natural log-transformed, depending upon background distribution

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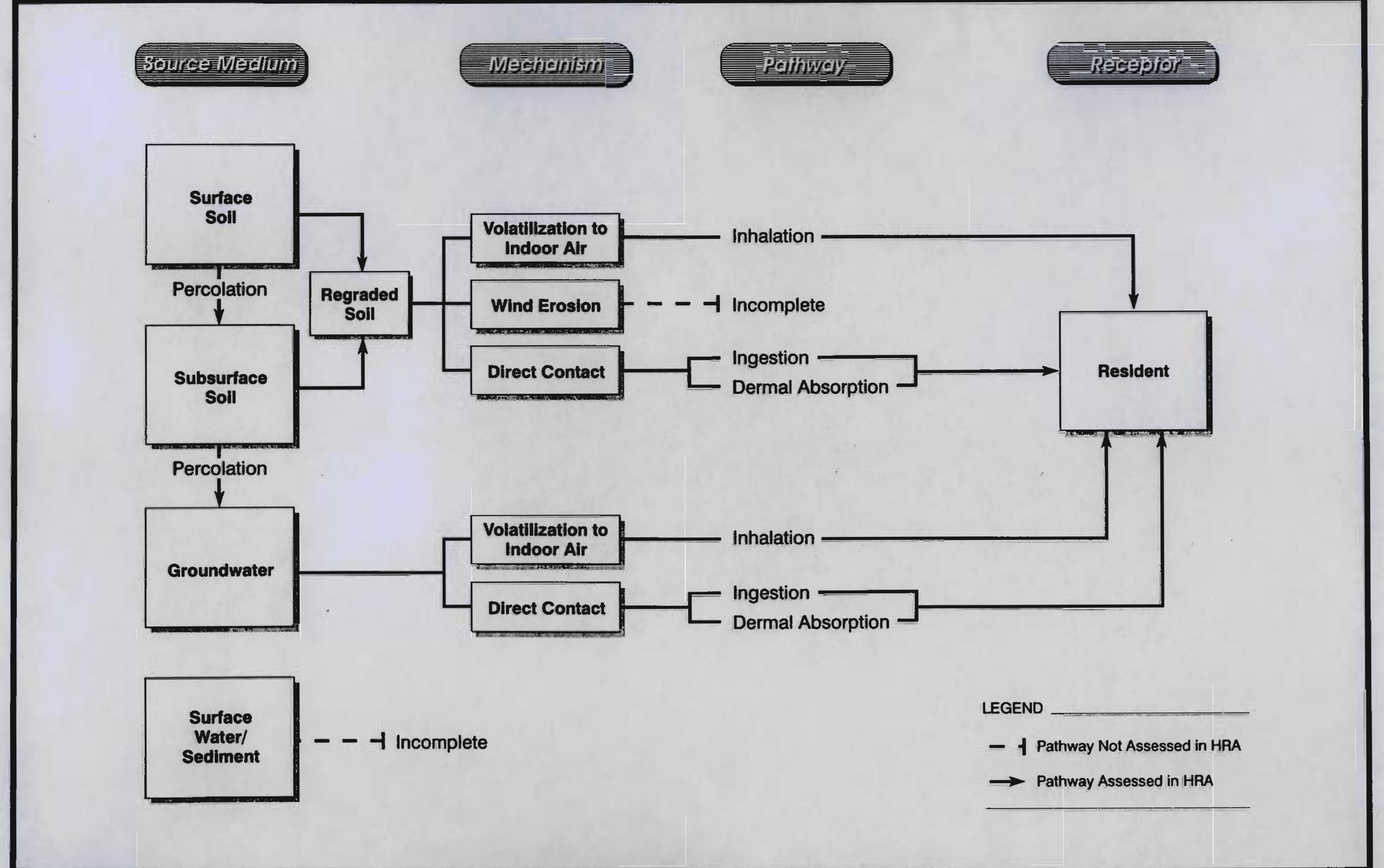
METHODS FOR SCREENING INORGANIC
CPCs IN SOIL AND GROUNDWATER
MUNITIONS MAINTENANCE SQUADRON
SS-013 SUPPLEMENTAL REMEDIAL INVESTIGATION

FIGURE 6-3

AG9299-35291.13-110195-GCM

AG9301-35291.13-110195-GCM



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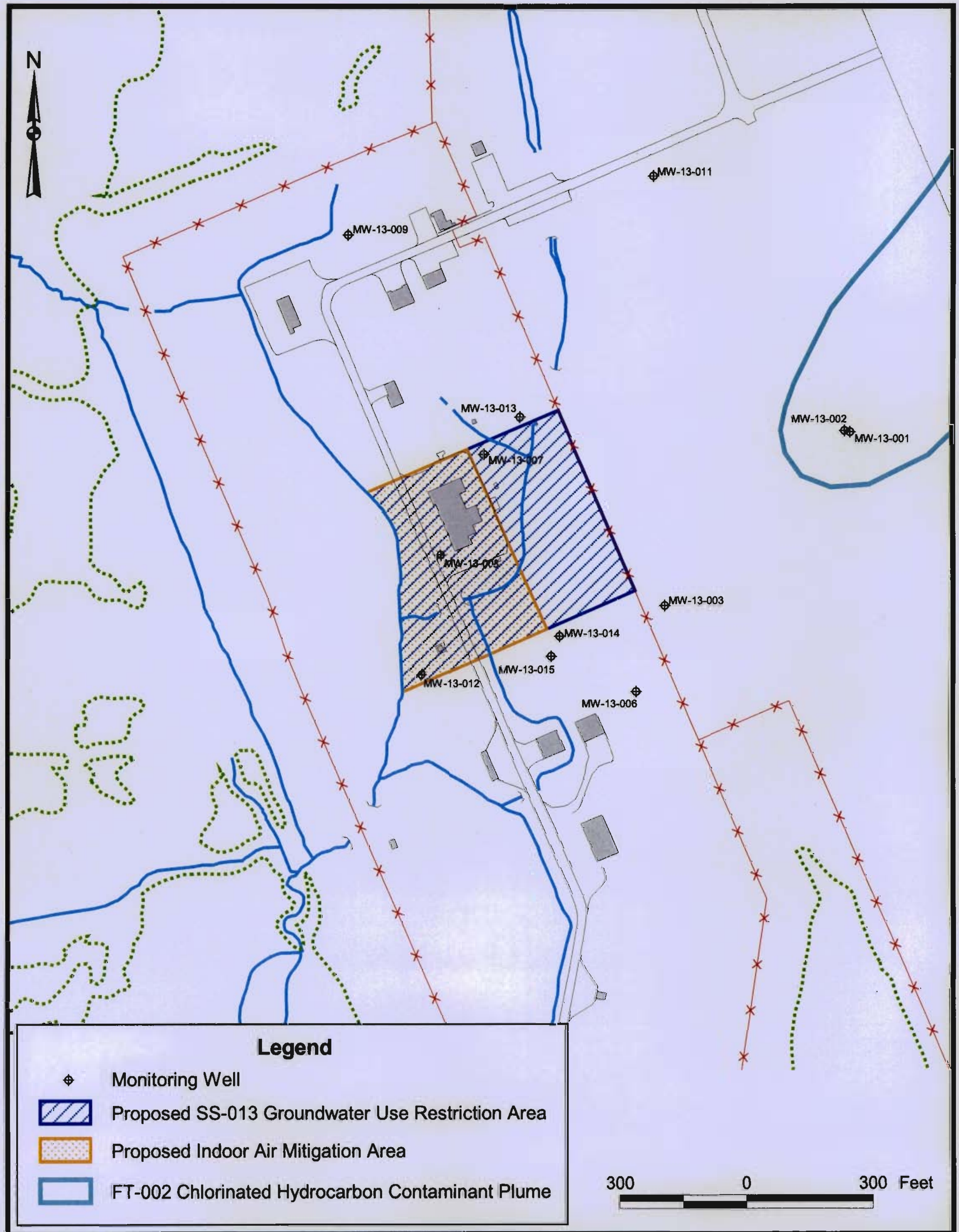
EXPOSURE PATHWAYS - FUTURE USE
MUNITIONS MAINTENANCE SQUADRON
SS-013 SUPPLEMENTAL REMEDIAL INVESTIGATION

FIGURE 6-4



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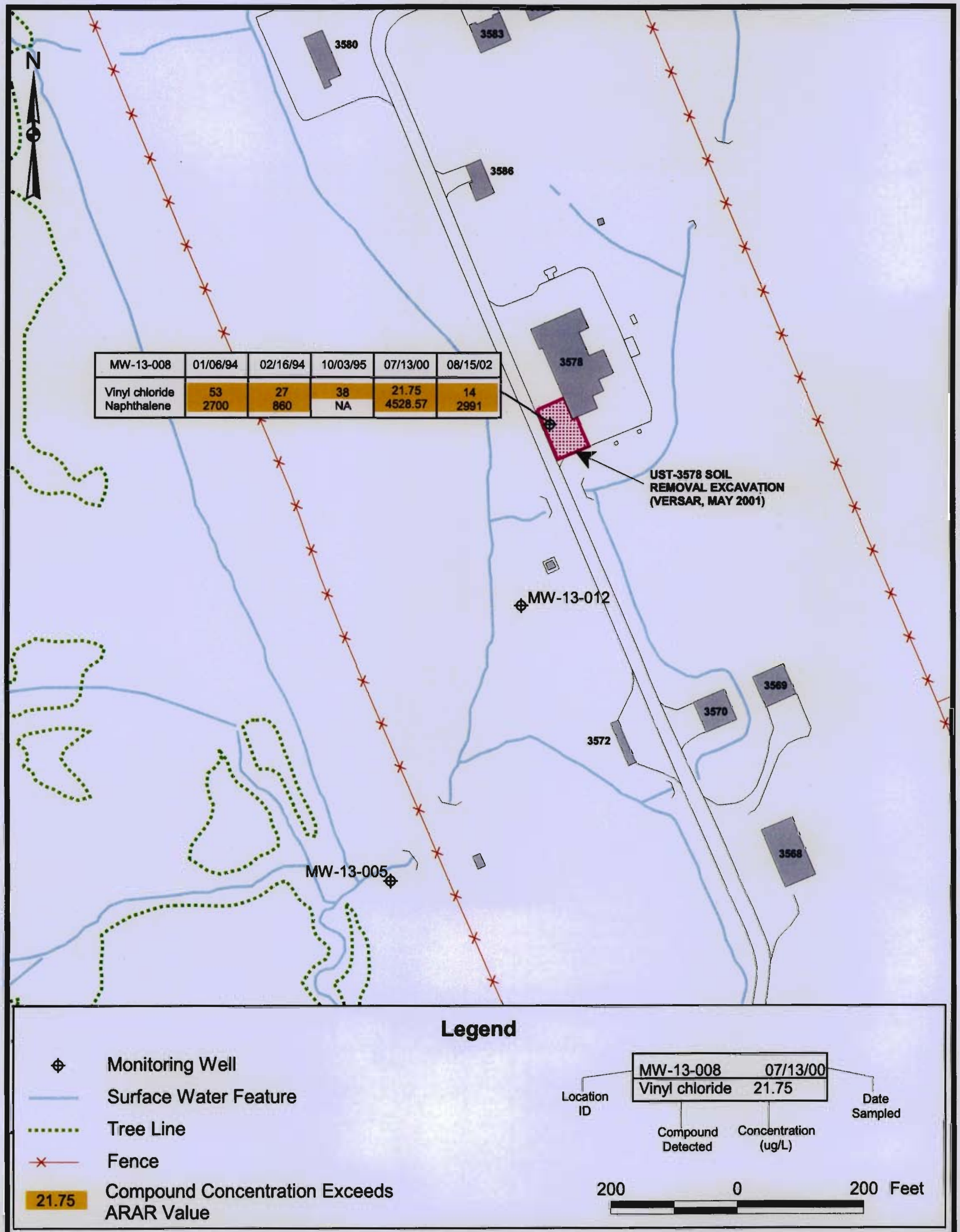
MUNITIONS MAINTENANCE SQUADRON (SS-013)
PROPOSED GROUNDWATER USE
RESTRICTION AREAS

FIGURE 8-1

J:\0100013.10\gis\Applications\ss-013.apr GROUNDWATER RESTRICTIONS
9/11/2001



MW-13-008	01/06/94	02/16/94	10/03/95	07/13/00	08/15/02
Vinyl chloride	53	27	38	21.75	14
Naphthalene	2700	860	NA	4528.57	2991

URS

MUNITIONS MAINTENANCE SQUADRON (SS-013)
VINYL CHLORIDE AND NAPHTHALENE
DETECTIONS AT MW-13-008

FIGURE 5-12

N:\11168476.00000\GIS\Applications\ss-013.apr VC & NAPH DETECTED IN GROUNDWATER
1/13/2003