

United States Air Force
Installation Restoration Program

Fire Training Area (FT-002)/Industrial Area Groundwater Operable Unit

Record of Decision

Former Plattsburgh Air Force Base
Clinton County, New York

**Final
September 2014**

**FIRE TRAINING AREA (FT-002)/INDUSTRIAL AREA
GROUNDWATER OPERABLE UNIT**

RECORD OF DECISION

**FORMER PLATTSBURGH AIR FORCE BASE
PLATTSBURGH, NEW YORK**

**UNITED STATES DEPARTMENT OF THE AIR FORCE
INSTALLATION RESTORATION PROGRAM**

**Prepared By;
URS GROUP, INC.**

**FINAL
SEPTEMBER 2014**

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
Air Force	United States Air Force
ARARs	applicable and/or relevant and appropriate requirements
AWQC	ambient water quality criterion
BCT	BRAC Cleanup Team
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, xylenes
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
DCE	dichloroethene
EE/CA	engineering evaluation/cost analysis
ERA	ecological risk assessment
FS	feasibility study
FT-002/IA	Fire Training Area/Industrial Area
gpm	gallons per minute
HI	hazard index
HRA	human health risk assessment
HQ	hazard quotient
IC	institutional control
IRM	interim remedial measure
IRP	Installation Restoration Program
LNAPL	light non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAEL	no observed adverse effects level
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operation and maintenance
OU	operable unit
PA	preliminary assessment
PAH	polycyclic aromatic hydrocarbon
PCE	perchloroethene (tetrachloroethene)
PID	photoionization detector
PRAP	Proposed Remedial Action Plan

ACRONYMS AND ABBREVIATIONS (Continued)

RAB	Restoration Advisory Board
RfD	reference dose
RI	remedial investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SF	slope factor
SI	site inspection
SVE	soil vapor extraction
SVI	soil vapor intrusion
SVOC	semi-volatile organic compounds
TCE	trichloroethene
TMV	toxicity, mobility, and volume
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compounds
WSA	Weapons Storage Area
mg/kg	milligrams per kilogram
µg/L	micrograms per liter
µg/m ³	micrograms per cubic meter

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Former Plattsburgh Air Force Base
Fire Training Area/Industrial Area (FT-002/IA) Groundwater Operable Unit
Plattsburgh, Clinton County, New York
EPA ID # NY4571924774

Statement of Basis and Purpose

This Record of Decision (ROD) presents the selected remedial alternative for the Fire Training Area/Industrial Area (FT-002/IA) Groundwater Operable Unit (OU) at the Plattsburgh Air Force Base (AFB) in Plattsburgh, New York. It has been developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record supporting this remedial decision. Copies of documents may be obtained at the following address:

AFCEC
8 Colorado Street, Suite 121
Plattsburgh, New York 12903
(518) 563-2871

The Administrative Record for this ROD is also available on-line at:

<http://afcec.publicadmin-record.us.af.mil>

The remedy has been selected by the United States Air Force (Air Force) and the United States Environmental Protection Agency (USEPA) and with the concurrence of the New York State Department of Environmental Conservation (NYSDEC), consistent with the Federal Facility Agreement executed among the parties pursuant to Section 120 of CERCLA, dated July 10, 1991. A copy of the NYSDEC concurrence letter is included in Appendix B of this ROD.

Assessment of the Site

The FT-002 site is an area formerly used by the base fire department for training exercises. Soil and groundwater were contaminated when combustible liquids were released into the environment during the exercises. Remediation at the FT-002 site has been divided into multiple OUs to facilitate remedial activities. The first OU, the FT-002 Source OU, focuses on free product (chemicals in pure form that are not dissolved in water) and the contaminated soils at the FT-002 site. A ROD for the FT-002 Source OU was signed in March 2001 (URS 2001a). Cleanup and control of groundwater contamination located at and downgradient from the FT-002 Source OU is what is being addressed in a prior 2003 remedy (discussed below) and this ROD, an area referred to as the FT-002/IA Groundwater OU.

This ROD addresses the FT-002/IA Groundwater OU which includes impacts from groundwater at or near six other Plattsburgh AFB Installation Restoration Program (IRP) sites including:

- SS-004 Flightline
- SS-005 Non-destructive Inspection Facility
- SS-006 Aerospace Ground Equipment Facility
- SS-011 Defense Reutilization and Marketing Office
- SS-017 Jet Engine Inspection and Maintenance Shop
- SS-041 Building 2612 (Formerly SD-041)

These sites are included within the FT-002/IA Groundwater OU because groundwater from the FT-002 site has impacted or could potentially impact groundwater at these sites. The sources and/or soil contamination at each of these sites are being addressed separately.

Groundwater contamination that begins at the FT-002 Source OU and has migrated downgradient includes chlorinated hydrocarbons and fuel-related compounds. Contamination has spread within the unconfined sand aquifer more than one mile downgradient from the FT-002 Source OU; contaminants have not been found in the underlying till, water-bearing zone and carbonate bedrock aquifer. Groundwater is retarded from migrating downward by a low-permeability clay unit which appears to be continuous beneath the sand aquifer. This clay approaches the ground surface to the east of the base's industrial area (east of Idaho Avenue), which limits eastward migration of contamination in groundwater (URS 2001d). Off-base groundwater users to the east along Route 9, who utilize the bedrock aquifer for

their potable water supply, have not been impacted by the groundwater contamination detected on base. Groundwater contamination is discharging into the Golf Course drainage system, which ultimately flows to Lake Champlain, and/or the Weapons Storage Area (WSA) drainage system, which ultimately flows to the Salmon River.

The remedial action objectives for this ROD are:

1. To prevent ingestion of groundwater containing contaminant concentrations above applicable, and/or relevant and appropriate requirements (ARARs); and
2. To prevent individual human exposure to soil gas vapor levels within buildings at unacceptable levels represented by an excess cancer risk greater than 1×10^{-6} and also represented by a potential non-cancer risk for a hazard index greater than one.

The remedy selected in this ROD is necessary to protect the public health from actual releases of hazardous substances into the environment.

Description of the Remedy

The FT-002/IA Groundwater OU is one of a number of operable units for waste sites administered under the Plattsburgh AFB IRP. RODs have been signed for 18 OUs at the base and additional RODs are planned for other IRP sites.

The remedy selected in this ROD for the FT-002/IA Groundwater OU includes the following:

- Continued operation of soil vapor extraction (SVE) systems installed in Building 2753, Building 2766, and New Building C;
- Groundwater and surface water monitoring; and,
- Institutional controls and other use restrictions to prohibit the use of groundwater, restrict the discharge of groundwater, prohibit development that would interfere with remedial operations or penetrate the subsurface clay confining layer, limit current use and future property development to non-residential uses, use restrictions related to soil vapor intrusion, and an occupancy restriction for Building 2612.

Statutory Determination

The selected remedy for the FT-002/IA Groundwater OU is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and resource recovery technologies to the extent practicable. Groundwater treatment, which will capture and/or destroy contamination, is included in the remedy, thereby satisfying the statutory preference for treatment as a principle element of the remedy.

Until groundwater ARARs are achieved, contaminants will remain within the OU's subject area above levels that allow for unlimited use and unrestricted exposure. Therefore, a statutory review, according to Section 121(c) of CERCLA, will be conducted within five years after initiation of the remedial action, and at a minimum of once every 5 years thereafter until performance standards are achieved, to insure that the remedy is protective of human health and the environment.

ROD Data Certification Checklist

The following information is included in this ROD. Additional information can be found in the Administrative Record for this ROD.

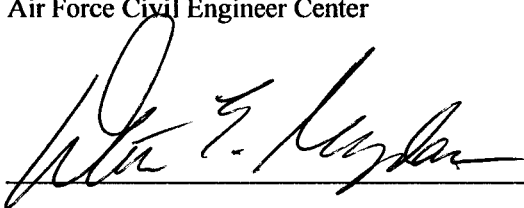
- Chemicals of concern and their respective concentrations (Section 5)
- Baseline risk represented by the chemicals of concern (Section 7)
- Cleanup levels established for chemicals of concern and the basis for these levels (Table 4)
- How source materials constituting principal threats are addressed (Section 4)
- Current and reasonably anticipated future land use assumptions, and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Sections 6 and 7)
- Potential land and groundwater use that will be available at the site as a result of the selected remedy (Section 6)
- Key factors that led to selecting the remedy (Sections 10, 12, 13 and 14)



ROBERT E. MORIARTY, P.E., SES, DAF
Director
Installations Directorate
Air Force Civil Engineer Center

26 Sep 14

Date



Mr. Walter E. Mugdan
Director, Emergency and Remedial Response Division
United States Environmental Protection Agency, Region 2

Sept. 29, 2014

Date

DECISION SUMMARY

1.0 SITE NAME, LOCATION AND DESCRIPTION

The former Plattsburgh AFB is located in Clinton County along the western shore of Lake Champlain in northeastern New York (Figure 1). The base was closed on September 30, 1995 as part of the third round of base closures mandated by the Defense Base Closure and Realignment Act of 1993. As part of the Air Force's IRP and the Base Realignment and Closure (BRAC) program, the Air Force initiated activities to identify, evaluate, and remediate identified hazardous material disposal and spill sites. The IRP at the former Plattsburgh AFB was implemented according to a Federal Facilities Agreement, Docket No.: II-CERCLA-FFA-10201, signed on July 10, 1991, by the Air Force, USEPA and NYSDEC. The Air Force is the lead agency for the IRP. Plattsburgh AFB was placed on the National Priorities List in 1989 (USEPA CERCLIS ID: NY4571924774). Cleanup of the former Plattsburgh AFB is being funded by the Air Force.

The FT-002 site is located approximately 500 feet west of the runway and 500 feet east of the base's western boundary (Figure 2). From the mid- to late-1950s through 1989, the site was used to meet the training requirements of the base fire department. During training exercises, fires were ignited in fire training pits on site. As a result of releases of combustible liquids (e.g., off-specification fuel and waste solvents) into the pits, the soil and groundwater were contaminated with a variety of organic chemicals. Groundwater contamination consists primarily of fuel-related compounds and chlorinated hydrocarbons. The fuel-related compounds are naturally biodegradable in groundwater and, at the time of the remedial investigation (URS 2001d), concentrations had attenuated below detection limits within 4,000 feet downgradient of the source. The chlorinated hydrocarbons, which are considerably less biodegradable, have been detected over 6,750 feet downgradient of the source.

The primary contaminants of concern in the groundwater are the fuel-related volatile organic compounds (VOCs), i.e., benzene, toluene, ethylbenzene, and xylene (collectively, BTEX), and three chlorinated hydrocarbon compounds, namely trichloroethene (TCE), 1,2-dichloroethene (DCE) and vinyl chloride. Only these two groups of compounds have been detected downgradient of the FT-002 Source OU at concentrations greater than their respective groundwater quality standards (URS 2002a).

The groundwater contamination extends into Plattsburgh AFB's industrial area to the east of the flightline where six other areas (SS-004, SS-005, SS-006, SS-011, SS-017, and SD-041) are located that are included in the FT-002/IA Groundwater OU. Descriptions of these areas are provided in Section 5.1.4. The boundary of the FT-002/IA Groundwater OU is shown on Figure 2.

2.0 HISTORY AND ENFORCEMENT ACTIVITIES

Groundwater contamination that begins at the FT-002 source area and has migrated downgradient includes chlorinated hydrocarbons and fuel-related compounds. This contamination co-mingles with similar contamination present in groundwater as a result of activities at other IRP sites located east of the FT-002 site. Investigation and remedial activities that have been undertaken at various other sites to address this groundwater contamination and the soil sources for this contamination are listed below. These activities are described in greater detail in Section 5.1.

Timeframe	Activity	Description
1984-1985	FT-002 Preliminary Assessment/Site Inspection (E.C. Jordan 1989)	Limited soil and groundwater sampling in FT-002 source area
1988-1993	FT-002 Source OU Remedial Investigation (ABB-ES & URS 1993)	Extensive soil sampling in FT-002 source area
1990	FT-002 Source Product Recovery Engineering Evaluation/Cost Analysis (E.C. Jordan 1990)	Evaluation of product recovery in FT-002 source area leading to installation of product recovery system
1991-1992	SS-011 Remedial Investigation (ABB-ES & URS 1992)	Evaluation of soil and groundwater contamination at SS-011
1989-1993	FT-002 GW OU Remedial Investigation (ABB-ES & URS 1994)	Evaluation of groundwater contamination attributed to FT-002 west of the industrial corridor
1993-1995	SS-004 Remedial Investigation (URS 1995b)	Evaluation of soil contamination in the flightline vicinity
1994-1995	FT-002 GW OU Feasibility Study (URS 1995c)	Evaluation of remedial alternatives for groundwater west of the industrial corridor
1995	FT-002 Source OU Feasibility Study (URS 1995a)	Evaluation of remedial alternatives for FT-002 source control leading to a ROD
1993-1996	SS-005, SS-006 and SS-017 (Malcolm Pirnie 1996)	Investigation of soil and groundwater contamination at 3 industrial area sites
1993-1997	FT-002 Intrinsic Remediation Engineering Evaluation/Cost Analysis (Parsons 1995 & 1997)	Evaluation of contaminant biodegradation in the FT-002 groundwater plume
1996	FT-002 Source OU Action Memo (Parsons & OHM 1996)	Selection of technology for FT-002 source control leading to installation of removal action systems
1995-2001	FT-002/IA Groundwater OU Remedial Investigation/Feasibility Study (URS 2001d)	Comprehensive groundwater investigation and evaluation of remedial alternatives
1999-2001	Supplemental Evaluation to the Environmental Baseline Survey (URS 2001e)	Preliminary evaluation of groundwater contamination at SD-041 (Building 2612)
2001	SS-017 Supplementary Evaluation/Feasibility Study (URS 2001c)	Evaluation of soil contamination at site SS-017
2001	SD-041 Remedial Investigation (URS 2008a)	Evaluation of soil and sediment contamination at site SD-041

Timeframe	Activity	Description
2001	Pump House No. 3 Investigation (URS 2001b)	Evaluation of groundwater contamination detected near former Pump House No. 3
2001	FT-002 Source OU ROD (URS 2001a)	Selection of alternative to remediate FT-002 source contamination
2003	FT-002/IA Groundwater OU ROD (URS 2003c)	ROD allowed for implementation of engineered portions of selected remedy
2006 -2007	Soil Vapor Intrusion Study (URS 2008b)	Evaluation of potential for contaminants to volatilize from groundwater and migrate into 14 Industrial Area buildings
2008	Soil Vapor Intrusion Survey (URS 2009b)	Supplemental evaluation of potential for contaminants to volatilize from groundwater and migrate into three industrial area buildings
2008	Building 2793 Investigation (Coulter 2008a)	Soil and groundwater sampling to investigate source of petroleum-related contamination
2008	Soil Vapor Intrusion Survey (Coulter 2008b)	Soil gas sampling around perimeter of New Building C
2009	Soil Gas/Indoor Air Sampling (Farnsworth 2009a, 2009b, and 2009c)	Re-sampling at five buildings: 2622, 2763, 2766, 2793, and New Building C
2009	Soil Gas Sampling (Shaw 2010)	Sub- slab soil gas sampling at Buildings 2622, 2763, 2766, and New Building C
2010	Soil Gas/Indoor Air Sampling (Farnsworth 2010a)	Sub-slab and indoor air sampling at Building 2622
2010	Soil Gas Sampling (Farnsworth 2010b)	Sub-slab soil gas sampling at Building 2793

3.0 COMMUNITY PARTICIPATION

The Air Force has kept the community informed regarding progress at the FT-002/IA Groundwater OU during periodic Restoration Advisory Board (RAB) meetings open to the public. This board consists of the BRAC Cleanup Team (BCT) members (key representatives from the Air Force, USEPA, and NYSDEC), as well as representatives from municipalities, community organizations, and associations including community members with environmental/engineering expertise. The RAB, which was chartered in 1995, serves as a forum for the community to become familiar with the various restoration activities ongoing at Plattsburgh AFB and to provide input to the BCT. In addition to the formal RAB meetings, several working group meetings were held in 1999, on base, specifically to discuss outstanding issues regarding the FT-002/IA Groundwater OU among RAB members.

Documents related to the FT-002/IA Groundwater OU were originally placed in an Information Repository located at the Feinberg Library on the Plattsburgh campus of the State University of New York. In 2009, the documents were removed from the library and sent for storage at the Air Force Civil Engineer Center (AFCEC) in San Antonio, Texas. Copies of documents produced after 2009 are available at the following address:

AFCEC
8 Colorado Street, Suite 121
Plattsburgh, New York 12903
(518) 563-2871

The Administrative Record for this decision is also available on line at:

<http://www.afcec.af.mil/library/administrativerecord/index.asp>.

A document entitled *Proposed Plan for the Fire Training Area/Industrial Area Groundwater Operable Unit* was issued in January 2002 (URS 2002a). This proposed plan is hereinafter referred to as the January 2002 Proposed Remedial Action Plan, or the January 2002 PRAP.

The notice of the availability of the January 2002 PRAP was published in the Plattsburgh *Press Republican* Newspaper on January 22, 2002, and a 30-day public comment period was held from January 22, 2002 to February 20, 2002. During this period, the public was invited to review the Administrative Record and comment on the preferred alternative being considered.

In addition, the Air Force hosted a public meeting on February 4, 2002 at the Old Court House, located at 133 Margaret Street in Plattsburgh, New York. The date and time of the meeting was published in the *Plattsburgh Press Republican* Newspaper. The meeting was divided into two segments. In the first segment, data gathered regarding the FT-002/IA Groundwater OU, the preferred alternative set forth in the January 2002 PRAP, and the decision-making process were discussed. In the second segment, immediately after the informational presentation, the Air Force, EPA, and NYSDEC held a formal public meeting to accept comments about the remedial alternative being proposed for the FT-002/IA Groundwater OU. The meeting provided the opportunity for people to comment officially on the plan. Public comments were recorded and transcribed, and a copy of the transcript was added to the Administrative Record and Information Repository.

A *FT-002/IA Groundwater ROD* was signed in June 2003 (URS 2003c). That ROD, hereinafter referred to as the June 2003 Interim ROD, allowed implementation of the physical components of the preferred alternative proposed in the January 2002 PRAP. A transcript of the February 4, 2002 public meeting and the responsiveness summary of Air Force responses to public comments are included in the June 2003 Interim ROD.

A *Supplement to the January 2002 Proposed Plan*, referred to as the Supplemental PRAP, was issued in August 2013 (URS 2013). The purpose of the Supplemental PRAP was to document modifications and additions that had been made to the preferred alternative for the FT-002/IA Groundwater OU since it was originally presented in the January 2002 PRAP and selected in the June 2003 Interim ROD. This includes modifications that came about during design of the June 2003 selected remedy and any additions that were made when the remedy was implemented. The remedy selected in the June 2003 Interim ROD, as modified, became fully operational in 2005.

A notice of the availability of the Supplemental PRAP was placed in the *Plattsburgh Press Republican* Newspaper on August 29, 2013, which began the 30-day public comment period that extended through September 27, 2013. A public meeting for the Supplemental PRAP was held on September 18, 2013 at the Clinton County Government Center located at 137 Margaret Street in Plattsburgh, New York. The date and time of the meeting was also published in the *Plattsburgh Press Republican* Newspaper. The transcript of that public meeting is included as Appendix A of this ROD. There were no public comments on the Supplemental Proposed Plan.

4.0 SCOPE AND ROLE OF THE OPERABLE UNIT

FT-002/IA Groundwater OU is one of a number of OUs administered under the Plattsburgh AFB IRP. Remedies have previously been selected for 18 other OUs at the base, and additional RODs are planned for other IRP sites. Because of the complex nature of the FT-002 site, site remediation was divided into multiple OUs:

- FT-002 Source OU
- FT-002 Groundwater OUs

Further, because groundwater contamination from site FT-002 is currently impacting or will potentially impact groundwater beneath several IRP sites in the base's industrial area east of the flightline, the Air Force, in conjunction with NYSDEC and USEPA, expanded the FT-002 Groundwater OU to include the groundwater portions of these affected areas. The expanded operable unit, called the FT-002/IA Groundwater OU, includes groundwater underneath seven IRP sites: FT-002, SS-004, SS-005, SS-006, SS-011, SS-017, and SS-041 (formerly SD-041). Only groundwater associated with these sites is included in the FT-002/IA Groundwater OU, which is the subject of this ROD. This OU addresses cleanup and control of contamination dissolved within groundwater (mainly chlorinated hydrocarbons and fuel-related contaminants) resulting from the FT-002 source area and other groundwater contamination comingled with the FT-002 source area contamination occurring downgradient from the FT-002 source area. The principle threats of contamination in groundwater are its potential to be ingested by humans and its potential to migrate to surface water bodies.

The extent of groundwater contamination above ARARs, based on the 2001 Remedial Investigation/Feasibility Study (RI/FS) (URS 2001d), shown on Figure 2, includes a plume that extends from the FT-002 site into the base's industrial area and a smaller contaminated area near the southeast corner of the industrial area. The boundary of the FT-002/IA Groundwater OU (Figure 2) extends beyond the limits of groundwater contamination to account for uncertainties associated with groundwater transport modeling and future contaminant migration, as well as to ensure that remedial measures, including deed and lease restrictions that are discussed in Section 12, are and will continue to be protective of public health and the environment. The extent of the groundwater plume, based on 2011 groundwater data, is also discussed in Section 12.

This action for the FT-002/IA Groundwater OU addresses the principal threats by restoring the aquifer to drinking water quality over time and by controlling and treating groundwater discharge to

surface water bodies. It is intended that this remedy will be the final action for the FT-002/IA Groundwater OU.

The sources of contamination in soils from each of the sites which are contributing to the FT-002/IA Groundwater OU plume are being addressed separately from this FT-002/IA Groundwater OU. The FT-002 Source OU addresses cleanup and control of product and contaminated soils at the FT-002 source area (from the ground surface vertically downward to a depth at which soil has been directly contaminated by free product to the lowest point of water table fluctuation). The 2003 Interim ROD addressed, among other things, the treatment of the FT002 groundwater plume. Other RODs have been executed for the SS-005 Soil OU, the SS-006 Soil OU, the SS-017 Soil OU, SS-011, SS-041, and as mentioned above the FT-002 Source OU. Analysis that will result in a ROD to address conditions present at SS-004 is underway. The selection of a remedy for the FT-002/IA Groundwater OU considers the actions that have been or are anticipated to be undertaken at these other source areas.

5.0 SITE CHARACTERISTICS

Past investigations at the FT-002 site and other relevant sites (Section 5.1), the hydrogeologic setting (Section 5.2), the nature and extent of groundwater contamination (Section 5.3), and the potential for future migration of contamination (Section 5.4) are summarized below.

5.1 Previous Investigations

5.1.1 FT-002 Preliminary Assessment/Site Inspection

In 1984-85, a preliminary assessment (PA) consisting of primarily a records search was conducted for FT-002. Based upon the results of the PA, a site inspection (SI) was conducted in 1987 (E.C. Jordan 1989). It included three borings that were completed as monitoring wells, soil sampling, an active soil gas survey, and geophysical surveys. The study confirmed the presence of fuel-related compounds and solvents in the subsurface soil. In addition, free product was detected floating on the water table surface.

Following the SI, further analysis of contamination related to the FT-002 site was divided into multiple OUs to address both Source and Groundwater. From that point, implementation and documentation of investigations and remediation for the OUs have proceeded along separate paths.

5.1.2 FT-002 Source OU Investigation and Actions

From 1988 to 1993, a multi-phased RI was undertaken to investigate soil contamination and the presence of free product at the FT-002 site (ABB-ES & URS 1993). The comprehensive study examined the vertical and horizontal extent of soil contamination by soil sampling. The study also included an evaluation of human and ecological health risks posed by the contaminants attributed to FT-002. Supplemental soil sampling was undertaken at the FT-002 site in 1997 (URS 1998c) and 1999 (Hunt 1999).

In 1990, an Engineering Evaluation/ Cost Analysis (EE/CA) was prepared to evaluate alternatives for the recovery of free floating product from the FT-002 site (E.C. Jordan 1990). As a result of the fire training exercises, product migrated vertically from the ground surface to the water table and formed a floating layer on the water table. Based on the EE/CA results, the Air Force implemented a removal action in June 1992. A groundwater treatment plant and product recovery system were constructed and

went on-line in 1993. The system was upgraded in 1996. More than 20,000 gallons of product were collected before the system was shut down in 2008.

In 1995, an FS was completed which included a detailed evaluation and comparison of nine alternatives to remediate FT-002 soil based on USEPA's nine criteria set forth in the NCP (URS 1995a).

In 1996, an Action Memorandum was prepared which included a recommendation and conceptual design for a removal action to address contaminated soil (Parsons & OHM 1996). The removal action, which was implemented later that year, consisted of SVE to address chlorinated hydrocarbon contaminants, bioventing to address fuel-related contamination, control of the water table surface using groundwater extraction wells, and the above-mentioned upgrade to the groundwater treatment plant constructed for the 1993 product removal action.

A Proposed Plan for the FT-002 Source OU (URS 2000b) was prepared and presented to the public at a public meeting on December 14, 2000. The proposed remedy included a combination of SVE and bioventing of contaminated soil, free product collection, water table depression enabling remediation of residual product adhering to soil below the water table, hydraulic containment of the source, institutional controls, and progress monitoring and sampling. A ROD for the FT-002 Source OU was prepared following public comment on the Proposed Plan and signed in March 2001 (URS 2001a).

With the signing of the FT-002 Source OU ROD, the removal action systems became part of the selected remedy for that OU. The ROD also set forth a process to identify the remaining contamination within the OU and to expand the remedial systems as necessary to adequately address that contamination. Per the ROD, an initial Remediation Progress Soil Boring and Sampling Event was executed in 2001 (URS 2003a). Based on the analytical results from soil samples, additional treatment system capacity, groundwater and product recovery wells, and SVE vent wells were added to the remedial systems to address contamination remaining above ROD-specified remediation goals.

Two additional boring programs were conducted within the FT-002 Source area, one in 2006 and the second in 2007. Based on the results of these two sampling events, and the fact that there was no longer recoverable free product at the site, in May 2008, the Air Force concluded that the remedial objectives specified in the FT-002 Source OU ROD had been met (Farnsworth 2008). Therefore, the Air Force recommended that the FT-002 Source OU remediation systems be shut down and placed in standby mode. USEPA and NYSDEC agreed, and the systems were shut down on July 17, 2008.

5.1.3 FT-002 Groundwater OU Investigation

5.1.3.1 FT-002 Groundwater Remedial Investigation

As a follow-up to the SI, a multi-phased FT-002 groundwater RI (ABB-ES & URS 1994) was undertaken to evaluate the nature and extent of contamination in groundwater attributable to FT-002. The RI identified the primary contaminants associated with the FT-002 groundwater plume as being TCE, DCE, and BTEX. TCE and DCE are chlorinated hydrocarbons. Other organic and inorganic compounds were limited in extent to the area close to the FT-002 source.

Based on the study it was concluded that the dissolved plume of chlorinated hydrocarbons extended from the FT-002 site eastward to beneath the flightline ramp. The maximum groundwater concentrations for TCE and DCE found during the RI were 3,900 micrograms per liter ($\mu\text{g/L}$) and 18,000 $\mu\text{g/L}$, respectively. The groundwater quality standard for these two compounds is 5 $\mu\text{g/L}$ (Table 3). The maximum total BTEX concentration in groundwater was 19,320 $\mu\text{g/L}$. The groundwater quality standard for benzene is 1 $\mu\text{g/L}$; the groundwater quality standard for toluene, ethylbenzene, and xylene, the other three components of BTEX, is 5 $\mu\text{g/L}$ for each compound.

Surface water sampling also indicated that groundwater contaminants were being discharged to a storm drain between the runway and flightline which flows to surface water at the WSA.

As part of the study, the health risk posed to potential human receptors was assessed. The assessment concluded that using groundwater contaminated by the FT-002 site for potable use could pose a significant threat to human health. It is important to note that the portion of the aquifer contaminated by the FT-002 plume currently is not used as a potable supply source because a public water supply is available.

5.1.3.2 Intrinsic Remediation EE/CA

In 1993 and 1994, an Intrinsic Remediation EE/CA was conducted (Parsons 1995). The purpose of the study was to determine whether naturally-occurring attenuation processes for fuel hydrocarbons were occurring in groundwater at the OU and, if so, to evaluate the impact of these processes on contaminant migration. The effort was part of a greater study by the Air Force to evaluate natural

attenuation processes at bases across the country. This report included valuable data concerning the size and strength of the contaminant source, the observed mechanics of biodegradation of fuel, the possible co-metabolism of chlorinated hydrocarbons, and the extent of contamination. The Air Force concluded in the report that geochemical data strongly suggests that BTEX is biodegrading; modeling data led the Air Force to predict that the BTEX plume would not migrate further. It was also concluded that chlorinated hydrocarbons are biodegrading by anaerobic co-metabolic processes within the BTEX plume.

In groundwater, the most important process for the natural biodegradation of chlorinated compounds is called reductive de-chlorination. During this process, a chlorine atom is removed from the chlorinated hydrocarbon and replaced with a hydrogen atom. As chlorine atoms are removed, TCE is transformed to DCE, DCE to vinyl chloride, and, finally, vinyl chloride to ethene. Although this transformation progresses slowly under normal aerobic conditions in groundwater, the reductive de-chlorination process appears to be accelerated under the anaerobic conditions within the portion of the FT-002 plume in which the BTEX compounds and the chlorinated compounds are co-metabolizing (URS 2001d).

Some of these data were used in the FT-002/IA Groundwater OU RI/FS, particularly to develop the groundwater transport model. An addendum to the study was issued in 1997 (Parsons 1997c).

5.1.3.3 FT-002 Operable Unit Two Groundwater Feasibility Study

In 1994-1995, an FS was conducted which evaluated ten alternatives to clean up contaminated groundwater associated with FT-002 and compared the alternatives to the NCP's nine criteria for evaluating remedial alternatives (URS 1995c). This study was based on the initial FT-002 groundwater RI report (ABB-ES & URS 1994). The FS did not make a recommendation regarding a preferred alternative.

5.1.3.4 FT-002/Industrial Area Groundwater OU Remedial Investigation/Feasibility Study

Following the issuance of the FS, it was determined by the Air Force, in conjunction with the NYSDEC and USEPA, that the groundwater operable unit for FT-002 should be expanded to include potentially impacted groundwater in the base's industrial area east of the flightline. As shown on Figure 2, the FT-002 groundwater contaminant plume has entered the western portion of the industrial area. In addition, a significant area of groundwater contaminated with chlorinated compounds is located in the

eastern portion of the industrial area as a result of spills that occurred within the industrial area; the FT-002 plume is migrating eastward and mingling with this contamination. The highest concentration of total chlorinated hydrocarbons in this second plume at the time of the RI/FS (URS 2001d) was 105.5 µ/L (TCE 28µg/L; DCE 75 µg/L; and vinyl chloride 2.5 µg/L).

It was also apparent that additional data were necessary to reasonably predict potential future movement of groundwater contamination and to adequately assess potential impact on off-base groundwater users and surface water bodies. Therefore, a comprehensive large-scale study was initiated.

The study (URS 2001d) included both RI and FS components. The RI achieved the following: (a) the geologic, hydrologic, and chemical conditions of groundwater were set forth; (b) potentially impacted human and ecological populations were identified; (c) the future disposition of contamination in groundwater was modelled; and (d) potential risk to human health and the environment was evaluated. In the FS the results of the RI were relied upon to establish remedial goals, evaluate remedial alternatives, and set forth a recommendation of an appropriate remedial action.

The field investigation and data compilation phases of the RI were conducted to fill in data gaps remaining from previous investigations and to address Air Force, USEPA, and NYSDEC concerns. Several phases of field investigation activities were conducted between December 1995 and August 1999. Activities consisted of:

- A potable well survey at over 50 residences and commercial properties along Route 9
- A rapid bioassessment (a screening level evaluation to determine whether biological impairment exists as a result of chemical releases from the area of study) of aquatic resources along the WSA and Golf Course surface water drainage systems
- Seismic and resistivity surveys
- Installing four borings and 44 monitoring wells and piezometers
- Geotechnical analyses
- Aquifer testing including slug tests, packer tests, and one pumping test
- Water level monitoring
- Collection and analysis of groundwater samples from about 100 wells and piezometers

- Soil gas surveys and soil sampling to attempt to identify a groundwater contamination source area upgradient of SS-011
- Stream flow measurements in the Golf Course and the WSA Drainage streams and the storm drainage culvert south of taxiway #1
- Geologic field reconnaissance and mapping
- Surveying and topographic mapping
- Three borings along the eastern base boundary to gather data on the depth and continuity of the clay confining layer
- A topographic survey of a large drainage basin between the runway and flightline ramp and the locations and elevations of storm sewer drainage features within this basin.

Data were analyzed using a comprehensive database of basewide groundwater information that was collected over time. The hydrogeologic and chemical conditions of groundwater are presented in Section 5 of this ROD. A summary of human and ecological risk is provided in Section 7. A summary and an evaluation of alternatives are presented in Sections 9 and 10, respectively.

5.1.3.5 Supplemental Surface Water and Groundwater Sampling

The Air Force has conducted periodic surface water and groundwater sampling at key locations on the base. The purpose of the sampling has been to provide a level of comfort to interested parties, including regulatory agencies and the community, that surface water contaminants migrating from groundwater to the Golf Course and WSA drainage systems are not migrating off-base. These two drainage systems are shown on Figure 2. Between February 1998 and December 2002, 22 surface water sampling events (at four locations) and ten groundwater sampling events (at 14 locations) have been undertaken. The latest available surface water data from this program, collected in December 2002 (URS 2003b), indicated that only one area of the WSA stream contains contamination above regulatory limits. Contamination was not detected in the groundwater wells sampled, indicating that eastward migration of groundwater contamination off base was not occurring.

The 2003 Interim Remedy as implemented includes two groundwater collection trenches that discharge to the Golf Course drainage system, one located along Idaho Avenue and the other on the east side of the flightline. Between September 2003, when the southern portion of the East Flightline Collection Trench was completed (the Idaho Avenue Collection Trench was completed in February 2005), and mid-2007, periodic surface water samples were collected at the point where the Golf Course

drainage system exits the base. No contaminants were ever detected at this location at concentrations that exceeded regulatory surface water quality standards. Sampling at this location was discontinued in July 2007 with the approval of NYSDEC and USEPA.

5.1.3.6 Soil Vapor Intrusion Study

Between November 2006 and April 2007, an SVI study, that included sub-slab soil gas and indoor air sampling, was conducted at 14 buildings in the Industrial Area east of the flightline ramp (URS 2008b). There was a concern that VOCs could be present in the soil vapor under, or in close proximity to, the building slabs as a result of volatilization of chemical contaminants from the groundwater beneath the buildings. The buildings included in the study are shown on Figure 2a. As a result of this study, SVE systems were installed at three of the buildings (2753, 2766, and New Building C) and use restrictions related to SVI have been included in this remedy (Section 12).

Health risks posed by groundwater contamination in this area were evaluated as part of the FT-002/IA Groundwater OU RI/FS (URS 2001d). Using observed groundwater contaminant concentrations, modeling was used to evaluate potential health risks resulting from contaminants migrating from the groundwater to the air inside Industrial Area buildings. Significant health risks were not identified; however, indoor air samples were not collected as part of the RI/FS evaluation.

In cooperation with NYSDEC, USEPA and the New York State Department of Health (NYSDOH), the Air Force performed additional studies in 2006 and 2007 to confirm the results of the RI modeling and to evaluate the extent to which any remedial action may be necessary to protect human health.

Sub-slab soil gas samples were collected at all 14 buildings in December 2006, and one building was re-sampled in March 2007 (Building 1810 only). Based on the concentrations in the sub-slab soil gas samples, the Air Force, NYSDEC, NYSDOH, and USEPA decided whether or not to proceed with indoor air sampling. For six of the buildings (1807, 1812, 2616, 2786, 2796, and 2797), VOC concentrations in the sub-slab soil gas samples were low enough that there appeared to be a limited potential for SVI; however, these six buildings are included within the areas of the FT-002/IA Groundwater OU that are subject to use restrictions related to SVI and groundwater use/non-residential use restrictions (Section 12.4.4).

For the remaining eight buildings (1810, 2612, 2622, 2753, 2763, 2766, 2793, and New Building C), the VOC concentrations in the sub-slab soil gas samples were high enough that indoor air samples were also collected in March and April 2007. The Air Force concluded that there appeared to be a limited potential for SVI at these eight buildings based on either the sub-slab soil gas sample results, the indoor air sample results compared to Air Force-derived indoor air risk-based screening levels, the estimated total risk from indoor air exposure, the present condition and/or use of the building, evidence of possible industrial use and exposure, or a combination thereof (URS 2008b). These eight buildings are, however, also included within the SVI and the groundwater use/non-residential use restriction areas described in Section 12.4.4.

On December 13, 2007, representatives of the Air Force, NYSDEC, NYSDOH, and USEPA met in Albany, New York to discuss the soil vapor intrusion study. USEPA and NYSDEC expressed concerns that further investigation of the eight buildings noted above was needed, and, subsequently, the Air Force agreed to perform additional sampling to determine if its conclusions remained supportable and to allay the expressed USEPA and NYSDEC concerns. The recommendations from the meeting and the actions that were taken are summarized below for each of the eight buildings.

Building 1810. The concentration of acetone was 26,000 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) in the sub-slab soil gas samples collected in December 2006. Acetone was not detected in the indoor air samples, and it has not been a contaminant of concern for the FT-002/IA Groundwater OU. However, because of this apparently anomalous high concentration, another sub-slab soil gas sample was collected in March 2007. Acetone was still detected, but at a much lower concentration ($1,800 \mu\text{g}/\text{m}^3$).

Although it could have been a laboratory contaminant, all parties at the December 2007 meeting agreed that another round of sub-slab sampling would be advisable to determine the source of the acetone, if there was one. In March 2008, two additional sub-slab soil gas samples were collected at Building 1810. The acetone concentrations in these two samples, $21 \mu\text{g}/\text{m}^3$ and $74 \mu\text{g}/\text{m}^3$, confirmed that the earlier sample results were anomalous (URS 2009).

Building 2612. This building is an unheated, sheet metal-sided storage building that is in very poor condition. There are numerous cracks in the building's concrete slab that could create a pathway for soil vapor intrusion. The building is, however, highly ventilated. There are visible gaps at wall-to-wall and wall-to-ceiling joints, and the roof vents are not sealed. These factors create an environment where the indoor air and outside air are essentially the same. Consequently, VOC concentrations in the 2007

indoor air samples were well below indoor air commercial/industrial screening levels, resulting in a low risk from soil vapor intrusion (URS 2008b).

At the December 2007 meeting, all parties agreed that, considering the current condition of the building, there appeared to be a limited potential for SVI at Building 2612, provided that it remained unoccupied (URS 2008b). Building 2612 is part of IRP Site SS-041, but restrictions related to SVI and a restriction requiring that the building remain unoccupied are specifically included for Building 2612 in the FT-002/IA Groundwater OU (Section 12).

Building 2622. In December 2006, TCE was found in two of six sub-slab soil gas samples at concentrations high enough (i.e., $170 \mu\text{g}/\text{m}^3$ and $320 \mu\text{g}/\text{m}^3$) that indoor air samples also were collected at these two locations, plus two others, in March 2007. Both TCE and tetrachloroethene, also known as perchloroethene (PCE), were detected in the Building 2622 indoor air samples. The presence of PCE in the indoor air, but not in the soil gas, indicated a probable source for PCE inside the building. There were no exceedances of health risk-based screening criteria for the indoor air samples, so it was therefore concluded that there appeared to be a limited potential for SVI at this building (URS 2008b).

Although the indoor air samples collected in this building did not represent a risk from soil vapor intrusion, there was still a concern regarding elevated concentrations of site-related contaminants in the sub-slab environment. Consequently, at the December 2007 meeting, it was agreed that additional sub-slab soil gas and indoor air samples would be collected in 2009, prior to the next five-year review (URS 2008b). The objective of the sampling was to evaluate if the decreasing FT-002/IA Groundwater OU plume size and concentrations were causing a corresponding decrease in the concentrations found in sub-slab soil gas samples collected at this building.

At Building 2622, six sub-slab soil gas samples were collected in March 2009 at approximately the same locations as the 2006 samples. Indoor air samples were also collected at the same six locations. In 2006, TCE was detected in four of the six sub-slab soil gas samples collected, but in 2009, TCE was only detected in two samples (Shaw 2010). At these two sub-slab soil gas sample locations, the TCE concentration dropped from $320 \mu\text{g}/\text{m}^3$ and $170 \mu\text{g}/\text{m}^3$ in 2006 to $130 \mu\text{g}/\text{m}^3$ and $16 \mu\text{g}/\text{m}^3$, respectively, in 2009. TCE was only detected in one indoor air sample collected during the March 2009 event. The concentration of TCE was $150 \mu\text{g}/\text{m}^3$, and the sample was collected at the same location as the sub-slab soil gas sample in which TCE was detected at $130 \mu\text{g}/\text{m}^3$. PCE was not detected in any of the sub-slab soil gas or indoor air samples.

The high concentration of TCE in one of the March 2009 indoor air samples is most likely the result of industrial activities within the building and not soil vapor intrusion, since the indoor air sample concentration was higher than the sub-slab soil gas concentration at the same location. Significant industrial activity and chemical usage that included chlorinated compounds were observed during the sampling event (Shaw 2010). Also, the similar concentration of TCE in the sub-slab soil gas sample at this same location could have been caused by leakage of indoor air containing TCE into the sample. Consequently, the Air Force concluded that there appeared to be a limited potential for SVI at Building 2622 (Farnsworth 2009a); however, based on discussions among the Air Force, NYSDEC, and USEPA, the Air Force agreed to re-sample this one location to determine if the TCE results were anomalous.

In January 2010, a sub-slab soil gas sample and an indoor air sample were collected at the same location as the March 2009 samples with $130 \mu\text{g}/\text{m}^3$ of TCE in the sub-slab soil gas and $150 \mu\text{g}/\text{m}^3$ in the indoor air (Shaw 2010). TCE was detected in the January 2010 sub-slab soil gas and indoor air samples, but at very low concentrations of $9.1 \mu\text{g}/\text{m}^3$ and $0.53 \mu\text{g}/\text{m}^3$, respectively, much less than the March 2009 concentrations. PCE was also detected, but at very low concentrations (less than $1.5 \mu\text{g}/\text{m}^3$).

In summary, sub-slab soil gas concentrations have decreased relative to the initial sampling results in 2006 and, based on the 2010 sampling results, there appears to be a limited potential for SVI at Building 2622 (Farnsworth 2010a).

Building 2753. In a sub-slab soil gas sample collected in the northeast corner of this building, TCE was detected at $18,000 \mu\text{g}/\text{m}^3$, which is higher than would normally be expected from a groundwater source alone. Chloroform and PCE also were detected in the same sample, but at lower concentrations, 259 and $200 \mu\text{g}/\text{m}^3$, respectively. TCE and PCE were also detected in the indoor air sample collected in the same area of the building, but the concentrations were only $1.1 \mu\text{g}/\text{m}^3$ and $0.5 \mu\text{g}/\text{m}^3$, respectively. Chloroform was not detected. Although it was concluded from the study that soil vapor intrusion was not currently an issue for this building, the high levels of TCE in the soil gas were a concern to NYSDEC.

From 1997 to 2002, an interim remedial measure (IRM) for Site SS-017 was in progress on the north and east side of Building 2753 (URS 2002b). The IRM included soil vapor extraction, bioventing, and biosparging. The high levels of TCE in the sub-slab soil gas may be due to residual contamination under the building remaining after the IRM systems were shut down.

An SVE system was designed to remove the potential source of the soil gas in the northeast portion of Building 2753 (Shaw 2009). It has been installed, and initial start-up of the system occurred in December 2009. In November 2010, after about 12 months of operating the SVE system, a sub-slab soil gas sample was collected from the same location that had exhibited 18,000 $\mu\text{g}/\text{m}^3$ of TCE in 2006. In 2010, the TCE concentration had reduced to 620 $\mu\text{g}/\text{m}^3$ (Shaw 2011). The SVE system continues to operate.

Building 2763. In 2006, sub-slab soil gas samples were obtained under Building 2763, and PCE was detected in four of five samples and at a maximum concentration of 150 $\mu\text{g}/\text{m}^3$ in one of the samples. TCE was also detected in three of the sub-slab soil gas samples at 18 $\mu\text{g}/\text{m}^3$, 120 $\mu\text{g}/\text{m}^3$ and 130 $\mu\text{g}/\text{m}^3$. PCE was detected in only one of six indoor air samples, and at a very low concentration of 0.75 $\mu\text{g}/\text{m}^3$. TCE was not detected in the indoor air samples. There were no exceedances of health risk-based commercial/industrial screening criteria for the indoor air samples, so it was therefore concluded that there was a limited potential for SVI at the building (URS 2008b).

Similar to Building 2622, however, a concern remained regarding elevated concentrations of PCE and TCE in the sub-slab environment, so, at the December 2007 meeting, it was agreed that additional sub-slab soil gas and indoor air samples would be collected in 2009, prior to the next five-year review (URS 2008b). Again, the objective of the sampling was to evaluate if the decreasing FT-002/IA Groundwater OU plume size has had a beneficial effect on the concentrations found in sub-slab soil gas samples collected at this building.

At Building 2763, five sub-slab soil gas samples were collected in March 2009 at approximately the same locations as the 2006 samples (Shaw 2010). One indoor air sample was collected. In 2006, TCE was detected in three of the five sub-slab soil gas samples; the highest concentration was 130 $\mu\text{g}/\text{m}^3$. In 2009, TCE was detected in the samples collected at the same three locations, but the highest concentration was only 12 $\mu\text{g}/\text{m}^3$. In 2006, the highest concentration of PCE in the sub-slab samples was 150 $\mu\text{g}/\text{m}^3$. PCE was not detected in the 2009 sub-slab soil gas sample at this location. PCE was detected in only two of the remaining four 2009 samples at 1.8 $\mu\text{g}/\text{m}^3$ and 5.3 $\mu\text{g}/\text{m}^3$. There were no detections of either TCE or PCE in the indoor air samples. Based on these results, the Air Force concluded that there was limited potential for SVI at Building 2763 (Farnsworth 2009c).

Building 2766. In one of three 2006 sub-slab soil gas samples obtained under building 2766, TCE was detected at $4,400 \mu\text{g}/\text{m}^3$, so it was decided to also collect indoor air samples. TCE was not detected in any of the indoor air samples.

During the initial sampling for this study, Building 2766 was unoccupied and used for storage. Subsequent to the sampling, the building use changed to aircraft storage and it appeared to be occupied, so at the December 2007 meeting, the parties agreed that there should be additional sub-slab and indoor air sampling. Also, the highest concentration of TCE in one of the sub-slab soil gas samples ($4,400 \mu\text{g}/\text{m}^3$) was significantly higher than the other sample results for this building and higher than would be expected from a groundwater source alone.

In March 2008, the original three locations were sampled again, as well as four new locations. Indoor air samples were also collected at the same locations. The sub-slab soil gas samples collected from these seven locations were analyzed for TCE, as well as PCE. Only one sub-slab soil gas sample contained PCE, at $4.6 \mu\text{g}/\text{m}^3$ (URS 2009). TCE was found in all seven samples; the highest concentration was $510 \mu\text{g}/\text{m}^3$, much less than the highest concentration found in the first round of sampling. The highest concentration of TCE in the sub-slab soil gas samples from the 2006 sampling event, $4,400 \mu\text{g}/\text{m}^3$, had decreased to $180 \mu\text{g}/\text{m}^3$ at the same location in 2008. PCE and TCE were not detected in any of the indoor air samples.

A third round of sub-slab soil gas sampling occurred at Building 2766 in March 2009 (Shaw 2010). The samples were collected at the same seven locations as in 2008; indoor air samples were not collected. TCE was detected in all seven samples at higher concentrations than were found in 2008. The highest TCE concentration in 2008 was $510 \mu\text{g}/\text{m}^3$; at the same location in 2009, the concentration increased to $1,200 \mu\text{g}/\text{m}^3$. All of the TCE concentrations were higher than those found in adjacent Building 2763; the highest concentration of TCE in the March 2009 sub-slab soil gas samples at Building 2763 was only $12 \mu\text{g}/\text{m}^3$.

The results from the three sampling events taken together suggest a probable source of contamination beneath the floor slab at Building 2766, and, consequently, the Air Force recommended that an SVE system be installed under the building (Farnsworth 2009c). The system was installed and began operating in mid-December 2010. In February 2012, after about 14 months of operating the SVE system, seven sub-slab soil gas samples were collected at the same locations that had been sampled in 2009 before the SVE system was installed. For the 2012 samples, the TCE concentrations decreased at

all of the sample locations compared to the 2009 data. The highest TCE concentration in 2009 was 1,200 $\mu\text{g}/\text{m}^3$; in 2012 at the same location the TCE concentration was only 68 $\mu\text{g}/\text{m}^3$. TCE concentrations at the other six locations in 2012 ranged from non-detect to 57 $\mu\text{g}/\text{m}^3$. The highest historical TCE concentration is 4,400 $\mu\text{g}/\text{m}^3$ from the 2006 sample data. The TCE concentration at this same location was only 13 $\mu\text{g}/\text{m}^3$ in 2012 (URS 2012a). The building 2766 SVE system continues to operate.

Building 2793. Sub-slab soil gas samples collected in December 2006 at Building 2793 yielded unexpected results; fuel-related compounds were detected. Benzene, toluene, ethylbenzene, m,p-xylene, and o-xylene, the fuel-related BTEX compounds, were detected in all three samples collected. The compound m,p-xylene had the highest concentrations, ranging from 1,500 $\mu\text{g}/\text{m}^3$ to 9,100 $\mu\text{g}/\text{m}^3$. Indoor air samples were then collected in March 2007. Benzene, ethylbenzene, m,p-xylene, and o-xylene were detected in all of the samples, but at levels well below the health risk-based commercial/industrial indoor air screening criteria. It was therefore concluded that there was a limited potential for SVI at this building (URS 2008b).

The December 2006 sub-slab soil gas sample results were unexpected because no subsurface petroleum contamination or other sources for that contamination have been reported for Building 2793 (URS 2008b). Historically, the only reported spills in the vicinity of Building 2793 were a 10-gallon and a 3-gallon jet fuel spill from aircraft parked on the north side of the building in 1989 and 1992 respectively (Tetra Tech 1997).

At the December 2007 meeting, it was agreed to conduct an investigation at Building 2793 to determine the source of the fuel-related compounds in the sub-slab soil gas samples. In October 2008, soil and groundwater samples were collected from inside and around the perimeter of the building. The samples were analyzed for VOCs and SVOCs.

The results of the sampling did not indicate a source of contamination underneath or in the immediate vicinity of Building 2793 that could have contributed to the unexpected detections of BTEX compounds in the sub-slab soil gas and indoor air samples. Compounds identified in the soil and groundwater samples were detected at concentrations less than established site-wide cleanup standards (Coulter 2008a). One additional round of sub-slab soil gas sampling was recommended to verify the results of the 2006 event.

In March 2009, three sub-slab soil gas samples were collected at approximately the same locations as the samples collected in 2006 (Shaw 2010). At two of the three sample locations, there were significant reductions in the total concentration of BTEX compounds; however, at the third location on the east side of the building, the total BTEX concentration increased from about 5,700 $\mu\text{g}/\text{m}^3$ to more than 48,000 $\mu\text{g}/\text{m}^3$. The Air Force, therefore, re-sampled this one location in an effort to confirm the possibly anomalous March 2009 results (Farnsworth 2009c).

In March 2010, a sub-slab soil gas sample was collected at the location of the result from March 2009 sampling event (Shaw 2010). Four additional samples were also collected at the cardinal compass points (north, east, south, and west) around that location. The total concentration of BTEX compounds in each sample was less than 100 $\mu\text{g}/\text{m}^3$, which confirms that the March 2009 results were likely anomalous (Farnsworth 2010b). Two sub-slab soil gas samples also were collected at the center and the west end of the building; concentrations of BTEX compounds were consistent with or less than those observed in March 2009. In addition, two indoor air samples were collected, one at the west end of the building, and one at the east end. BTEX compounds were detected in each sample, but their presence is most likely the result of the building's continued use for aircraft parking and maintenance. The concentrations detected were similar to those found in the December 2006 samples, and, at that time, the Air Force concluded that there was a limited potential for SVI (URS 2008b).

In summary, no source of contamination has been found in the soil or groundwater beneath the building, and the BTEX concentrations in sub-slab soil gas and indoor air samples appear minor. Consequently, based on the sampling results, there appears to be a limited potential for SVI at Building 2793 (Farnsworth 2010b).

New Building C. In December 2006, four soil gas samples were collected from beneath the floor slab of New Building C. PCE was detected in one of the samples at 3,900 $\mu\text{g}/\text{m}^3$, which is higher than would be expected from a groundwater source alone. Two other samples also contained PCE, but at much lower concentrations of 12 $\mu\text{g}/\text{m}^3$ and 160 $\mu\text{g}/\text{m}^3$, respectively.

Groundwater samples also were collected from two monitoring wells located about 250 feet east and west of the building, but PCE was not detected in either of the samples.

Because of the high concentrations of PCE in the sub-slab soil gas samples, six indoor air samples were collected in March 2007. PCE was detected in all of the samples, but at less than 1 $\mu\text{g}/\text{m}^3$,

which is well below its Air Force's risk-based commercial/industrial indoor air screening criterion. Therefore, based on the sample data, the Air Force concluded that there appeared to be a limited potential for SVI at New Building C (URS 2008b).

The high levels of PCE in the soil gas were still a concern, however. At the December 2007 meeting, all parties agreed that two additional rounds of sub-slab soil gas and indoor air sampling would be performed during the 2007/2008 heating season. It also was agreed that soil gas samples would be collected from around the outside perimeter of the building.

One week apart, at the end of March and the beginning of April 2008, additional sub-slab soil gas and indoor air samples were collected. PCE concentrations were detected at levels much lower in the sub-slab soil gas samples than they were at the same locations as those having the elevated concentrations in December 2006. However, at a new sub-slab soil gas sample location within the building footprint, the PCE concentrations were still elevated at 4,300 $\mu\text{g}/\text{m}^3$ and 4,500 $\mu\text{g}/\text{m}^3$. PCE was detected in only one of the indoor air samples at 0.29 $\mu\text{g}/\text{m}^3$, which is only barely above the analytical method detection limit of 0.27 $\mu\text{g}/\text{m}^3$, well below screening criterion (Coulter 2008b).

Additional soil gas sampling around the perimeter of the New Building C occurred in October 2008. The objective of this investigation was to determine if there is a source of contamination outside and/or upgradient of the building that could be contributing to the high concentrations of PCE found in the sub-slab soil gas samples. PCE was detected in all of the samples at concentrations ranging from 11 $\mu\text{g}/\text{m}^3$ to 310 $\mu\text{g}/\text{m}^3$.

Concentrations of PCE in the perimeter soil gas samples were much less than the concentrations in the sub-slab soil gas samples, so it is unlikely that there is a source for PCE outside the building. It is more likely that the hot spots under the building are artifacts from previous activities and/or spills in the vicinity of New Building C (Coulter 2008b).

At the December 2007 meeting, all parties agreed that the Air Force would install a remediation system under the building if the PCE concentrations in the additional sub-slab soil gas samples collected in 2008 were the same as those in the samples collected in December 2006. The levels of PCE were still elevated, but the distribution of the concentrations had changed, as noted above. Consequently, in March 2009, additional sub-slab samples were collected to define the extent of the problem (Shaw 2010). Sub-slab soil gas samples were collected at the same locations as the 2008 samples plus two new locations in

the south half of the building. Access had been previously limited in this area of the building by the tenant. Indoor air samples also were collected. The 2009 sub-slab soil gas concentrations were similar to the 2008 results. PCE was detected in all of the samples. The highest concentration of PCE was found at the same location as in 2008, and at the same concentration, 4,500 $\mu\text{g}/\text{m}^3$. PCE was not detected in any of the March 2009 indoor air samples.

Because of the continued high concentrations of PCE in the sub-slab soil gas samples, the Air Force recommended installing an SVE system under New Building C (Farnsworth 2009b). The installation of the system was completed and began operating in mid-December 2010. In February 2012, after about 14 months of operating the SVE system, sub-slab soil gas samples were collected at New Building C at approximately the same locations as all of the previous events. At the location at which PCE had previously been detected at 4,500 $\mu\text{g}/\text{m}^3$, the concentration had reduced to 150 $\mu\text{g}/\text{m}^3$ (URS 2012a). The SVE system continues to operate.

5.1.4 Other Relevant Investigations

This sub-section describes investigations related to the six sites other than FT-002 that are included in the FT-002/IA Groundwater OU. The sources of these six sites (e.g., soils) are being addressed in separate OUs, but the impacted groundwater at these sites, which comingles with the FT-002/IA Groundwater OU plume, are all being addressed in this one OU, the subject of this ROD. One other site (Pump House No. 3), which is situated within the boundaries of the FT-002/IA Groundwater OU but not considered part of the OU, is also discussed.

5.1.4.1 Site SS-004 (Flightline)

Groundwater at site SS-004 has been included in the FT-002/IA Groundwater OU (Figure 2). Two studies were conducted within the boundaries of site SS-004 that evaluated potential sources for groundwater contamination at the site. The first phase of the SS-004 RI occurred in 1993; a supplemental RI was conducted in 2001/2002 (URS 2007). In addition, extensive investigation of soil contamination was undertaken underneath the flightline ramp and near the pump houses and underground storage tanks along the western edge of the flightline as part of the closure of the aircraft refueling system (OHM 2000). Several hundred soil and groundwater samples were collected during these studies. Based on these studies, the primary sources of chlorinated hydrocarbon contamination at SS-004 appear to be two former concrete-lined drainage trenches that spanned the entire north-to-south length of the flightline

ramp. Aircraft degreasing activities, which may have introduced contamination into the trenches, occurred on the ramp between Colorado Street and Taxiway #3 (Figure 2). These trenches were abandoned by filling them in with concrete circa 1970. Preparation of a Proposed Plan for the non-groundwater component of the SS-004 release is currently independently underway.

5.1.4.2 Sites SS-005 and SS-006 (Non-Destructive Inspection and Aerospace Ground Equipment Facilities)

The Non-Destructive Inspection Facility, site SS-005, was a facility used for nondestructive x-ray inspection of aircraft parts. A waste accumulation area was previously located at the facility. Materials used and stored at this facility included PD-680 cleaning solvent, engine oil, 1,1,1-trichloroethane, developer, dye penetrant fluid, remover, and photographic fixer solution.

The Aerospace Ground Equipment Facility, site SS-006, was a facility used for the maintenance and repair of ground power carts that provided electrical and pneumatic power to parked aircraft. Building 2801, where aircraft maintenance tools were calibrated, is also included in site SS-006. SS-006 is the location of one of the hazardous waste accumulation points on the base. The point accepted hazardous waste from satellite accumulation points at Site SS-006 and at Building 2801. Underground diesel fuel tanks and an oil/waste separator in an underground holding tank were also formerly located at Building 2815.

The groundwater at sites SS-005 and SS-006 has been included in the FT-002/IA Groundwater OU. Site inspections were conducted at sites SS-005 and SS-006 in 1987 (E.C. Jordan 1989). Between October 1992 and February 1995, an RI was performed at the sites which included a health risk assessment for the two sites combined. Monitoring wells were installed, and soil and groundwater samples were collected. Based on the evaluation presented in the RI Report (Malcolm Pirnie 1996), RODs were executed for each of the SS-005 and SS-006 Soil OUs (URS 1998a and URS 1998b). The selected remedies for both sites were institutional restrictions to limit development to non-residential use and prohibition of the installation of wells for drinking water. It was determined that addressing the groundwater contamination at these sites would be included in this FT-002/IA Groundwater OU, groundwater remedial actions for these sites were deferred to and are included in this FT-002/IA Groundwater OU ROD.

5.1.4.3 Site SS-011 (Defense Reutilization and Marketing Office)

Site SS-011, the Defense Reutilization and Marketing Office, is located on the eastern side of the base near Idaho Avenue. Several investigations and soil removal actions were conducted at SS-011 between 1984 and 1992 in response to polychlorinated biphenyl and pesticide spills at the site. During an RI of SS-011 (ABB-ES & URS 1992), chlorinated hydrocarbons were detected in groundwater. Since the concentrations of the chlorinated hydrocarbons clearly increased upgradient from the site, the contamination was attributed to an upgradient source. Post-removal action sampling and health risk analysis substantiated the adequacy of the soil removal actions. Therefore, a ROD for Site SS-011 specifying no further action was executed (URS 1993). Groundwater contamination detected upgradient from and at site SS-011 is being addressed as part of the FT-002/IA Groundwater OU.

5.1.4.4 Site SS-017 (Building 2774)

The former Jet Engine Inspection and Maintenance Shop (Building 2774) is located in the industrial area near the southernmost extent of the FT-002 chlorinated hydrocarbon groundwater plume. Solvent and petroleum product spills occurred in the parking lots in the vicinity of the building. An RI was conducted at the site between 1992 and 1995 (Malcolm Pirnie 1996). In 1992, 200 cubic yards of contaminated soil (contaminated mainly by BTEX and dichlorobenzenes) were removed from the site. Between 1997 and 2002, several treatment systems were operated as part of an additional removal action at the site to clean up the remaining soil contamination (OHM 1997b). Some of the major contamination of concern in soil which necessitated the removal action included TCE, BTEX, and dichlorobenzenes. The treatment systems included soil vapor extraction, biosparging, and bioventing. Although relatively high levels of chlorinated hydrocarbons and other VOCs were detected in groundwater at the site during the RI, more recent groundwater sampling has indicated that the source removal actions have helped reduce groundwater contaminant levels to near or below ARARs (URS 2001c). A ROD for the SS-017 Soil OU was signed in 2002 (URS 2002b). Because the site lies directly and immediately downgradient from the FT-002 groundwater plume, the groundwater for SS-017 site has been included in the FT-002/IA Groundwater OU.

5.1.4.5 Site SS-041 (Building 2612)

In 1998 and 1999, 15 monitoring wells were installed and sampled to investigate groundwater around Building 2612 (a.k.a. SS-041, formerly SD-041), a former Base Equipment and Supply Warehouse located near the intersection of Arizona and Idaho Avenues. The investigation was

undertaken as part of a Supplemental Evaluation to the Plattsburgh AFB Environmental Baseline Survey (URS 2001e). The results indicated that the groundwater near SS-041 is being impacted by an upgradient groundwater chlorinated hydrocarbon plume. However, the contaminant distribution also indicated that a source in the vicinity of Building 2612 could be contributing to the observed contamination.

Additional sampling occurred between 2001 and 2004 as part of the SS-041 RI (URS 2008a). The RI did not identify any continuing sources for groundwater contamination at or in the vicinity of Building 2612. Physical features within and adjacent to the building that could have potentially served as sources for groundwater contamination were cleaned and abandoned in place or removed.

Contaminant transport modeling has indicated that groundwater beneath site SS-041 will be impacted by the FT-002 chlorinated hydrocarbon plume well into the future. Therefore, groundwater contamination in this area is included in the FT-002/IA Groundwater OU.

The only remaining area of concern at this site is a wetland area south of Building 2612. Shallow sediments within the wetland contain cadmium and chromium at concentrations that are of possible concern to terrestrial ecological receptors. A ROD for this site was signed in September 2012 (FPM 2012). The remedy selected in that ROD was to remove the contaminated wetland sediment so as to attain remediation goals that would result in conditions that would not pose a threat to ecological receptors and would also be considered protective of human health for residential use.

5.1.4.6 Pump House No. 3

Pump House No. 3 was formerly located along the western edge of the flightline ramp immediately south of taxiway 3 (Figure 2) and included six 50,000 gallon and one 2,000 gallon underground fuel storage tanks (USTs). In November 1968, the pump house was destroyed by fire during which jet fuel may have been released. In addition, a small fuel spill occurred in this area in 1994. In 1994, the seven USTs at the former Pump House No. 3 were removed. The tanks were originally used (beginning in 1956) for storage of jet fuel, but they were later used (beginning in the early 1970s) for storage of heating fuel and waste fuels until 1994; these tanks were tightness tested annually, from 1991 through 1994, and found to be intact. Following the removal of the USTs, soil and groundwater samples were collected using Geoprobe sampling techniques. BTEX compounds were detected at significant levels in several of the samples. The magnitude and extent of groundwater contamination was not determined. The BTEX contamination appeared located immediately south of a portion of the FT-002

chlorinated hydrocarbon plume, and both the BTEX and the chlorinated fractions appeared to be traveling toward the WSA drainage system (see Figure 2).

In 2001, an investigation of the groundwater contamination in the vicinity of Pump House No. 3 was conducted. The investigation included analyzing 131 groundwater-screening samples collected from 55 borings for BTEX and chlorinated hydrocarbons, installing 6 monitoring wells, analyzing groundwater from the 6 wells, and analyzing 2 sediment and soil samples collected from the adjacent storm drainage system for VOCs. A report of results (URS 2001b) was submitted to NYSDEC and USEPA.

Based on the groundwater screening and monitoring well sampling results, it was concluded that BTEX contamination originating from former Pump House No. 3 is limited in areal extent to within 450 feet from the pump house. The contamination is likely in an equilibrium state as evidenced by the likely age of the spill at the pump house (over 30 years) and high biological activity (indicated by oxygen depleted conditions). The plume of chlorinated hydrocarbons appears to trend separately from the BTEX contamination from the pump house (at a greater depth and to the north). Because the BTEX contaminants are not likely to migrate any farther downgradient and groundwater is not likely to be utilized at this location in the future, active remediation of the BTEX plume was not recommended by the Air Force. The NYSDEC Region 5, Office of Environmental Quality concurred with the conclusions of the report on December 4, 2001. NYSDEC also recommended that monitoring of 9 wells and 2 storm drain locations be conducted every 6 months for at least 2 years.

The last sampling event of the 2 year periodic sampling at Pump House No. 3 occurred in April 2004 (URS 2004). Subsequent to 2004, sampling of several wells in the vicinity of Pump House No. 3 has been included in the annual groundwater sampling event for the FT-002/IA Groundwater OU.

5.2 Hydrogeologic Setting

Groundwater in the vicinity of Plattsburgh AFB occurs in both overburden deposits and bedrock. Hydrologically, the stratigraphic sequence can be divided into the following units from top to bottom: the unsaturated zone, the unconfined sand aquifer, the clay confining layer, the confined till water-bearing zone, and the confined bedrock aquifer. Groundwater movement in these units is controlled by aquifer characteristics, infiltration, and run-off. Borings and monitoring wells were advanced within each of these units to characterize them during the RI/FS for this OU (URS 2001d). The units are described in Table 1.

Groundwater flow from the FT-002 area is multi-directional, as indicated in Figure 3. Note that Figure 3 depicts and the discussion that follows describes groundwater flow conditions within the unconfined aquifer prior to the 2003 groundwater remedy that is described in Section 12 was installed and began operating.

Contamination has been detected only in the unconfined sand aquifer, and flow into the underlying till water-bearing zone and bedrock aquifer is constrained by the clay confining unit. The predominant flow direction from the FT-002 source area is southeastward; much of the groundwater flow is directed toward a deep drainage basin that is situated between the runway and the flightline. The groundwater in this vicinity is diverted to the WSA drainage system by a large storm sewer. Some of the groundwater is not affected by the deep drainage basin and travels southward then southwestward around the deep drainage basin and discharges directly into the WSA drainage system (Figure 3). The streams of the WSA drainage system eventually converge and discharge into the Salmon River.

Some of the groundwater emanating from the FT-002 site is not affected by the deep drainage basin and travels southeastward under the flightline into the industrial area. A geologic cross-section along this southeastward flow path is depicted in Figure 4. Near the southeastern boundary of the base, the unconfined sand aquifer thins, and clay and bedrock are found at or near the surface. Groundwater from the industrial area discharges into the Golf Course drainage system. The several streams in this drainage system converge near the Barracks Golf Course Clubhouse and discharge via a stream that runs just south of Cliff Haven into Lake Champlain.

Some residences near Plattsburgh AFB rely on private groundwater wells for their potable water supply. To identify commercial and residential groundwater well users downgradient from the FT-002 site, a house-to-house water use survey was conducted during the RI/FS (URS 2001d). These well users are shown in Figure 3. Elsewhere off-base and on-base downgradient from the FT-002 site, a public water line is available for residences and businesses. The geologic configuration, groundwater modeling, and groundwater sampling along the eastern base boundary indicate that the off-base residents along Route 9 are not and should not be affected by contamination from FT-002.

Ecological resources in the WSA and Golf Course drainage systems (shown in Figure 3) are receiving groundwater, and contaminant loading, from the FT-002 site. A bioassessment of aquatic resources in the streams of these drainage basins was conducted during the RI/FS (URS 2001d) to

evaluate potential impairment to the stream ecological communities. The study included sampling of benthic macroinvertebrates. Further analysis was performed and is presented in Section 7.2 of this ROD.

5.3 Nature and Extent of Contamination in Groundwater

The chemical quality of groundwater in the vicinity of the FT-002 site, the flightline industrial area, and the former WSA was evaluated by compiling a database of existing groundwater analytical data (307 wells, 968 sample records) from studies/investigations conducted at Plattsburgh AFB during the period from 1987 to 1999. Contaminants detected in groundwater in the immediate vicinity of the FT-002 site included 17 VOCs, 14 semi-volatile organic compounds (SVOCs), and 12 metals (Table 2). The metals generally were detected at or near background concentrations. VOCs detected in groundwater included chlorinated hydrocarbons (e.g., TCE), ketones (e.g., acetone), and fuel-related hydrocarbons (e.g., benzene). SVOCs included light fuel-related polycyclic aromatic hydrocarbons [PAHs] (e.g., naphthalene), heavier polycyclic aromatic hydrocarbons (e.g., phenanthrene), and phenolic compounds (e.g., 2-4 dimethyl phenol). Ketones, fuel-related PAHs, heavier polycyclic hydrocarbons, and phenolic compounds were not detected at concentrations above ARARs outside the source area and are not considered primary contaminants of concern for the FT-002/IA Groundwater OU. Only two groups of compounds, namely chlorinated hydrocarbons (TCE, DCE, and vinyl chloride) and fuel-related volatiles (BTEX), were detected beyond the immediate source area at concentrations above ARARs. Groundwater quality ARARs for these compounds are presented in Table 3. Chlorinated hydrocarbons and BTEX were detected at very high concentrations in the source area, and these two groups of compounds are highly soluble and mobile in groundwater. Therefore, they are considered to be primary contaminants of concern. Contamination was found to be present only in the unconfined sand aquifer.

The extent of BTEX contamination at the time of the 2001 RI/FS (URS 2001d) is shown in Figure 5. The BTEX plume from the FT-002 source area is about 4,000 feet long and 600 to 750 feet wide. This plume does not appear to be expanding, rather it appears to be at equilibrium (biological degradation is occurring as fast as the FT-002 source is feeding the plume). This accounts for the great difference in size between the BTEX plume and the larger chlorinated hydrocarbon plume (Figure 5). The biodegradation of the FT-002 BTEX plume was thoroughly investigated and documented by Parsons Engineering Science, Inc. and the USEPA National Risk Management Research Laboratory (formerly known as the Robert S. Kerr Laboratory) from 1993 through 1996 (Parsons 1995; 1997). Some of the BTEX compounds reach the deep drainage basin between the runway and flightline. These compounds travel via a large storm drain to the WSA drainage system. Benzene has been detected frequently in this

drainage system, but at concentrations below surface water ARARs. In addition, a small area of BTEX groundwater contamination is located immediately south of Taxiway #3 at the former location of Pump House No. 3 (See Figure 2 and Section 5.1.4.6).

The extent of chlorinated hydrocarbon contamination at the time of the 2001 RI/FS (URS 2001d) is also shown in Figure 5. Although chlorinated hydrocarbons undergo biodegradation by a process known as reductive de-chlorination, the biodegradation is slow and the plume of chlorinated hydrocarbons is still expanding. This biodegradation process changes TCE to DCE, DCE to vinyl chloride, and vinyl chloride to the non-toxic compound ethene over time. Vinyl chloride was detected at several locations away from the FT-002 source area. The plume of chlorinated hydrocarbons intersects the deep drainage basin between the runway and the flightline, and chlorinated hydrocarbons are discharging via the storm drain to the WSA drainage system. TCE is routinely detected at a concentration above its surface water ARAR (NYSDEC 2008) within a few hundred feet of the discharge location (Figure 5) before diluting to below its ARAR downstream. Some of the groundwater is not affected by the deep drainage basin and travels southward then southwestward around the deep drainage basin and discharges directly into the WSA drainage system. However, groundwater sampling data indicate that the concentrations of contaminants following this southwestward path have decreased substantially over time, and the levels are currently less than groundwater ARARs.

Chlorinated hydrocarbons from the FT-002 site have also migrated underneath the flightline into the industrial area, mingling with groundwater contamination upgradient from site SS-011, at site SS-041, at site SS-017, and from drains that formerly were located in the flightline. These other sources are shown in Figure 5. Sites SS-005 and SS-006 also were investigated as potential sources of groundwater contamination (URS 1998a and URS 1998b). These sites were determined not to be significant sources of groundwater contamination, although they lie on the northernmost limit of the FT-002 plume and chlorinated hydrocarbons have been intermittently detected in groundwater at those sites. Chlorinated hydrocarbons in groundwater in the industrial area eventually discharge to the Golf Course drainage system, although no chemicals attributable to this OU have been detected in the Golf Course system at levels above ARARs.

5.4 Future Migration of Contamination in Groundwater

A numerical contaminant transport model was developed as part of the RI/FS (URS 2001d) to evaluate the fate of chlorinated hydrocarbons in groundwater and to predict their future potential impact

on receiving surface water bodies. The transport model was built upon a groundwater flow model developed to provide a mathematical representation of the groundwater flow regime at Plattsburgh AFB. The program MODFLOW was used. The flow model was calibrated to a basewide groundwater flow map developed from measurements of groundwater levels at over 300 wells and piezometers. The transport model was calibrated to the existing pattern of contamination determined using the extensive database of chemical data.

The modeling predicted that the extent of the chlorinated hydrocarbon plume would expand in the industrial corridor and toward the WSA drainage system as shown in Figure 5 if no remedial action was taken. About 90% of the mass of contamination migrated toward the WSA drainage system, with the remainder heading toward the Golf Course drainage system. The chlorinated hydrocarbon plume was predicted to reach its maximum extent in about 30 years if no remedial action was taken. Loading to the WSA drainage system was expected to remain at its current level or decrease slightly in the future, whereas loading to the Golf Course drainage system was expected to increase in the future (but to levels one order of magnitude less than the loading to the WSA drainage system) if no action was taken.

5.5 Conceptual Site Model

As described in Section 1, the FT-002 site was used for on-base fire training activities from the mid to late 1950's until 1989. During that time, jet fuel, mixed with small amounts of other flammable liquids such as solvents, was poured into four unlined pits and ignited. Some of the flammable mixture that did not burn leaked through the bottom of the pits, contaminating the underlying soil. Upon reaching the water table, the fuel mixture formed a floating layer on the water table surface. This floating layer is referred to as a light non-aqueous phase liquid, or LNAPL. Since the water table fluctuates vertically and groundwater flows horizontally, the product migrated and smeared on soil near the surface water table as it fluctuated seasonally. A dissolved phase groundwater contaminant plume from the fire training activities also migrated downgradient from the FT-002 site into the industrial area (Figure 2). A conceptual site model of the FT-002 Source Area is shown on Figure 5a.

Buildings in the industrial area of the base on the east side of the flightline are being used for commercial/industrial activities, and additional buildings could be constructed in the future. Indoor workers could be exposed by breathing indoor air contaminated by chemicals volatilizing from groundwater and migrating into the building air, such as via soil vapor intrusion, or SVI. This pathway is shown on Figure 5b.

Contaminants of concern in groundwater may also discharge into the two on-base draining systems, the Golf Course drainage system and the WSA drainage system shown on Figure 2. The contaminants in the surface water can volatilize, creating a potential exposure pathway via inhalation. This pathway is shown on Figure 5c.

6.0 CURRENT AND POTENTIAL LAND AND RESOURCE USES

According to land use plans for the base (PARC 1995), the identified use of FT-002, its surrounding area, and the base's industrial area is commercial/industrial and aviation support. To the east of the industrial area, downgradient from FT-002, the identified use is recreational. The area is currently in use as a golf course (the Barracks Golf Course). The base land use plans were incorporated into the Air Force's Environmental Impact Statement (Tetra Tech 1995). Currently, groundwater in the affected aquifer at the site is not being utilized as a resource. New York State considers all groundwater (Class GA) in the State as having the potential for use as a future potable resource. The two on-base drainage systems, the Golf Course drainage system and the WSA drainage system, are classified as Class D water bodies as defined by New York Codes, Rules, and Regulations Title 6, Part 701 Classifications - Surface Waters and Groundwaters. The best use of Class D streams is fishing.

7.0 SUMMARY OF SITE RISKS

Baseline risk assessments pertaining to groundwater or surface water were conducted as part of the RI supporting this ROD. These assessments estimated the risks associated with current and potential future planned industrial and hypothetical residential land use conditions. A baseline risk assessment estimates the human health and ecological risk which could result from contamination at a site if no remedial action is taken.

7.1 Human Health Risk Assessment (HRA)

A four-step process is utilized for assessing site-related human health risks for a reasonable maximum exposure scenario. Step 1 - *Hazard Identification* – identifies the contaminants of concern at a site based on several factors such as toxicity, frequency of occurrence, and concentration. Step 2 - *Exposure Assessment* – estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well water) by which humans are potentially exposed. Step 3 - *Toxicity Assessment* – determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response). Step 4 - *Risk Characterization* – summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated using the following equation:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

where: risk = a unitless probability of an individual developing cancer
CDI = chronic daily intake averaged over 70 years in mg/kg-day
SF = slope factor expressed (mg/kg-day)⁻¹

The resulting risk is a probability that is usually expressed in scientific notation (e.g. 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that an individual has a 1 in 1-million chance of developing cancer as a result of site-related exposure. The risk is referred to as an excess lifetime cancer risk because it

would be in addition to the risk of cancer individuals face from other causes. Under USEPA regulations, for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess lifetime cancer risk to an individual of between 1×10^{-4} and 1×10^{-6} (USEPA 1990).

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g. lifetime) with a reference dose (RfD) derived for a similar time period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ), calculated as follows:

$$HQ = CDI/RfD$$

where: CDI = chronic daily intake
 RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period; i.e., chronic, sub-chronic, or short-term. An HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely.

The Hazard Index (HI) is calculated by adding the HQs for all chemicals of concern that affect the same target organ or that act through the same mechanism within a medium or across all media to which a given individual may reasonably be exposed. An HI less than 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. Conversely, a potential noncarcinogenic risk is indicated if the HI exceeds 1 (USEPA 1991).

7.1.1 1994 FT-002 Groundwater RI

At the time of the initial 1994 RI for this OU (ABB-ES & URS 1994), conducted between 1988 and 1993, the base was still an active Air Force facility. Although groundwater was not and still is not used for domestic purposes, including drinking water, New York State has classified the aquifer for potential future use as a residential drinking water supply. There is a public water supply on base so domestic use of groundwater is unlikely; however, the RI considered future residential land use scenarios for:

- ingestion of groundwater, and
- inhalation of vapor-phase chemicals from groundwater while showering

The potentially exposed population was assumed to be an adult resident living directly downgradient of FT-002 ingesting 2 liters of water per day and showering for 12 minutes per day, 350 days per year, for 30 years, the time spent in one residence.

For each scenario, health risks were quantified for two cases: exposure to groundwater from what was called the plume core and exposure from the plume periphery. The plume core was defined by monitoring wells with total VOC concentrations greater than 1,000 µg/L; the plume periphery was defined by wells with total VOC concentrations of less than 1,000 µg/L. The assessment of risk included the maximum concentrations of all compounds detected within the two areas of the plume, not just VOCs.

The results of the HRA are shown in Table 5. The excess cancer risk posed by carcinogenic chemicals detected in both the plume core and the plume periphery exceeded the USEPA acceptable limit of 1×10^{-4} for ingestion of groundwater and inhalation of vapors while showering. Also, for noncarcinogenic effects, the HI for ingestion of groundwater and inhalation of vapors is greater than the USEPA's acceptable limit of 1. Clearly there is a potential human health risk associated with the use of groundwater from the FT-002 plume.

7.1.2 2001 FT-002/IA Groundwater OU RI/FS

The 1994 RI Report, discussed in Section 7.1.1, evaluated human health risks associated with residential use of groundwater. The HRA concluded that excess cancer and non-cancer risks were higher than USEPA acceptable levels.

The subsequent 2001 FT-002/IA Groundwater OU RI/FS (URS 2001d) evaluated the human health risks associated with volatilization of contaminants from groundwater within the plume, migration of the vapors into buildings (i.e., SVI), and the subsequent inhalation of the vapors by indoor workers. The chemicals of potential concern identified in the HRA were the chlorinated hydrocarbons TCE, DCE, and vinyl chloride, and also the BTEX compounds. Chlorinated compounds are mobile in groundwater and degrade slowly under normal groundwater conditions, but the BTEX compounds, constituents of fuels, are both mobile and readily biodegradable. Based on their detection in groundwater samples, all of these compounds were selected as chemicals of potential concern for the HRA.

Indoor air concentrations were derived from representative groundwater concentrations using the Johnson-Ettinger model for predicting the intrusion rate of contaminant vapors into buildings (Johnson and Ettinger 1991). This model is a screening-level model that uses chemical-specific properties related to volatilization and transport of chemicals in soil, along with standard or default assumptions regarding the subsurface conditions and conditions in the building, to estimate concentrations of volatile compounds in the indoor air.

The HRA also evaluated inhalation of volatilized contaminants from surface water. Three compounds detected in the WSA and Golf Course drainage systems, TCE, DCE, and vinyl chloride, were selected as chemicals of potential concern for surface water. Benzene was detected only sporadically and was therefore not included as a potential contaminant of concern.

For the SVI/Inhalation pathway, two areas were evaluated, the FT-002 Source area in the northwest portion of the base and the industrial area to the east of the flightline (Figure 2). The HRA for both of these areas considered exposure to commercial/industrial workers in existing buildings or in buildings that may be constructed in the future. Residential use in these two areas is not likely and is currently prohibited by use restrictions.

The industrial area was divided into four zones for evaluation, based on the source and the extent of groundwater contamination (Figure 5d):

- Zone 1 was a localized area of groundwater contamination in the vicinity of SS-011 that was attributed to an old local source. This was an area of interest because vinyl chloride was detected in two monitoring wells, which is likely indicative of reductive dechlorination of TCE and DCE in the past.
- Zone 2 was a relatively diluted zone of groundwater contamination with 10 µg/L to 100 µg/L of TCE and DCE combined.
- Zone 3 was an area of higher groundwater contamination with 100 µg/L to 1,000 µg/L of TCE and DCE combined.
- Zone 4 was a small plume of BTEX contamination from a local source near the intersection of Arizona Avenue and Connecticut Road.

Groundwater contaminants of concern discharging into the two on-base drainage stream systems, the WSA and the Golf Course drainage systems, can volatilize thereby creating a potential pathway via

inhalation of ambient air. The golf course is currently being used and will remain in use as a golf course for the foreseeable future. Potential receptors near the Golf Course drainage system include golfers and maintenance workers. The exposure potential for the worker would be greater than for the occasional golfer since a worker would be at the golf course more often and for longer periods of time. Therefore, the HRA evaluated exposure by a golf course maintenance worker to contaminants volatilizing from the streams.

At the time of the 2001 FT-002/IA Groundwater OU RI/FS (URS 2001d), there were no potential receptors in the area of the WSA streams; however, the impacted portion of the stream was in an area designated for industrial use or aviation support in the future. Under this scenario, future workers exposed to contaminants from the streams while pursuing outdoor activities were evaluated.

In summary, the 2001 FT-002/IA Groundwater OU RI/FS (URS 2001d) included an evaluation of the human health risks associated with the inhalation of vapors resulting from volatilization of chemicals from groundwater and from surface water impacted by groundwater. Potable uses of groundwater, drinking water ingestion and inhalation of vapors while showering were not revisited since these pathways were evaluated in the 1994 RI Report (ABB-ES and URS 1994). The 2001 HRA, summarized in Table 6, shows the following:

- Hazard indices are below the acceptable value of 1 for all receptors
- None of the estimated excess cancer risks exceeded the acceptable risk level of 1×10^{-4} .

7.2 Ecological Risk Assessment (ERA)

A screening level ecological ERA was performed for the FT-002/IA Groundwater OU RI/FS (URS 2001d). The objective of the ERA was to evaluate the potential ecological risks to receptors which reside within or utilize the resources of the two on-base surface water drainages (Figure 2): The WSA drainage system which discharges to the Salmon River, and the Golf Course drainage system which discharges to Lake Champlain. Both drainage systems are classified as Class D water bodies as defined by New York Codes, Rules, and Regulations Title 6, Part 701 Classifications – Surface Waters and Groundwaters. The best use of Class D waters is fishing.

The ERA was limited to an assessment of risks from four VOCs that were detected in surface water samples from the two drainages, namely, TCE, DCE, vinyl chloride, and benzene. The maximum

detected concentrations of these four compounds, shown in Table 7, were used as exposure point concentrations in the ERA. Also used were the maximum concentrations of TCE and DCE expected to be found in either drainage system in the future based on the numerical contaminant transport model discussed in Section 5.4. The modeled TCE and DCE concentrations were higher than the measured concentrations. Vinyl chloride and benzene were not modeled because surface water sampling data indicated that vinyl chloride and benzene loadings into the drainage systems were negligible (URS 2001d).

Three species and two groups of species were selected as target receptors that come into contact with the surface waters of the two drainage systems:

- Benthic macroinvertebrates, which are prey species for fish;
- Rainbow trout;
- Salamanders, frogs, and toads as representative amphibians;
- Raccoons as a representative terrestrial mammal; and,
- The American robin as a representative avian receptor.

USEPA (1986) has established ambient water quality criteria (AWQC) for the protection of aquatic life for TCE, DCE, and benzene. The USEPA criteria are intended to be protective of 95 percent of all aquatic genera including amphibian larvae. Federal chronic criteria were selected for the ERA primarily to protect the reproduction and growth of aquatic biota. The USEPA DCE and benzene criteria are freshwater acute toxicity values, while the USEPA TCE criterion is a freshwater chronic criterion. To develop chronic DCE and benzene criteria for use in the ERA, the USEPA acute criteria were divided by 10.

NYSDEC ambient water quality criteria are based on fish survival. Neither USEPA nor NYSDEC has established aquatic life criteria for vinyl chloride, so the lowest observed adverse effect level (LOAEL) concentration, 388,000 µg/L, cited by USEPA (1996) for northern pike was used. The ambient water quality criteria used in the ERA are shown in Table 7.

The HQ approach was used to quantify ecological risk. The HQ was calculated as the exposure point concentration divided by a toxicity reference value, which was the AWQC for a given compound or the LOAEL in the case of vinyl chloride. A risk was interpreted to exist if the HQ was greater than 1. HQs for benthic invertebrates, amphibian larvae, and the rainbow trout are presented in Table 7.

DCE and benzene are expected to pose no significant ecological risk to the rainbow trout, benthic invertebrates or amphibian larvae. HQs for DCE and benzene are all less than 1 for both measured and modeled exposure point concentrations. The HQ for vinyl chloride, based on its LOAEL, is also less than 1, indicating no significant ecological risk to these species from vinyl chloride.

Using the USEPA AWQC for TCE, there is no risk to the rainbow trout, amphibian larvae or benthic macroinvertebrates. Using the NYSDEC criteria, however, there is a potential risk for these species. The HQ for the maximum measured and maximum modeled TCE concentration were 2.1 and 8.1 respectively.

The screening level ERA evaluated the risk to the raccoon and the American robin from exposure to surface water in terms of the amount of contaminated water that each species would have to consume to exceed a no observed adverse effect level (NOAEL) or lowest observed adverse effect level (LOAEL) for each contaminant of concern. To assess the risk, the amount of water needed to exceed the NOAEL or LOAEL was compared to the amount of water the raccoon and American robin normally consumes in a day, which was determined to be 0.25 liters/day and 0.01 liters/day respectively.

The surface water was assumed to contain TCE, DCE, vinyl chloride and benzene at the maximum measured and modeled concentrations for the WSA and Golf Course drainage systems (Table 7). The results of the analyses for the raccoon and robin are shown in Table 8.

It was concluded that none of the four compounds evaluated poses a significant ecological risk to the raccoon or the American robin. The amounts of water that would have to be consumed by either species to exceed the LOAEL or NOAEL far exceeds the amount of water the species is likely to consume daily.

7.3 Conclusion

Based on the results of the HRA and the ERA, the response actions selected in this ROD are necessary to protect the health from actual releases of hazardous substances into the environment.

8.0 REMEDIAL ACTION OBJECTIVES

Four remedial action objectives were cited in the January 2002 PRAP (URS 2002a) and the June 2003 Interim ROD (URS 2003c) for the FT-002/IA Groundwater OU:

1. To prevent ingestion of groundwater containing contaminant concentrations above ARARs;
2. To restore impacted groundwater to ARARs;
3. To prevent migration of groundwater with contaminant concentrations above ARARs beyond base boundaries; and,
4. To restore surface water that has been impacted by contaminated groundwater to ARARs.

To address the potential for SVI at unacceptable risk levels, a remedial action objective has been added to this remedy as follows:

5. To prevent human exposure to soil gas vapor levels within buildings at unacceptable levels represented by an excess cancer risk greater than 1×10^{-6} and also represented by a potential non-cancer risk for a hazard index greater than one.

9.0 DESCRIPTION OF THE ALTERNATIVES

In 2002, sixteen alternatives were developed and evaluated in the 2001 RI/FS for the initial remedy selected to address conditions at the FT-002/IA Groundwater OU. Fifteen alternatives were developed during the Draft-Final version of the RI/FS (URS 2000a). A sixteenth alternative was added for comparative analysis in the Final RI/FS (URS 2001d). Those alternatives were presented in the 2002 PRAP (URS 2002a) and evaluated in the June 2003 Interim ROD (URS 2003c).

The remedy selected in the 2003 Interim ROD was as follows:

- A groundwater collection trench, 3,800 feet long, located between the runway and the flightline ramp;
- Five groundwater extraction wells located downgradient of the FT-002 Source OU;
- An aeration basin to treat contaminated water from the runway/flightline collection trench and the extraction wells to levels less than effluent discharge criteria;
- A 4,400-foot long groundwater collection trench located on the east side of the flightline ramp;
- A 2,900-foot long permeable treatment wall containing reactive media (iron filings) located along Idaho Avenue;
- An 800-foot long permeable treatment wall containing reactive media (iron filings) located on the west side of the runway, upgradient of the former Weapons Storage Area;
- Groundwater and surface water monitoring;
- Five-Year Site Reviews; and
- ICs to prohibit withdrawal of groundwater for potable use, to control discharge of groundwater withdrawn during construction activities, and to prohibit land use that interferes with remedial operations.

The proposed remedy included a contingency to select a groundwater collection trench along Idaho Avenue instead of a permeable reactive barrier. The decision to use a permeable reactive barrier or a collection trench was to be made jointly by the Air Force, USEPA, and NYSDEC during the design process. The proposed remedy also included a contingency to treat the effluent discharge from the groundwater collection trench on the east side of the flightline ramp, as well as the Idaho Avenue groundwater collection trench. If effluent sampling, conducted after construction, showed discharge criteria exceedances, then the contingency to treat the water would be implemented.

The length of the groundwater collection trench between the runway and the flightline was reported to be 5,300 feet long in the January 2002 PRAP, but this length included the existing solid discharge pipe, a storm sewer, running under the runway to the treatment system. The actual length of the trench that collected groundwater was about 3,800 feet as noted above (Figure 6).

Many of the above elements of the remedy selected in 2003 have been implemented, and some modifications have been made during design and/or implementation. Also, additional remedial activities not considered at the time of the 2003 Interim ROD (e.g., to address institutional controls (ICs) and SVI) have been considered and included in this ROD. Changes to the remedy selected in the 2003 Interim ROD subsequent to the selection of the remedy are described in Section 12. The additional activities such as to address the SVI remedial action objective are also discussed in Section 12.

Remediation goals include chemical- specific targets for remediation that are developed consistent with the remedial action objectives. For the FT-002/IA Groundwater OU, remediation goals for groundwater are ARARs which include federal maximum contaminant levels or New York State groundwater quality standards, whichever are most stringent. Remediation goals for the contaminants of concern (TCE, DCE, vinyl chloride, and BTEX) are presented in Table 4. Remediation goals for surface water are NYSDEC surface water quality standards for the Golf Course and WSA drainage systems, which are classified as Class D water bodies as defined by New York Codes, Rules, and Regulations Title 6 (6 NYCRR), Part 701 Classifications - Surface Waters and Groundwaters. The best use of Class D waters is fishing. Remediation goals for primary contaminants of concern in surface water also are presented in Table 4.

For clarification, it should be noted that the surface water remedial action objective will not be achieved by actively or directly treating surface water. Rather this objective will be addressed by collecting and treating groundwater that is currently impacting the WSA stream.

10.0 SUMMARY OF COMPARATIVE ANALYSIS

The NCP stipulates that a detailed analysis be performed of remedial alternatives representing viable approaches to remedial action [NCP Section 300.430(e)(9)]. Alternatives were evaluated in the FT-002/IA Groundwater OU RI/FS (URS 2001d) against each of the nine evaluation criteria specified in the NCP and a comparative analysis was also made of the relative performance of each alternative against the criteria. This section summarizes the comparative analysis presented in the FT-002/IA Groundwater OU RI/FS.

The nine evaluation criteria are listed below:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and performance
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

The first two criteria are what the NCP refers to as threshold criteria that must be satisfied by an alternative for it to be eligible for selection. Criteria 3 through 7 are balancing criteria that are used to make comparisons and to identify the major trade-offs among the alternatives. The last two criteria, 8 and 9, are modifying criteria that may modify the recommended alternative presented in the Proposed Plan by public input before it is finalized and presented in the ROD.

A detailed discussion of the criteria and a comparative analysis is contained in the FS.

11.0 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that treatment that reduces the toxicity, mobility, or volume of the principal threat wastes will be utilized by a remedy to the extent practicable. The principal threat wastes for the FT-002/IA Groundwater OU include fuel and solvent-derived VOCs dissolved within groundwater. The selected remedy includes soil gas treatment, which will capture and/or destroy contamination, thereby satisfying both the regulatory expectation for treatment of the principal threat wastes and the statutory preference for treatment as a principal element of the remedy.

12.0 SELECTED REMEDY

The remedy selected in the June 2003 Interim ROD (URS 2003c) included addressing groundwater contamination through control or treatment along all pathways of expected migration, and that remedy is expected to capture and treat an estimated 91 percent of the groundwater contamination in the first 10 years of operation.

This remedy memorializes certain response actions which have been taken by the Air Force and selects certain additional ICs for this OU.

12.1 June 2003 Interim Record of Decision

The 2003 Interim Remedy (URS 2003c) included a contingency which allowed for the installation of a groundwater collection trench along Idaho Avenue instead of a permeable reactive barrier, if determined to be appropriate. The proposed remedy also included a contingency to allow for the treatment of the effluent discharge from the groundwater collection trench on the east side of the flightline ramp, as well as the Idaho Avenue groundwater collection trench. If effluent sampling, conducted after construction, revealed discharge criteria exceedances, the contingency to treat the water would be implemented.

The length of the groundwater collection trench between the runway and the flightline was reported to be 5,300 feet long in the January 2002 PRAP, but this length included an existing solid discharge pipe, a storm sewer, which runs under the runway to the treatment system. The actual length of the collection trench that collected groundwater was about 3,800 feet.

The June 2003 Interim ROD allowed for implementation of the physical components of the that remedy while negotiations continued between USEPA and the Department of Defense concerning issues related to the development and implementation of ICs. The two contingencies set forth in the June 2003 Interim ROD described above were ultimately implemented during design of the 2003 Interim Remedy. Changes made to the 2003 Interim Remedy during design and later are discussed in Section 12.2.

12.2 Changes to the 2003 Interim Remedy

The following changes were made to the 2003 Interim Remedy during its design and implementation:

- The aeration basin which was selected to treat contaminated water from the extraction wells and the collection trench between the runway and flightline was replaced by a groundwater treatment plant;
- The permeable treatment wall along Idaho Avenue was replaced with a groundwater collection trench;
- The permeable treatment wall at the Weapons Storage Area was eliminated; and
- An aeration system was added to treat the discharge water from the collection trench along the east side of the flightline;

Regarding the five-year review, five-year reviews are required by Section 121(c) of CERCLA and, therefore, it is not included as part of the remedy. No less often than each five year period after the initiation of the remedy, for as long as contamination remains at the FT-002/IA Groundwater OU above levels that allow for unlimited use and unrestricted exposure, the Air Force shall, in coordination with USEPA and NYSDEC, review the selected remedy to determine whether the remedy remains protective of human health and the environment. Remedial progress and a review of the need to continue ICs to protect human health and the environment will also be evaluated as part of the review.

12.3 Additional Response Activities

The following remedial activities are selected as components of this remedy:

- The continued operation of the SVE systems which were installed at Building 2753, 2766, and New Building C;
- Updated ICs to reflect (a) the permanence of the ICs selected in the 2003 Interim ROD and (b) the restrictions related to SVI, as discussed in more detail below

12.4 Identification of the Remedy

The changes to the 2003 Interim ROD described in Section 12.2 have been selected as part of this final remedy for the FT-002/IA Groundwater OU. Measures to address the soil vapor intrusion pathway are also included in this ROD. They were included at the request of NYSDEC and USEPA following the

soil vapor intrusion study described in Section 5.1.3.6. Based on regulatory concerns, institutional controls related to soil vapor intrusion have also been added to the remedy, as well as the continued operation of the SVE systems which have been installed at Buildings 2753, 2766, and New Building C. Some additional controls to limit property development and function of the site to non-residential uses have also been included in this remedy, as well as incorporating the finalizing of the interim institutional controls set forth in the 2003 Interim ROD.

The selected remedy for remediation of the FT-002/IA Groundwater OU now includes the following components:

- Continued operation of SVE systems installed in Building 2753, Building 2766, and New Building C;
- Groundwater and surface water monitoring; and,
- ICs to prohibit the use of groundwater, restrict the discharge of groundwater, prohibit development that would interfere with remedial operations or penetrate the subsurface clay confining layer, limit current use and future property development to non-residential uses, use restrictions related to soil vapor intrusion, and an occupancy restriction for Building 2612.

The components of the as-constructed 2003 Interim Remedy are shown on Figure 7. The continued operation of the groundwater treatment system for the Runway/Flightline Collection Trench and the extraction wells which began in January 2004 is anticipated. The southern half of the East Flightline Collection Trench became operational in September 2003; it was deemed to be fully operational in January 2005. The Idaho Avenue Collection Trench was completed and became fully operational in February 2005. The aeration system to treat the discharge from the East Flightline collection trench began operating in August 2010, and the three SVE systems began operating in December 2009 (Building 2753), and December 2010 (Building 2766 and New Building C). SVI use restrictions, as well as the continued operation of the three SVE systems, are included in this remedy to meet the remedial action objective for SVI noted in Section 8.

The components of the selected remedy are discussed individually below. These components include the obligation for maintenance of remedial systems selected in this ROD until remedial action objectives are achieved, for example, maintenance of monitoring systems such as monitoring wells.

12.4.1 Water Treatment System

Rather than constructing an aeration basin as selected in the 2003 Interim ROD, a 600 gallons per minute (gpm) treatment system was constructed to treat groundwater from the Runway/Flightline Collection Trench as well as from the five extraction wells (installed as part of the 2003 Interim Remedy). The aeration basin was selected to treat VOCs and primarily TCE. The concept was formulated during the RI/FS prior to NYSDEC providing discharge criteria. The conceptual design did not consider treatment and removal of significant quantities of iron that became necessary to meet the discharge criteria. Consequently, it is for these reasons that the method of treating the groundwater was changed from an aeration basin method to a more traditional groundwater treatment system (URS 2002c).

The treatment system includes an aerator, a five-stage air stripper, a clarifier, and four sand filters (currently not being used). The air stripper was initially installed with a closed-loop air circulation system that used two carbon adsorption units to remove VOCs from the process air stream. The system was modified in the fall of 2005 to allow operation in single-pass mode instead of the closed-loop circulation system. In April 2007, because of decreasing VOC concentrations, NYSDEC approved discharging the process air stream directly to the atmosphere without any carbon treatment. Treated water is discharged to the WSA drainage system on the west side of the base. At the present time, samples of the treatment plant effluent water are collected every two weeks (bi-weekly), and the analytical results are compared to NYSDEC effluent discharge criteria established in May 2011 (NYSDEC 2011).

The remedy selected in this ROD includes memorializing the change of treatment method for contaminated groundwater from an aeration basin to the above-described pump and treat system.

12.4.2 Weapons Storage Area Permeable Treatment Wall

The 2003 Interim Remedy included a permeable treatment wall upgradient of the former WSA on the west side of the runway (Figure 6). The purpose of the permeable treatment wall was to treat the portion of the groundwater plume extending southwest across the runway and flightline ramp in the direction of the WSA. During design of the remedy, this treatment wall was eliminated and replaced with groundwater monitoring of wells upgradient of the WSA. Groundwater samples collected in 2002 and 2003 (URS 2003d) from monitoring wells in the area of this southwestern portion of the plume indicated that TCE and DCE concentrations had decreased to levels that were at or below the New York State

groundwater quality standard of 5 µg/L for these compounds. Additional groundwater data for this portion of the plume are provided in Section 14.

It is for this reason that the remedy selected in this ROD includes memorializing the elimination of the permeable treat wall upgradient of the former WSA.

12.4.3 SVE at Buildings 2753, 2766, and New Building C

As discussed in Section 5.1.3.6, during the 2006 SVI investigation, elevated concentrations of chlorinated hydrocarbon compounds (variously TCE and PCE) were found in sub-slab soil gas samples at Buildings 2753, 2766, and New Building C. An SVE system was installed at Building 2753 and it became operational in November 2009. SVE systems at Building 2766 and New Building C began operating in December 2010. The continued operation of these systems is part of this remedy.

SVE System Exit Strategy. These SVE systems can be shut down when it has been determined that the SVI remedial action objective has been achieved or that continued operation of the system is not effective or needed; i.e., contamination is no longer being removed, sub-slab soil gas concentrations have been reduced to a level that would not impact indoor air at unacceptable levels, and there is no remaining groundwater contamination in the vicinity of the buildings at concentrations greater than groundwater ARARs that could impact the SVI pathway into the buildings.

The following are exit strategy guidelines for permanently shutting down the three SVE systems:

- **Groundwater Samples:** The concentrations of VOCs in groundwater in the vicinity of the SVE systems will be evaluated to assess the SVI pathway into the buildings. VOC groundwater concentrations should generally be less than groundwater ARARs (i.e., established groundwater quality standards) before evaluating whether or not to shut down the SVE systems.
- **SVE Influent:** As an indicator of remediation progress in the sub-slab environment, VOCs in the influent to the SVE system prior to any carbon treatment will be monitored periodically with a photo-ionization detector (PID) that measures in parts-per-billion. Samples also will be collected of the influent soil gas for laboratory analysis to verify the PID readings. The SVE systems may also be shut down and re-started periodically (i.e., pulsed) to determine if concentration rebound occurs. When the PID readings and/or the laboratory data reach a

stable trend (i.e., they are no longer decreasing) or the laboratory results for the SVE system influent indicate that the sub-slab soil gas concentrations may be below the NYSDOH no further action screening criteria (NYSDOH 2006 or more recent updates) and the USEPA risk-based screening levels (USEPA 2013) for contaminants of concern, the SVE systems will be shut down temporarily.

- **Sub-Slab Soil Gas Samples:** Following the temporary shutdown of the SVE systems, the locations and the number of samples will be agreed upon among the Air Force, NYSDEC, NYSDOH, and USEPA. Indoor air samples may also be collected. Three sampling events will occur across three consecutive heating seasons after the temporary SVE system shutdown. If the sampling results for each of the three heating seasons do not exceed the NYSDOH no further action screening criteria (NYSDOH 2006 or more recent updates) and the USEPA risk-based screening levels (USEPA 2013) for the contaminants of concern, then the SVE systems can be permanently shut down. If, however, the sub-slab soil gas concentrations are higher than the screening criteria cited, the systems may be re-started. Alternatively, if the laboratory results are approaching but are still higher than the screening criteria cited, a risk assessment will be performed to determine if the remedial action objective for SVI has been achieved. If the remedial action objective has been achieved, the SVE system can be shut down permanently.

12.4.4 Institutional Controls

ICs are a component of this selected remedy for the FT-002/IA Groundwater OU. ICs are the non-technical, non-engineering aspects of a remedy which help to minimize the potential for exposure to contamination and/or protect the integrity of a remedy. In this ROD, the ICs are intended to, among other things, complement the collection and treatment elements of the remedy, such as prohibiting use of contaminated groundwater as a potable water source or prohibiting residential use. ICs will be used to minimize the exposure of any future users of the Areas Subject to Institutional Controls encompassed by the FT-002/IA Groundwater OU (Figures 9 and 10), including Air Force personnel, transferees, lessees/sub-lessees, construction workers, and the environment to hazardous substances. The ICs will also be used to maintain the integrity of the physical remedial action components.

The Air Force is responsible for implementing, maintaining, monitoring, and enforcing the ICs selected in this ROD and the 2003 Interim ROD until such time as they are no longer necessary to protect

human health. It will exercise this responsibility in accordance with CERCLA and the NCP. The Air Force, USEPA, and NYSDEC recognize that the geographic area where the ICs are required to restrict certain activities may be modified (expanded or constricted) over time as the remedy is implemented, new data is collected, and conditions change. These changes will be appropriately documented.

As part of the remedy selected in the 2003 Interim ROD, ICs related to groundwater use and discharge have been put in place in the entire area designated as the FT-002/IA Groundwater OU (see Figure 2). In January 2012, the Air Force, NYSDEC, and USEPA agreed to reduce the size of the groundwater use restriction area within the overall OU. The revised groundwater boundary is shown on Figure 9. An added prohibition on residential use restriction also applies to this same area. Similarly, it was also agreed to establish a separate boundary for SVI restrictions. The SVI boundary is shown on Figure 10.

Both the groundwater use/non-residential use boundary and the SVI boundary are based on a reduction in the size of the groundwater plumes subsequent to implementing the 2003 Interim Remedy (Figure 8).

In addition to incorporating and perpetuating the ICs selected in the June 2003 Interim ROD, ICs to limit property development and future uses of certain areas of the site to non-residential uses as well as prohibiting penetration of the clay confining layer underlying the sand aquifer at specified areas at site have also been included in this remedy.

ICs to address the SVI pathway were not included in the June 2003 Interim ROD. They are included in this ROD based on the results of the SVI study described in Section 5.1.3.6. ICs related to SVI are included in this ROD requiring evaluation or mitigation of SVI impacts if there are changes in the use of or modifications to existing Industrial Area buildings within the SVI restriction area, or if new construction occurs within the SVI restriction area. There is also an IC restricting the occupancy of Building 2612. These ICs are selected to achieve the new remedial action objective regarding the potential for human exposure to soil gas vapors.

It is anticipated that successful implementation of the selected remedy, which includes the implementation and enforcement of the above-described ICs, will achieve protection of human health and the environment and compliance with all legal requirements.

The following are goals and objectives of the ICs:

- Prevent the use of contaminated groundwater for drinking water or any other purpose that could result in the inhalation of vapors from, dermal absorption of, or ingestion of the contaminated groundwater in the Area Subject to Institutional Controls (Figure 9).
- Address any future identified potential soil vapor intrusion pathway above unacceptable risk levels through requiring either evaluation of such potential pathways to demonstrate no unacceptable risk or installation of mitigation measures to cut off a pathway which may be associated with occupancy of buildings located within a specific Soil Vapor Intrusion Restriction Area that is included in the Area Subject to Institutional Controls (Figure 10).
- Prevent the discharge of groundwater withdrawn during construction dewatering activities within the Area Subject to Institutional Controls to the ground or surface water, without prior concurrence of the NYSDEC, since this discharge could exacerbate the spreading of the contamination.
- Prevent residential land use or development in designated areas.
- Prevent property development or land use that would interfere with the proper operation of the groundwater collection trenches, extraction wells, associated groundwater treatment system, and all other related components of the remedy.

To achieve the remedial action objectives, the Air Force is requiring that certain use restrictions and controls be placed on the Area Subject to Institutional Controls where the residual contamination is located. The following are the corresponding use restrictions and controls on the Area Subject to Institutional Controls:

- Continued prohibition on the installation of any wells for drinking water or any other purposes that could result in the use of the underlying groundwater within the area shown on Figure 9.
- Except for environmental response actions conducted by the Air Force pursuant to CERCLA, prohibition on discharges of groundwater that is withdrawn within the area shown on Figure

9 during construction dewatering to the ground or surface water without prior approval of NYSDEC through the State Pollution Discharge Elimination System permitting process.

- Prohibit property development or land use that would interfere with the proper operation of the remedy. Except for utility improvements, surface paving, and modification of the grade established during construction of the physical remedy with Air Force pre-approval, prohibition on any development within 20 feet of any aboveground structure or underground structure constructed as part of the active physical remedy (these structures include but are not limited to pumping wells, underground and overhead electrical wiring, collection drains, piping, groundwater treatment facilities, aeration basins, manholes, and pump stations). Except for utility improvements, surface paving, and modification of the grade established during construction of the physical remedy with Air Force pre-approval, prohibition on any development within 5 feet of any monitoring point that will be used in the monitoring of the physical remedy. “Air Force pre-approval” means that any utility improvements, surface paving removal or construction, or modification of the grade established during construction of the physical remedy within 20 feet of any aboveground structure or underground structure constructed as part of the active physical remedy (as itemized above) shall be approved by the Air Force prior to the initiation of such activities. “Air Force pre-approval” also means that any utility improvements, surface paving removal or construction, or modification of the grade established during construction of the physical remedy within 5 feet of any monitoring point that will be used in the monitoring of the physical remedy shall be approved by the Air Force prior to the initiation of such activities. The locations of the structures and monitoring points of the physical remedy will be established by survey following construction. A map showing the structures and monitoring points referenced to horizontal coordinates will be included in all property transfer and lease agreements.
- Any excavation within the Area Subject to Institutional Controls (Figure 9) shall be conducted in a manner that prevents migration of groundwater contamination into the deep groundwater aquifer. Penetration of the subsurface clay confining layer, without the prior written approval of the Air Force, NYSDEC, and USEPA, is prohibited.
- Prohibit residential property development or residential land use within the Area Subject to Institutional Controls (Figure 9).

The above restrictions shall be maintained until the concentrations of hazardous substances in the groundwater have been reduced to levels that allow for unlimited use and unrestricted exposure and the continued operation of groundwater collection, extraction, and treatment systems and other related components of the remedy are no longer necessary because the goals of the remedy are attained.

The following restrictions related to SVI have been placed in the deed(s) and will remain and run with the properties within the Area Subject to Institutional Controls (Figure 10) until USEPA and NYSDEC approve a change:

- With respect to the potential for risks posed via indoor air contaminated by chemicals volatilizing from below the building slab (vapor intrusion), a grantee covenant will be included in the deed of any property within the SVI restriction area (Figure 10) that will require either of the following: (a) mitigation of any unacceptable risk as that risk is determined under CERCLA and the NCP in a circumstance with (1) any construction of new buildings (which includes any expansion of the footprint of an existing building) or (2) any change in the current use of existing buildings to a use that would increase the potential exposure of its users to vapor intrusion (e.g., up zoning"); or (b) an evaluation of the potential for unacceptable risk associated with vapor intrusion that must occur prior to any construction of new buildings or any up zoning in the current use of existing buildings, and if an unacceptable risk under CERCLA and the NCP associated with vapor intrusion is posed, mitigation of the vapor intrusion shall be included in the design/construction of the structure prior to occupancy or implemented prior to the change in use. Any such mitigation or evaluations will be coordinated with the USEPA and NYSDEC. This covenant will remain on the property until the property meets applicable criteria for acceptable risk for specified property use as such criteria and use are established in an applicable ROD, or until such time as it is agreed to by the Air Force, USEPA, and NYSDEC.
- Also with respect to the potential for risks posed via indoor air contaminated by chemicals volatilizing from beneath existing Building 2612 (i.e., vapor intrusion), a deed covenant (occupancy restriction) will be imposed which requires that the existing Building 2612 on the property remain unoccupied (i.e., it may not be used for occupied purposes). "Occupied" means that the building is used and there is human occupation of it regularly (e.g., persons present the same day of the week for approximately the same number of hours). Incidental use of the building, such as for storage of materials, that necessitates intermittent visits by

individuals who would not remain in the building after delivery or retrieval of such material, would not meet this definition of occupation. The grantee may demolish the building.

The Air Force will not modify or terminate the above use restrictions without approval by USEPA and without concurrence from NYSDEC. The Air Force will seek prior concurrence before any anticipated action that may disrupt the effectiveness of the restrictions, or any action that may alter or negate the need for restrictions.

The Air Force will take the following actions to ensure that the aforementioned use restrictions and the controls are effective in eliminating the exposure scenario and protecting human health and the environment:

Deed Restrictions: Each transfer of fee title from the United States will include a CERCLA 120(h)(3) covenant which will have a description of the residual contamination on the property and the environmental use restrictions, described above, expressly prohibiting activities inconsistent with the performance measure goals and objectives.

The deed will include the CERCLA 120(h)(3) covenant that the United States is required to include in the deed for any property owned by the United States on which hazardous substances were stored for one year or more, or where hazardous substances were known to have been released or disposed of on the property. The Air Force will consult with USEPA and NYSDEC on the covenants and the deed restriction language. The deed will contain appropriate provisions to ensure that the restrictions continue to run with the land and are enforceable by the Air Force. Each deed will also contain a reservation of access to the property for the Air Force, USEPA, and the State of New York, and their respective officials, agents, employees, contractors, and subcontractors for purposes consistent with the Air Force IRP and the Federal Facility Agreement.

In addition, the deed will require the transferee and subsequent transferee(s) to comply with the environmental use restrictions and IC requirements specified herein, including, without limitation, annual monitoring and reporting on ICs, and that the initial transferee who will receive fee title from the United States and all subsequent transferees will place the same obligations and responsibilities on a subsequent transferees receiving a real property interest in the Area Subject to Institutional Controls.

Environmental Easement and State Land Use Notification: The Air Force will condition transfer of any property subject to these ICs upon the transferee granting an environmental easement, containing a complete description of the restrictions described in this ROD, for the Area Subject to Institutional Controls shown on Figures 12 and 13 in accordance with Article 71, Title 36 of the New York State Environmental Conservation Law. The Air Force will ensure that the transferee will grant the environmental easement to NYSDEC, on behalf of the State of New York, at the time of transfer of title of the property from the United States. The content of the document creating the environmental easement must be approved by NYSDEC.

Notice: Prior to property transfer, the transferee will be notified by the Air Force of any environmental use restrictions and ICs or reporting requirements. Concurrent with the transfer of fee title, information regarding the environmental use restrictions and controls will be communicated in writing to the property owners and to appropriate state and local agencies to ensure such agencies can factor such conditions into their oversight and decision-making activities regarding the Area Subject to Institutional Controls. The Air Force will also provide a copy of the deeds to the regulatory agencies as soon as practicable after the transfer of fee title.

Monitoring and Enforcement:

Monitoring: Monitoring of the environmental use restrictions and controls will be conducted annually by the Air Force, and a report of the findings will be provided. Any such annual monitoring reports will be included in a separate report or as a section of another environmental report, if appropriate, and provided to the USEPA and NYSDEC. Upon the effective date of the property conveyance, the Air Force will place a requirement in the deed that the transferee or subsequent property owner(s) will conduct annual physical inspections of the FT-002/IA Groundwater OU to confirm continued compliance with all IC objectives unless and until all ICs at the FT-002/IA Groundwater OU are terminated and will provide to the Air Force, USEPA, and NYSDEC an annual monitoring report.

If a transferee fails to provide an annual monitoring report as described above to the Air Force, the Air Force will notify USEPA and NYSDEC as soon as practicable. If USEPA or NYSDEC do not receive the annual monitoring report from the transferee, it will notify the Air Force as soon as practicable. Within 30 days of the report's due date, the Air Force will take steps to determine whether the ICs are effective and remain in place and advise the regulators of its

efforts. In any event, within 90 days of the report's due date, the Air Force shall determine the status of ICs at the site and provide its written findings, with supporting evidence sufficient to confirm the reported status independently, to USEPA and NYSDEC unless either USEPA or NYSDEC, in their sole discretion, acts to confirm the status of the ICs independently.

All annual monitoring reports will detail the status of the ICs and how any IC deficiencies or inconsistent uses have been addressed, whether the use restrictions and controls were communicated in the deed(s), whether the owners and state and local agencies were notified of the use restrictions and controls affecting the property, and whether use of the property has conformed with such restrictions and controls.

The IC monitoring reports will be used in the preparation of the Five-Year Reviews to evaluate the effectiveness of the remedy. The Five-Year Reviews will make recommendations on the continuation, modification, or elimination of annual reports and IC monitoring frequencies. Elimination of the monitoring reports or any changes to IC monitoring frequencies will be subject to USEPA and NYSDEC approval. The Air Force will submit the Five-Year Review reports to the regulatory agencies for review and comment.

The Air Force is ultimately responsible for implementing, maintaining, and monitoring the remedial actions (including the ICs) before and after property transfer, even if it transfers some obligations with property conveyance.

Response to Violations: The Air Force will notify the USEPA and the NYSDEC via e-mail or telephone as soon as practicable, but no later than ten days after discovery, of any activity that is inconsistent with the IC objective or use restrictions, or any action that may interfere with the effectiveness of the ICs. Any violations that breach federal, state, or local criminal or civil law will be reported to the appropriate civilian authorities, as required by law.

Enforcement: Any activity that is inconsistent with the remedial action objectives, ICs, or use restrictions, or any action that may interfere with the effectiveness of the ICs will be addressed by the Air Force as soon as practicable (but in no case more than 10 days) after the Air Force becomes aware of the violation. The Air Force will notify USEPA and NYSDEC regarding how the breach has been or will be addressed within 10 days of sending USEPA and NYSDEC notification of the breach. The Air Force will exercise such rights under the deed and applicable

laws to direct that activities in breach of the controls be immediately halted. To the extent necessary, the Air Force will engage the services of the Department of Justice to enforce such rights.

Notification of Institutional Control Modification: The recipient(s) of the property encompassing the Area Subject to Institutional Controls will obtain approval from the Air Force, USEPA, and NYSDEC for any proposals for a land use change within the Area Subject to Institutional Controls inconsistent with the use restrictions and assumptions described in this ROD.

State Land Use Notification Requirements: At the time of transfer by the Air Force, the environmental easement will require that the new property owner provide an annual certification, prepared and submitted by a professional engineer or environmental professional acceptable to the NYSDEC, which would certify that the institutional controls and engineering controls put in place are unchanged from the previous certification, and nothing has occurred that would impair the ability of the control(s) to protect human health and the environment or constitute a violation or failure to comply with any operation and maintenance or site management plan.

12.5 Comparison of the Selected Remedy to Nine USEPA Criteria

The USEPA has developed nine evaluation criteria, which are specified in the National Contingency Plan, that are used to assess remedial alternatives. These criteria are listed in Table 9 and are compared to the Air Force's selected remedy.

The selected remedy for the FT-002/IA Groundwater OU will meet the remedial action objectives cited in Section 8.

13.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and Section 300.430(f)(5)(ii) of the NCP, a remedy must be protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), is cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants and contaminants as a principal element and a bias against off-site disposal of untreated materials. The following subsections discuss how the selected remedy meets these statutory requirements.

13.1 Protection of Human Health and the Environment

The selected remedy is protective of human health and the environment. Continued groundwater collection and treatment via a traditional pump and treat system will reduce the time required to restore groundwater quality to ARARs. Groundwater treatment prior to discharge to surface waters on-base is also protective. The selected remedy includes use restrictions, as well as groundwater monitoring under the 2003 Interim Remedy which will serve to verify the effectiveness and progress of the groundwater remediation. The 2003 Interim Remedy, coupled with the pump and treat system, will ultimately result in achieving groundwater quality standards (ARARs) within the plume; however, the remediation process is anticipated to take an estimated 80 years. To verify that the remedy remains protective of human health and the environment during the period prior to attaining ARARs, five-year reviews will be performed by the Air Force in coordination with USEPA and NYSDEC.

13.2 Compliance with Applicable and Relevant and Appropriate Requirements (ARARs)

The NCP requires that the selection of remedial actions at CERCLA sites meet ARARs. ARARs are Federal and State human health-based and environmental-based requirements used (1) to evaluate the appropriate extent of site cleanup; (2) to scope and formulate remedial action alternatives; and (3) to govern the implementation and operation of a selected remedial action. The definitions of applicable requirements and relevant and appropriate requirements are provided in the Glossary.

Under the description of ARARs set forth in the NCP and CERCLA, State and Federal ARARs are divided in three types: location-specific, chemical-specific, and action-specific.

- Location-specific requirements pertain to existing natural or cultural features at the site that are specifically protected, such as wetlands, floodplains, wilderness areas, and endangered species.
- Chemical-specific requirements are those that establish numerical values, or methodologies that result in the establishment of numerical values, when applied to chemicals present at a site. These values establish the acceptable amount of a chemical in the environment and govern the extent of the remediation.
- Action-specific requirements govern implementation of the selected site remedy based on which activities are considered to address conditions at a site.

As noted in Section 12.4, many elements of the 2003 Interim Remedy are already in place. This Remedy will enhance the 2003 Interim Remedy and address other risks, such as those posed by SVI, through continued compliance with Federal and State requirements identified in the FS (URS 2001d) that are applicable or relevant and appropriate to this remedial action.

13.3 Cost Effectiveness

At the time of the selection of the June 2003 Interim Remedy, it was believed that that Remedy was the most cost effective. The selected remedy provides an overall protectiveness to human health and the environment proportional to its cost and with consideration given to the time required to remediate the groundwater plume (80 years compared to 190 years for the plume to naturally attenuate – Alternative 2).

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable and cost effective manner for the FT-002/IA Groundwater OU. Of the 16 alternatives evaluated that protect human health and the environment and comply with ARARs, the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria (long-term effectiveness and permanence, reduction of TMV through treatment, short-term effectiveness, implementability, and cost), while also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

13.5 Preference for Treatment as a Principal Element

The selected remedy includes a treatment plant for groundwater from the Runway/Flightline collection trench and the five extraction wells (Figure 7). An aeration pond is also included to treat groundwater from the East Flightline collection trench and a contingency is included to treat groundwater from the Idaho Avenue collection trench if needed. At Building 2753, 2766, and New Building C, SVE systems were installed to address SVI issues.

By utilizing treatment as a significant portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

13.6 Five-Year Review Requirements

Because the selected remedy will result in hazardous substances, pollutants, or contaminants remaining at this OU above levels that allow for unlimited use and unrestricted exposure, Section 121(c) of CERCLA and Section 300.430(f)(4)(ii) of the NCP require a review of the remedy at least every five years of the initiation of remediation to verify that the remedy is protective of human health and the environment. The next five-year review for the former Plattsburgh AFB will occur in 2014.

14.0 DOCUMENTATION OF SIGNIFICANT CHANGES

Changes which were made during design and implementation to the 2003 Interim Remedy are discussed in Section 12. There have been no changes to the remedy proposed in the Supplemental PRAP (URS 2013).

15.0 RESPONSIVENESS SUMMARY

On August 29, 2013, the Air Force Civil Engineer Center, following consultation and concurrence of USEPA and NYSDEC, released for public comment the Supplement to the January 2002 Proposed Plan for the FT-002/IA Groundwater OU located at the former Plattsburgh Air Force Base. The release of this document initiated the public comment period, which concluded on September 27, 2013.

During the public comment period, a public meeting was held on September 18, 2013 at the Clinton County Government Building, First Floor Meeting Room, 137 Margaret Street, Plattsburgh, New York. The selected remedy for the FT-002 Groundwater OU was presented at the public meeting and a court reporter recorded the proceedings of the meeting. Copies of the transcript and attendance list are included in the Administrative Record. The public comment period and the public meeting were intended to elicit public comment on the Supplement to the January 2002 Proposed Plan for the FT-002/IA Groundwater OU.

No oral or written comments were received at the public meeting or during the public comment period.

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GLOSSARY

Accelerated Restoration: A pump-and-treat restoration process by which groundwater is pumped out of an aquifer faster than the rate of normal groundwater recharge. The pumped water is reinjected into the aquifer after treatment so that water is recirculated through the aquifer at a rapid rate. Also called soil washing.

Administrative Record: A file established and maintained in compliance with Section 113(K) of the Comprehensive Environmental Response, Compensation, and Liability Act consisting of information upon which the lead agency bases its final decisions on the selection of remedial method(s) for a Superfund site. The Administrative Record is available to the public.

Aeration: A remediation method whereby air is pushed through a contaminated media (e.g., soil or groundwater), facilitating compounds susceptible to volatilization to do so.

Applicable Requirements: Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. See also Relevant and Appropriate Requirements.

Aquifer: A water-bearing formation or group of formations.

Area Subject to Institutional Controls. The area is delineated in Figure 6. This area is subject to the institutional controls associated with the alternative actions and selected alternative. A deed for property encompassing all or a portion of this area will contain the applicable institutional controls for the area.

BTEX: Volatile organic compounds (benzene, toluene, ethylbenzene, xylene) typically associated with gasoline and other fuel product contamination.

Carcinogenic: Chemicals which, when exposure occurs at a particular level, may produce cancer.

Chlorinated Compounds: Organic compounds that contain chlorine, such as trichloroethene (TCE) and dichloroethene (DCE). Also referred to as chlorinated hydrocarbons or chlorinated solvents.

Collection/Treatment: Collecting and treating groundwater to remove contamination. Collection can be accomplished by wells or trenches. For volatile organic compounds, treatment is usually by air stripping or carbon polishing; cleaned water is returned to the ground or discharged to nearby surface water.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980. The act requires *inter alia*, that federal agencies investigate and remediate abandoned or uncontrolled hazardous waste sites on federal land.

Containment: A remedial measure whereby contaminants in groundwater are to prevented from migrating by a barrier. The barrier can be physical (e.g., slurry wall) or hydrologic (line of pumping wells that reverse the direction of groundwater flow).

Contaminant Plume: A volume of contaminated groundwater with measurable horizontal and vertical dimensions. Plume contaminants are dissolved in and move with groundwater.

Ecological Receptors: Fauna or flora (plant and animals) in a given area that could be affected by contaminants in surface soils, surface water, and/or sediment.

Feasibility Study (FS): An evaluation to identify and evaluate appropriate remedial goals and remedial alternatives for a site based upon United States Environmental Protection Agency criteria.

Floating Product: A chemical or mixture of chemicals in pure form (non-aqueous or not dissolved in water) that is of lighter density than water and therefore floats on the top of the water table.

Free Product: A chemical or mixture of chemicals in pure form (non-aqueous or not dissolved in water). The substance is free if it can be recovered by pumping.

Groundwater: Water found beneath the earth's surface that fills pores within materials such as sand, soil, gravel, and cracks in bedrock, and often serves as a source of drinking water if found in an adequate quantity.

Inorganic Compounds: A class of naturally occurring compounds that includes metals, cyanide, nitrates, sulfates, chlorides, carbonate, bicarbonate, and other oxide complexes.

Installation Restoration Program (IRP): The United States Air Force subcomponent of the Defense Environment Restoration Program (DERP) that specifically deals with investigating and remediating sites associated with suspected releases of toxic and hazardous materials from past activities. The DERP was established to cleanup hazardous waste disposal and spill sites at Department of Defense facilities nationwide.

Monitoring: Ongoing collection of information about the environment that helps gauge the effectiveness of a cleanup action. Information gathering may include groundwater well sampling, surface water sampling, soil sampling, air sampling, and physical inspections.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The NCP provides the organization, structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants. The NCP is required under CERCLA and the Clean Water Act, and USEPA has been delegated the responsibility for preparing and implementing the NCP. The NCP is applicable to response actions taken pursuant to the authorities under CERCLA and the Clean Water Act.

National Priorities List: USEPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under the Superfund program.

Natural Attenuation: Processes by which contaminant levels are reduced in nature. Contaminants in soil or groundwater are reduced by aerobic (oxygen-using) bacteria, other biological activity, volatilization, and dilution/dispersion.

New York State Registry of Inactive Hazardous Waste Sites: The state's compilation of all known hazardous waste sites, comprising nine volumes with site descriptions and locations. (Copies available for review in NYSDEC offices).

Noncarcinogenic: Chemicals that may produce adverse health effects that are not related to cancer.

Operation and Maintenance. (O&M): A step in the remedial program. While a site is being remediated it is overseen to make sure that the remedy is working as planned and that the construction remains operational.

Operable Unit (OU): A separate and distinct remedial project that is part of a large, complex hazardous waste site. Each OU has its own Record of Decision, remedial investigation, feasibility study, design and construction.

Organic Compounds: Any chemical compounds built on the carbon atom, i.e., methane, propane, phenol, etc.

Permeable Treatment Wall: A remedial measure whereby contaminated groundwater passes through a reactive media (usually an iron filings-type material) and a chemical reaction occurs destroying the contamination.

Polycyclic Aromatic Hydrocarbons (PAHs): Compounds often associated with combustion process and distillation tars.

Proposed Plan: A public document that solicits public input on a recommended remedial alternative to be used at a National Priorities List (NPL) site. The Proposed Plan is based on information and technical analysis generated during the RI/FS. The recommended remedial action could be modified or changed based on public comments and community concerns.

Product: A chemical or mixture of chemicals in pure form (nonaqueous or not dissolved in water).

Record of Decision (ROD): A public document that explains the remedial alternative to be used at a National Priorities List (NPL) site. The ROD is based on information and technical analysis generated during the remedial investigation, and on consideration of the public comments and community concerns received on the Proposed Plan. The ROD includes a Responsiveness Summary of public comments.

Relevant and Appropriate Requirements: These are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not “applicable” to a hazardous substance, pollutant,

contaminant, remedial action, location, or other circumstance at a CECLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than the federal requirements may be relevant and appropriate.

Remedial Action: An action that stops or substantially reduces a release or threat of a release of hazardous substances that is serious but not an immediate threat to human health or the environment.

Remedial Alternatives: Options evaluated to address the source and/or migration of contaminants to meet health-based or ecology-based remediation goals.

Remedial Investigation (RI): An investigation that determines the nature and extent and composition of contamination at a hazardous waste site. It is used to assess the types of remedial options that are developed in the feasibility study.

Semi-volatile Organic Compounds (SVOCs): Organic constituents which are generally insoluble in water and are not readily transported in groundwater.

Solvents: Organic liquids used to dissolve grease and other oil-based materials. Many solvents are toxic at high concentrations.

Source: Area at a hazardous waste site from which contamination originates.

Source Control: A remedy that addresses contamination problems at their source, rather than at some other more distant point along the chain of exposure.

Sparging: A remedial action that involves injecting air into the soil's saturated zone below or within the zone of contamination. Contaminants are entrained in the air and may be discharged to the atmosphere at the surface.

Superfund: The trust fund, created by CERCLA out of special taxes, used to investigate and clean up abandoned or uncontrolled hazardous waste sites. Out of this fund USEPA either: (1) pays for site remediation when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work or (2) takes legal action to force parties responsible for site contamination to cleanup the site or pay back the federal government for the cost of the remediation. Federal facilities are not eligible for Superfund monies.

Terrestrial Wildlife: Animals living on land (e.g., reptiles, small mammals, small birds, predatory mammals, predatory birds).

To Be Considered (TBC): Federal and state policies, advisories, and other non-promulgated health and environment 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 applicable or relevant and

appropriate requirements (ARARs) for a chemical or other site conditions exist, or if ARARs are not deemed sufficiently protective.

Vadose Zone: The volume located between the ground surface and the water table. Also known as the unsaturated zone.

Volatile Organic Compounds (VOCs): Organic constituents which tend to volatilize or to change from a liquid to a gas form when exposed to the atmosphere. Many VOCs are readily transported in groundwater.

TABLES

TABLE 1
HYDROGEOLOGIC UNITS

Hydrogeologic Unit	Description	Hydraulic Conductivity	No. of Wells or Borings
Unsaturated Zone	The unsaturated zone lies between the ground surface and the water table. It lies entirely within the sand unit, except in the southeastern portion of the base where the water table surface may intersect clay, till, or bedrock. This zone ranges in thickness from 1 to 50 feet.	Not Determined	Over 400 borings
Unconfined Sand Aquifer	The unconfined aquifer, contained in the sand unit, has the water table as its upper bound and the clay confining layer as its lower bound. The saturated thickness of the aquifer is greatest in the northwest and north-central portions of the base (at over 50 feet), and decreases to the north, east, and south (being less than 5 feet in the vicinity of the golf course and the southern end of the flightline and runway). The unconfined aquifer is limited to the north and south by the Saranac and Salmon Rivers, respectively. Their river valleys cut through the sand into the underlying clay unit. Lake Champlain and bedrock outcrops east of the golf course limit the unconfined aquifer to the east and southeast. The FT-002 contaminant plume is contained within this unit.	10^{-2} to 10^{-4} cm/sec	321 monitoring wells
Clay Confining Unit	The clay unit forms a low permeability confining layer that separates the sandy unconfined aquifer from the till and bedrock below. The clay confining layer is believed to be continuous beneath the base; it is known to be absent only in the Saranac River valley and where bedrock outcrops. The clay was found in thicknesses up to 30 feet.	10^{-8} cm/sec	21 borings
Confined Till Water-Bearing Zone	The till water-bearing zone is confined by the overlying clay unit. It is isolated from the sand aquifer above, but is in immediate contact with the bedrock below. Vertical flow from the till toward the sand above appears upward except in a portion of the flightline industrial corridor. This unit is heterogeneous in composition (silty gravel to gravelly silt) and ranges widely in thickness (3 to 182 feet)	10^{-4} cm/sec	6 wells; 20 borings
Confined Bedrock Aquifer	The bedrock aquifer is isolated from the unconfined sand aquifer by the overlying clay unit. Groundwater movement in the bedrock, which is variably fractured limestone and dolostone, is controlled by the secondary porosity features of the rock such as fractures, faults, bedding planes, joints, and solution cavities. Regional groundwater flow in the bedrock aquifer is generally to the east and southeast toward Lake Champlain. Artesian flow occurred from several wells installed at the golf course and along the southern end of the flightline and runway.	10^{-2} to 10^{-6} cm/sec	15 wells

Notes: Hydraulic conductivity is a measure of the ability of a unit to allow water to flow through it. The higher the number (e.g., 10^{-2}), the quicker water will pass through the unit. The lower the number (e.g., 10^{-7}), the slower water will pass through the unit.

cm/sec = centimeter per second

TABLE 2
CHEMICALS DETECTED IN GROUNDWATER NEAR THE FT-002 SOURCE AREA

Volatile Organic Compounds	Semi-Volatile Organic Compounds	Metals
Methylene Chloride (20) Acetone (19) Carbon Disulfide (280) 1,1-Dichloroethene (DCE) (140) 1,2-DCE (total) (18,000) 1,2-Dichloroethane (45) 2-Butanone (690) Trichloroethene (TCE) (3,900) 1,1,2-Trichloroethane (19) Benzene (720) 4-Methyl-2-Pentanone (70) 2-Hexanone (96) Tetrachloroethene (52) Toluene (4,200) Chlorobenzene (7) Ethylbenzene (1,400) Total Xylenes (13,000)	Phenol (110) 2-Chlorophenol (130) 1,2-Dichlorobenzene (1,200) 2-Methylphenol (17) 4-Methylphenol (140) 2,4-Dimethylphenol (98) Naphthalene (3,700) 4-Chloro-3-Methylphenol (42) 2-Methylnaphthalene (9,600) Acenaphthene (780) 4-Nitrophenol (150) Pentachlorophenol (140) Phenanthrene (1,700) bis(2-Ethylhexyl)phthalate (1,100)	Aluminum (3,610) Arsenic (20.6) Calcium (112,000) Chromium (143) Iron (23,400) Lead (126) Magnesium (45,900) Manganese (12,100) Nickel (56.6) Potassium (7,470) Sodium (43,500) Zinc (9,910)

BTEX = benzene, toluene, ethylbenzene, and total xylenes

(52) = Maximum concentration of contaminant detected in the source area during the RI (URS 1993) in micrograms per liter (µg/L). Note that concentrations at the well locations where the maximum detections occurred have generally diminished significantly since 1993.

Benzene = Chemicals shown in **bold** were detected in greater than 10% of the samples taken.

Primary Contaminants of Concern
1,2-Dichloroethene (DCE) Trichloroethene (TCE) Vinyl Chloride* (VC) Benzene Toluene Ethylbenzene Total Xylenes

* Vinyl Chloride is a degradation product of DCE and is detected downgradient from the FT-002 Source Area.

TABLE 3
GROUNDWATER QUALITY ARARs
FOR PRIMARY CONTAMINANTS OF CONCERN

COMPOUND	MAXIMUM ALLOWABLE CONCENTRATION (µg/L)
Benzene	1
1,2-Dichloroethene	5
Ethylbenzene	5
Toluene	5
Trichloroethene	5
Vinyl Chloride	2
Xylene	5

Notes:

µg/L = microgram per liter

Reference: NYSDEC. 2008. *6 NYCRR Part 703, Surface Water and Groundwater Effluent Limitations*.
February. Retrieved from <http://www.dec.ny.gov/chemical/27985.html> on March 9, 2009.

TABLE 4
GROUNDWATER AND SURFACE WATER REMEDIATION GOALS
(µg/L)

Compound	Groundwater	Surface Water
Vinyl Chloride	2	NV
1,2-Dichloroethene	5	NV
Trichloroethene	5	40
Benzene	1	10
Toluene	5	6,000
Ethylbenzene	5	NV
Xylene (total)	5	NV

Note:

NV = No value; there are no Class D surface water standards for these compounds.

Reference: NYSDEC. 2008. *6 NYCRR Part 703, Surface Water and Groundwater Effluent Limitations*. February. Retrieved from <http://www.dec.ny.gov/chemical/27985.html> on March 9, 2009.

TABLE 5
SUMMARY OF HUMAN HEALTH RISK ASSESSMENT
1994 FT-002 GROUNDWATER RI REPORT ⁽¹⁾

LOCATION	EXPOSURE PATHWAY	CANCER RISK	HAZARD INDEX
Plume Core	Ingestion of Groundwater	2×10^{-3}	70
	Inhalation of Vapors While Showering	7×10^{-3}	40
	Total - Groundwater Pathway	9×10^{-3}	110
Plume Periphery	Ingestion of Groundwater	2×10^{-4}	10
	Inhalation of Vapors While Showering	5×10^{-4}	7
	Total - Groundwater Pathway	7×10^{-4}	17

Notes:

1. ABB-ES & URS 1994

TABLE 6
SUMMARY OF HUMAN HEALTH RISK ASSESSMENT
2001 FT-002/IA GROUNDWATER OU RI/FS

LOCATION	DESCRIPTION	EXPOSURE PATHWAY	RECEPTOR	CANCER RISK	HAZARD INDEX
Area 1	FT-002 Source Area	Vapor Inhalation	Industrial/Commercial Worker	5×10^{-6}	0.02
Area 2- Zone 1	Industrial Area - Site SS-011 Area	Vapor Inhalation	Industrial/Commercial Worker	5×10^{-6}	NC
Area 2- Zone 2	Industrial Area - 10 to 100 µg/L Total Chlorinated Hydrocarbons	Vapor Inhalation	Industrial/Commercial Worker	8×10^{-6}	NC
Area 2-Zone 3	Industrial Area - 100 to 1000 µg/L Total Chlorinated Hydrocarbons	Vapor Inhalation	Industrial/Commercial Worker	7×10^{-7}	NC
Area 2-Zone 4	Industrial Area - BTEX Plume	Vapor Inhalation	Maintenance Worker	4×10^{-7}	0.00004
Area 3	Golf Course Drainage Stream	Vapor Inhalation	Industrial/Commercial Worker	5×10^{-9}	NC
Area 4	Weapons Storage Area Drainage Streams	Vapor Inhalation	Industrial/Commercial Worker	5×10^{-7}	NC

NC = Toxicity is insufficient for calculation of Hazard Index.

TABLE 7
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
2001 FT-002/IA GROUNDWATER OU RI/FS

HAZARD QUOTIENTS FOR MEASURED AND MODELED CONTAMINANT CONCENTRATIONS IN SURFACE WATER

Compound	Exposure Point Concentrations (µg/L)		USEPA AWQC (µg/L)	Hazard Quotient	Expected Risk	NYSDEC AWQC Class D Streams (µg/L)	Hazard Quotient	Expected Risk	Hazard Quotient Using LOAEL ⁽²⁾	Expected Risk
	Measured	Modeled ⁽¹⁾								
TCE	84		21,900	0.0038	No	40	2.1	Yes	--	--
DCE	110		1,160	0.095	No	No Criterion	--	--	--	--
Vinyl Chloride	11		No Criterion	--	--	No Criterion	--	--	0.00003	No
Benzene	0.6		530	0.001	No	760	0.0008	No	--	--
TCE		324	21,900	0.015	No	40	8.1	Yes	--	--
DCE		629	1,160	0.542	No	No Criterion	--	--	--	--

AWQC = Ambient water quality criterion

µg/L = micrograms per liter

LOAEL = Lowest observed adverse effect level concentration

-- = Not calculated

Notes:

1. Only TCE and DCE were modeled.
2. The hazard quotient using the LOAEL criterion, 388,000 µg/L, has been calculated for vinyl chloride only because vinyl chloride does not have a USEPA or NYSDEC AWQC.

Hazard Quotient = Exposure Point Concentration ÷ AWQC or LOAEL; unitless

TABLE 8

**SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
2001 FT-002/IA GROUNDWATER OU RI/FS**

**ESTIMATED SURFACE WATER INTAKE TO EXCEED NOAEL
FOR
RACCOON AND ROBIN**

Compound	LOAEL or NOAEL ^{1,2}		Maximum Concentration (µg/L)	Daily Water Intake to Exceed LOAEL/NOAEL (L)	
	Concentration (mg/kg/day)	Species		Raccoon	American Robin
DCE	30 (NOAEL)	rat	629	143	4
TCE	100 (LOAEL)	mouse	324	926	24
Vinyl Chloride	1.7 (LOAEL)	rat	11	464	12
Benzene	26.36 (NOAEL)	mouse	0.6	125,424	3,222

LOAEL = Lowest observed adverse effect level

NOAEL = No observed adverse effect level

mg = milligram

kg = kilogram

µg = microgram

L = Liter

Daily Water Intake = (LOAEL or NOAEL; mg/kg x body weight; kg) ÷ (Maximum Concentration; µg/L x 1 mg/1000

µg)

Species	Body Weight (kg) ³	Normal Daily Water Consumption ³	
		g/g BW	Liters
Raccoon	3	0.082	0.25
American Robin	0.077	0.14	0.01

g/g BW = grams of water per gram of body weight

Liters = (Body Weight; kg) x (1,000 g/kg) x (water consumption; g/g BW) x (1 L/1000g)

References:

1. Sample et. al. 1996
2. Nawrot and Staples 1979
3. USEPA 1993

TABLE 9
COMPARISON OF PREFERRED ALTERNATIVE TO USEPA EVALUATION CRITERIA

CRITERION	DESCRIPTION OF CRITERION	COMPARISON OF ALTERNATIVE TO CRITERION
Overall Protection of Human Health and the Environment	Addresses whether a remedy provides adequate protection to human and ecological receptors.	The preferred alternative is protective of human health and the environment. It includes measures to reduce the time required to restore groundwater and surface water to ARARs. The extent of the plume and, therefore, the site risk decreases over time for this alternative. This alternative also includes measures that limit the extent of plume migration that further protects human health and the environment. Institutional controls to prevent groundwater use also provide protection during remediation.
Compliance with ARARs	Addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of all state and federal environmental statutes.	Chemical-specific ARARs for groundwater should be achieved in an estimated time period of 80 years and chemical-specific ARARs for surface water will be achieved almost immediately after successful operation of the trench and treatment system between the runway and flightline is achieved.
Long-Term Effectiveness and Permanence	Refers to the magnitude of residual risk and the ability of the remedy to maintain reliable protection of human health and the environment once cleanup goals have been met.	The risk for groundwater ingestion will be reduced to an acceptable level after remediation. Groundwater and surface water concentrations will be at or below ARAR levels. During the remediation period, monitoring and deed and lease restrictions will adequately and reliably protect human health and the environment. Institutional controls and monitoring would be discontinued when remediation goals are achieved.

TABLE 9 (Continued)

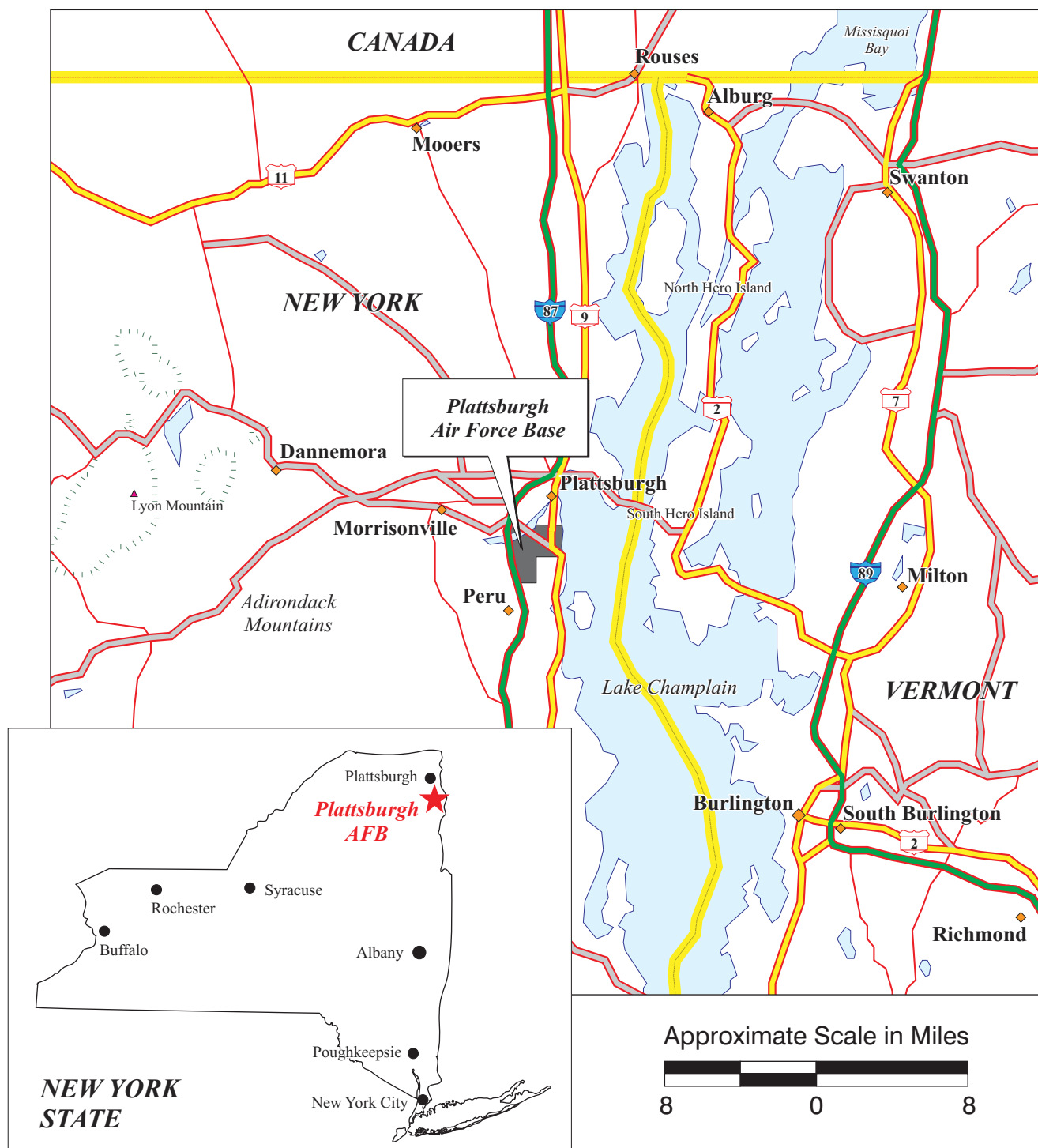
CRITERION	DESCRIPTION OF CRITERION	COMPARISON OF ALTERNATIVE TO CRITERION
Reduction of Toxicity, Mobility, or Volume	Addresses the anticipated performance of treatment technologies employed in the remedy.	Groundwater treatment included in the selected remedy for the Runway/Flightline collection trench will remove an estimated 8,000 pounds of chlorinated compounds from groundwater during the first 10 years of operation. This is approximately 91% of the estimated quantity of chlorinated compounds presently in groundwater.
Short-Term Effectiveness	Refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts during its implementation.	Intrusive activities required for construction of three collection trenches would produce a small potential risk to workers and the community, mainly from air emissions. However, potential risk could be minimized easily by implementing standard environmental health and safety measures. Groundwater would be restored to ARARs in an estimated time period of 80 years and surface water (a portion of the WSA drainage stream) would be restored to ARARs almost immediately after successful operation of the trench and treatment system between the runway and flightline is achieved.
Implementability	Addresses aspects of implementing the remedy such as the ability to construct and operate technologies, reliability, ability to monitor effectiveness, availability of materials, permitting, and coordination with other agencies.	The preferred alternative is feasible. Design and construction of all the technologies are conventional and standardized. Groundwater and surface water monitoring would reliably test the effectiveness of remediation.
Cost	Refers to the capital and O&M cost of a remedy and its present worth.	The cost to construct the elements of the preferred alternative is \$9.5 million (capital cost). It is expected that \$370,000 will be needed annually to operate the remedial systems and to perform monitoring. The overall present worth is \$15.7 million.

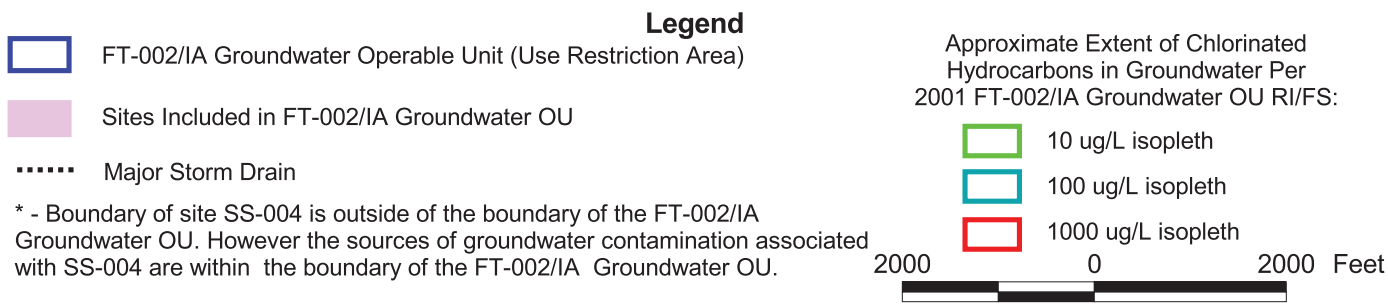
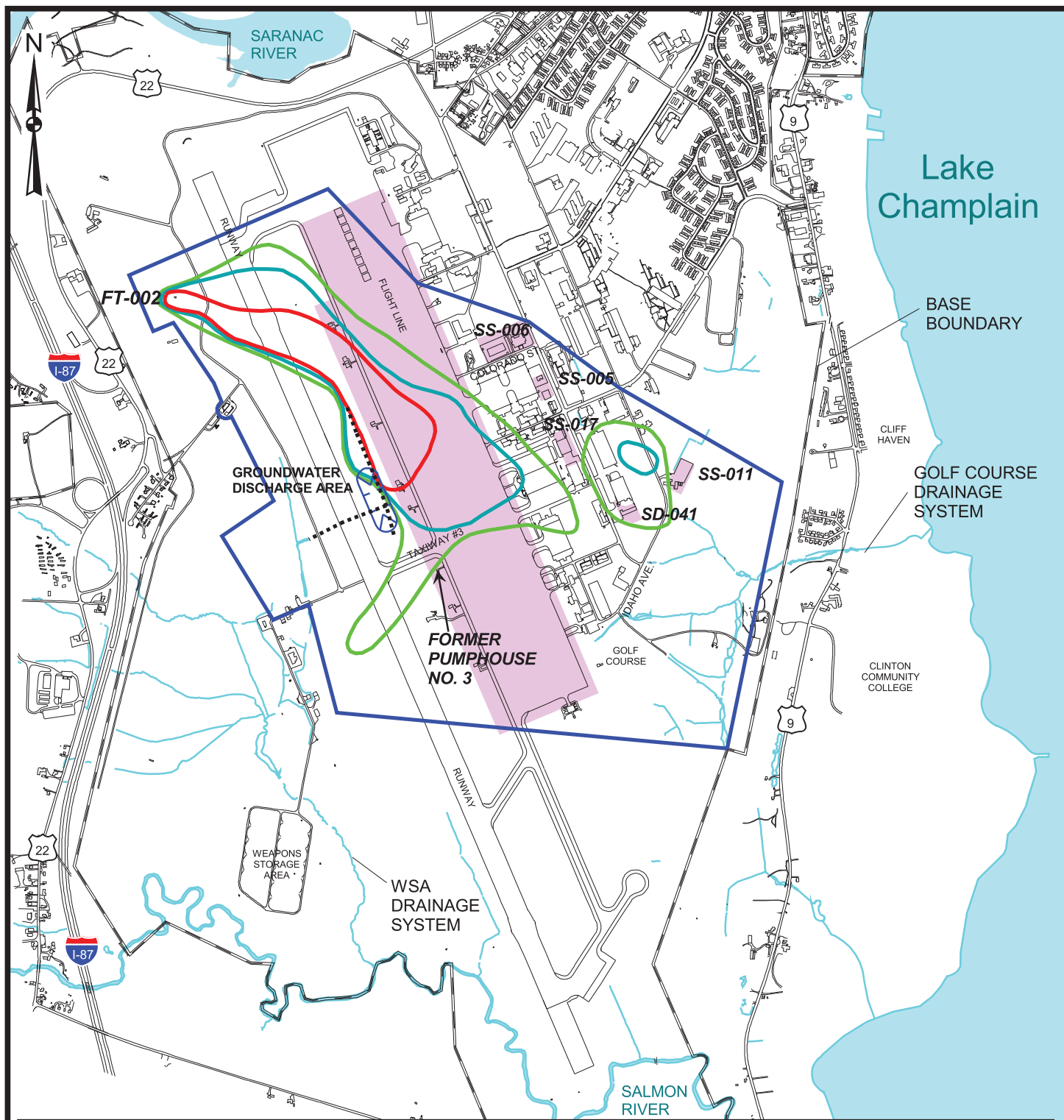
TABLE 9 (Continued)

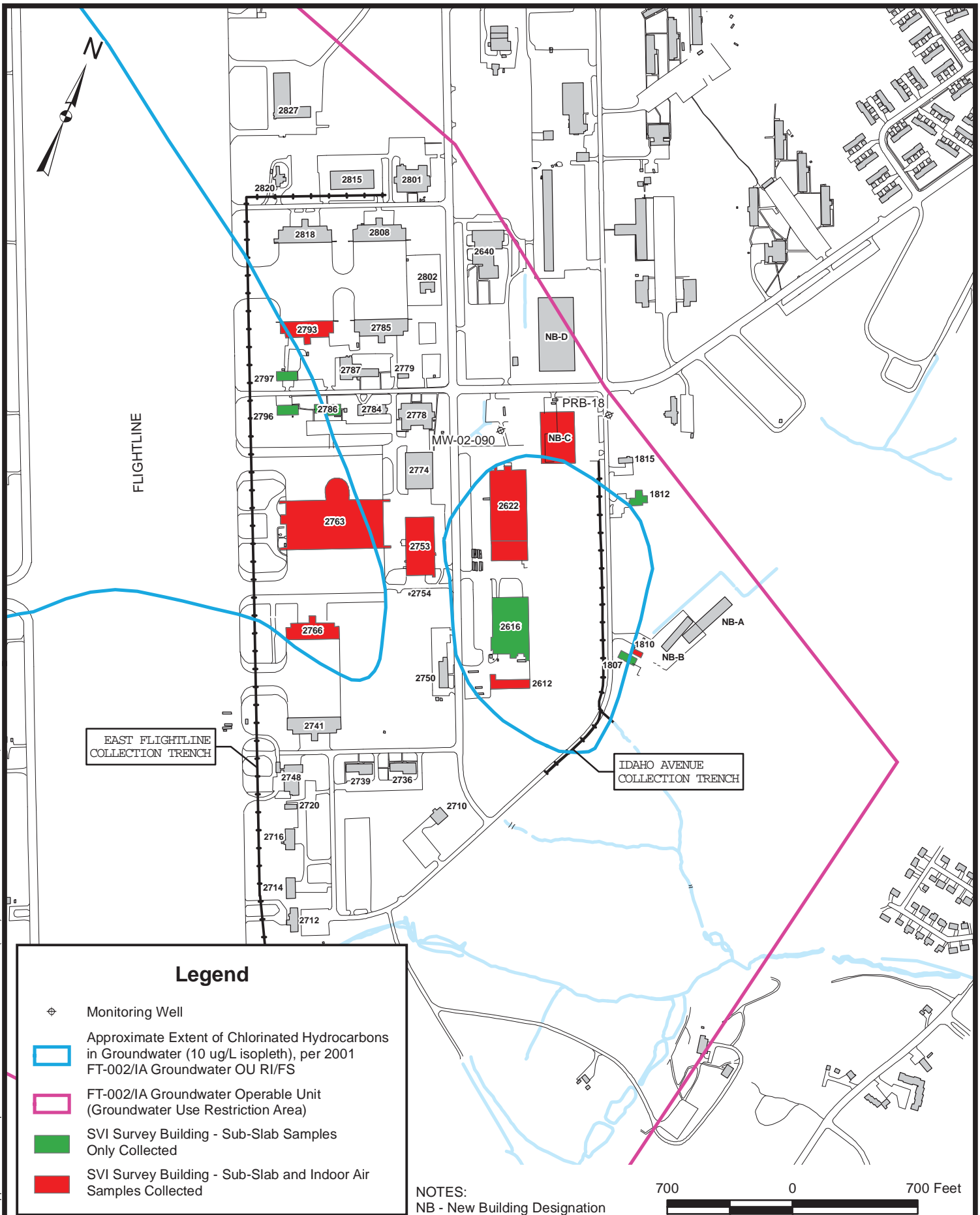
CRITERION	DESCRIPTION OF CRITERION	COMPARISON OF ALTERNATIVE TO CRITERION
State Acceptance	Addresses the technical and administrative concerns of the State with regard to remediation.	The NYSDEC has provided input during the preparation of the Proposed Plan and ROD and its concurrence is given in Appendix B.
Community Acceptance	Addresses public comments received on the Administrative Record and the Proposed Plan.	Community comments to the selected remedy were evaluated following the public comment period for the January 2002 PRAP (URS 2002a) and are discussed in the Responsiveness Summary included with the June 2003 Interim ROD (URS 2003c). As a general statement, the community concurs with the selected remedy.

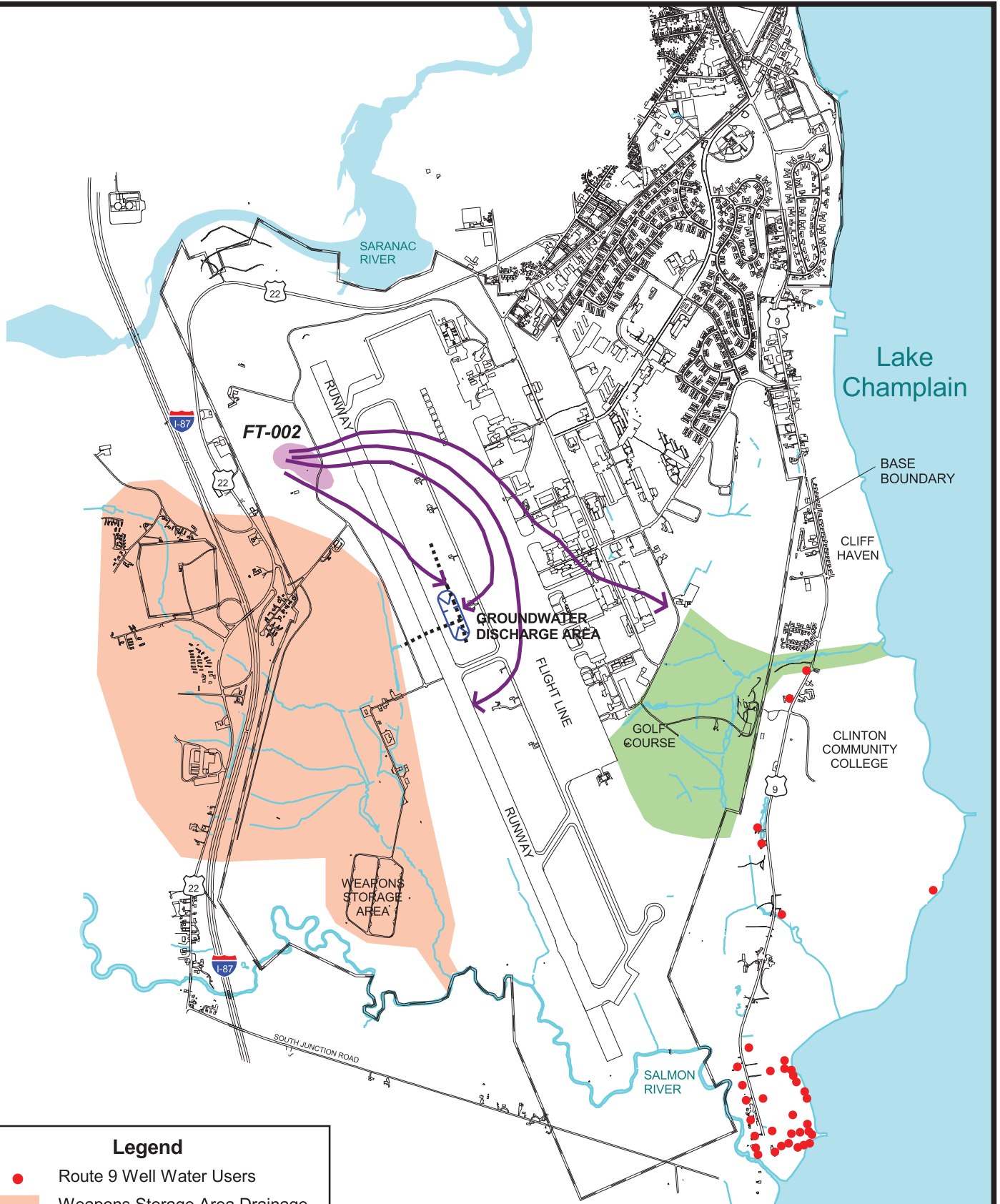
Note: The estimates of cleanup timeframes and mass of contaminants treated are based on the groundwater transport model and are imprecise. That is, the estimates are based on projections of the model several decades into the future so results cannot be regarded with absolute certainty. The accuracy of the estimates, however, meets the goals of USEPA RI/FS guidance with respect to evaluating and comparing alternatives.

FIGURES









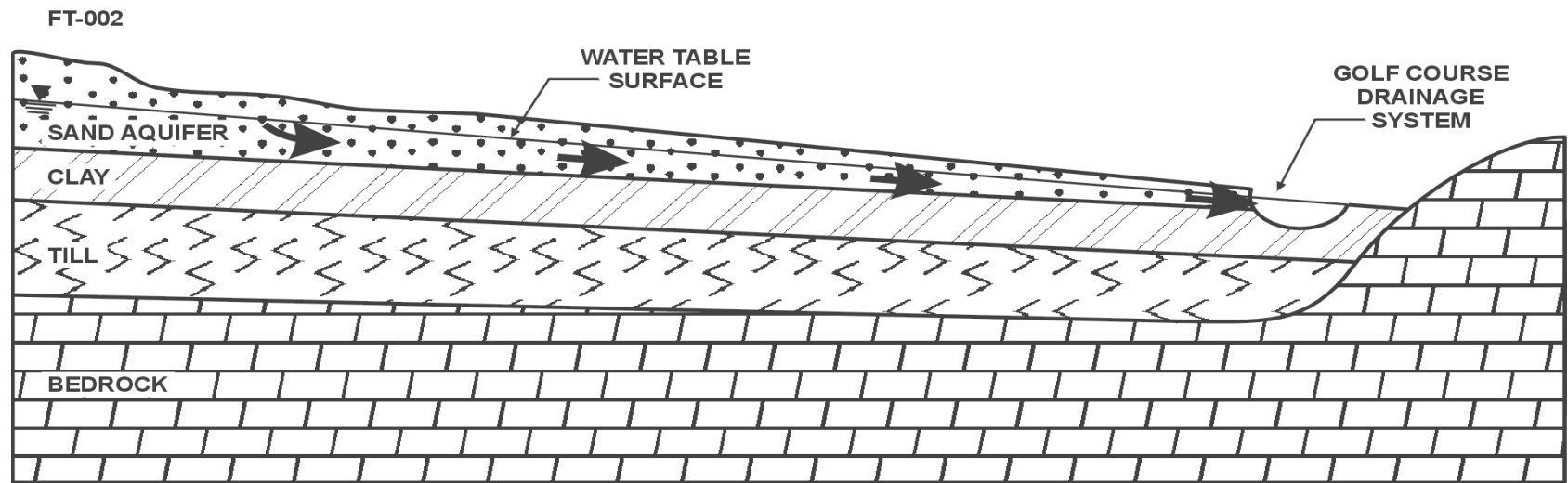
Legend

- Route 9 Well Water Users
- Weapons Storage Area Drainage
- Golf Course Drainage
- Major Storm Drain
- ➔ Groundwater Flow Direction

2500 0 2500 Feet

NORTHWEST

SOUTHEAST

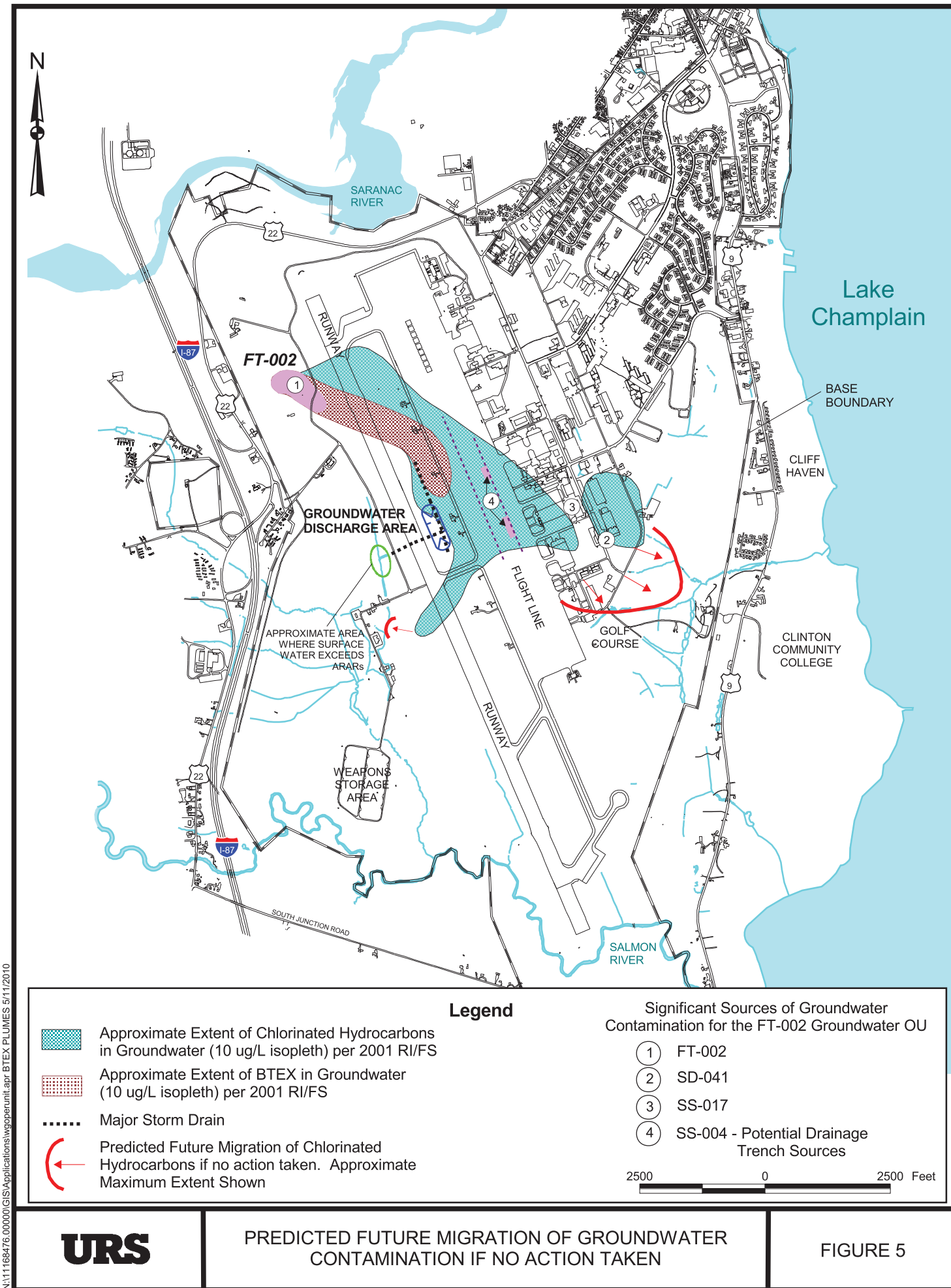


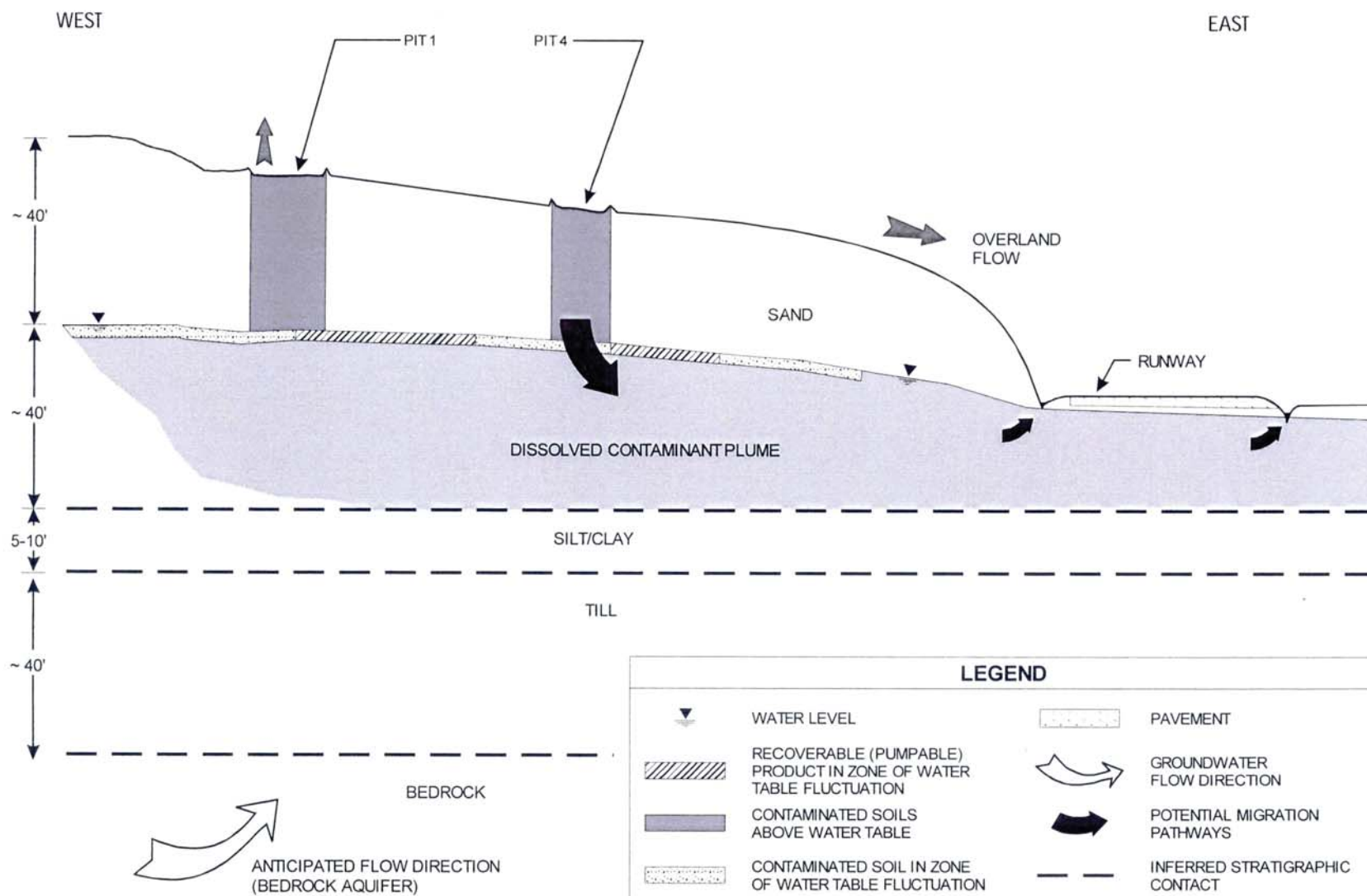
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FT-002/IA GROUNDWATER OPERABLE UNIT
CONCEPTUAL CROSS SECTION

FIGURE 4





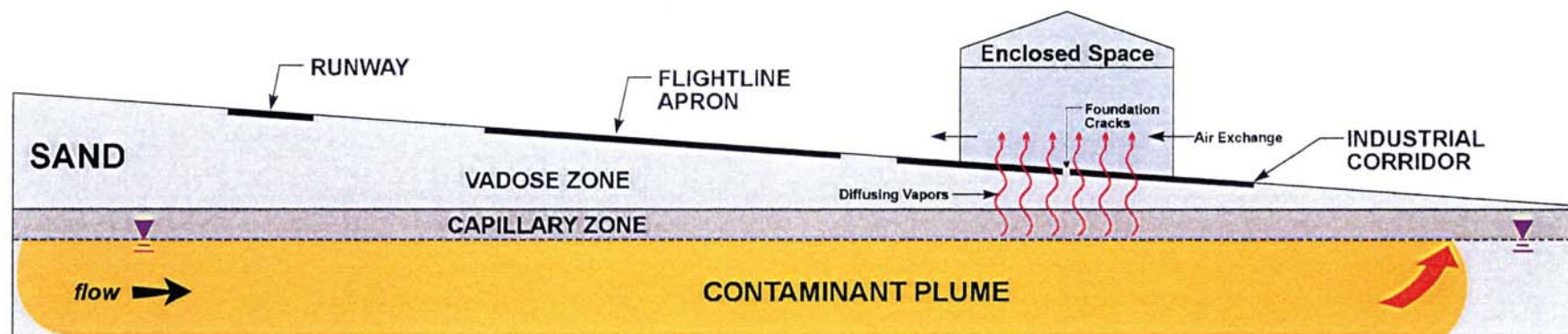
Reference: URS 2001d

NOT TO SCALE

URS

**CONCEPTUAL SITE MODEL
FT-002 SOURCE AREA**

FIGURE 5a



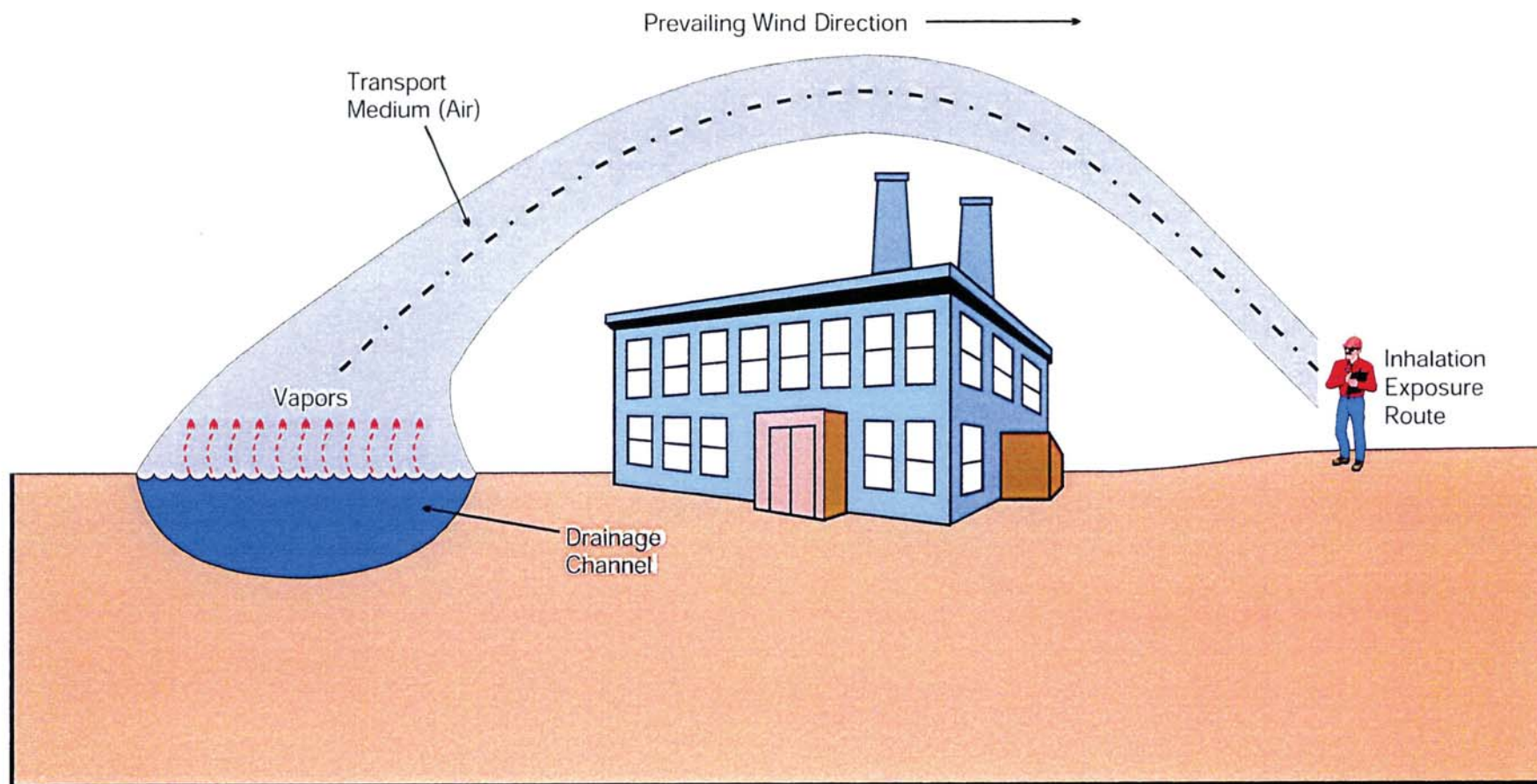
NOT TO SCALE

Reference: URS 2001d

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**CONCEPTUAL SITE MODEL
VOLATILIZATION FROM GROUNDWATER TO ENCLOSED-SPACE AIR**

FIGURE 5b



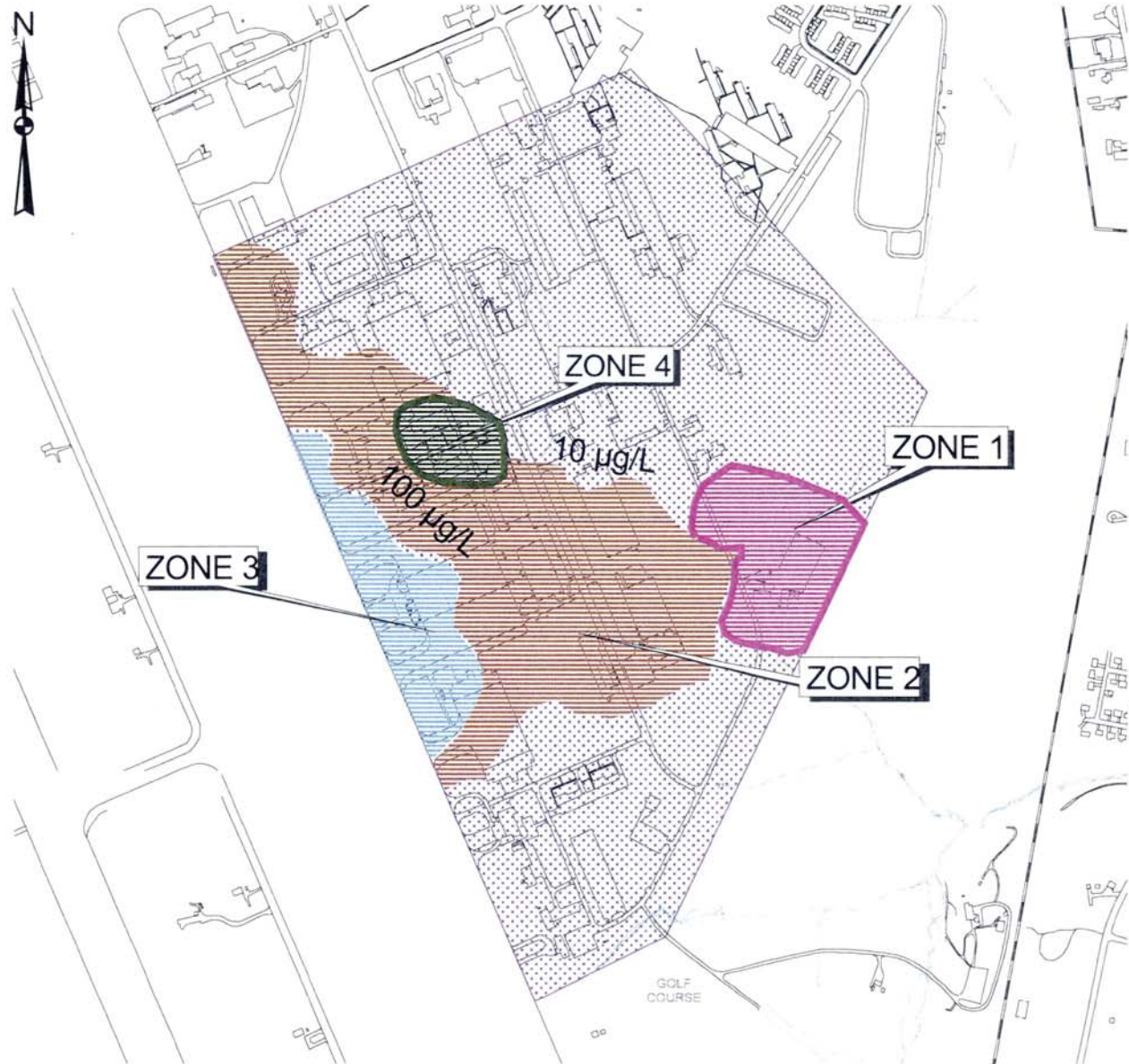
NOT TO SCALE

Reference: URS 2001d

URS

**CONCEPTUAL SITE MODEL
VOLATILIZATION FROM DRAINAGE STREAMS**

FIGURE 5c



IMPACTED AREA



ZONE 1 - SS-011 Area



ZONE 2 - 10-100 µg/L Total Chlorinated Hydrocarbon



ZONE 3 - 100-1000 µg/L Total Chlorinated Hydrocarbon



ZONE 4 - BTEX Plume

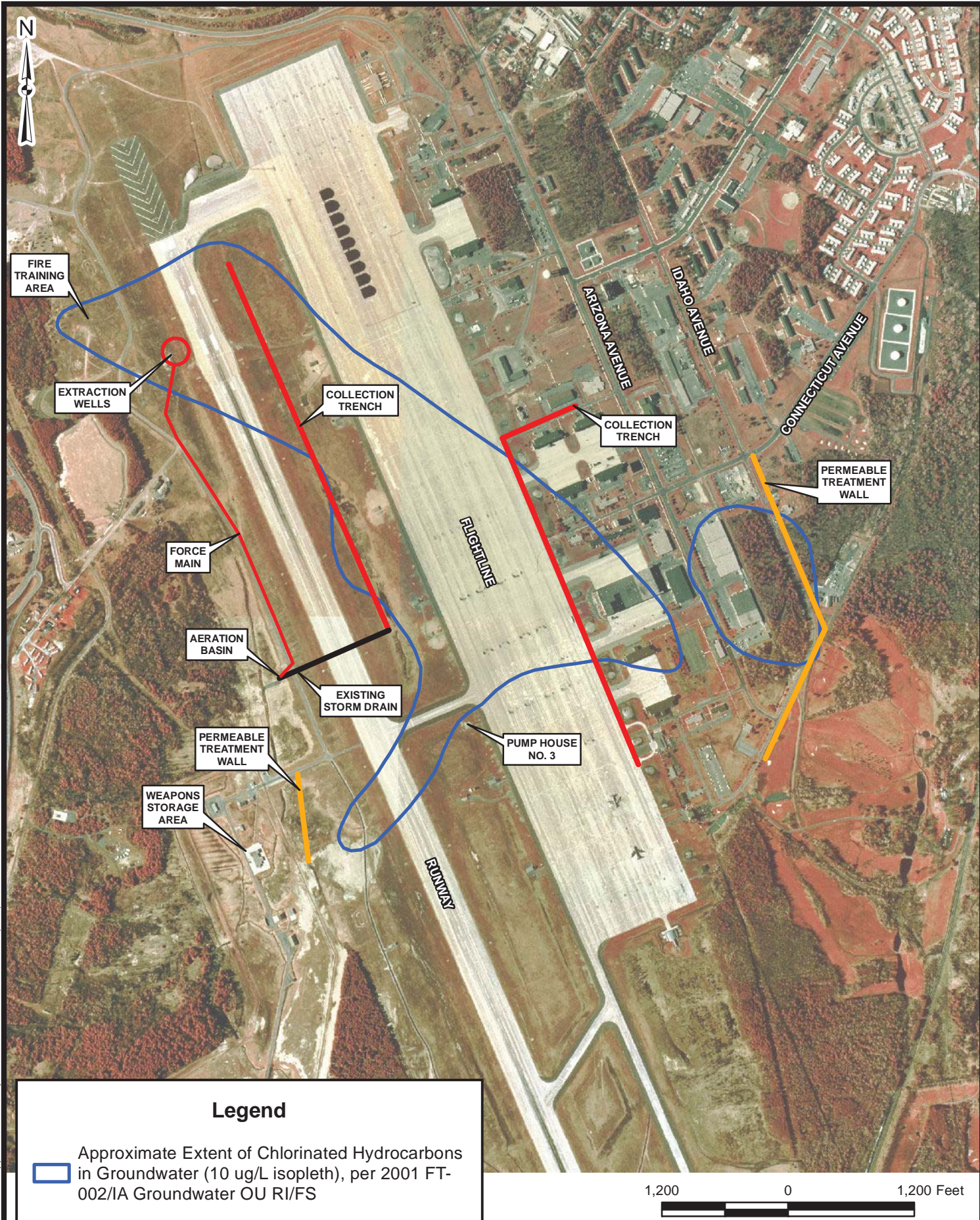
400 0 400 800 Feet



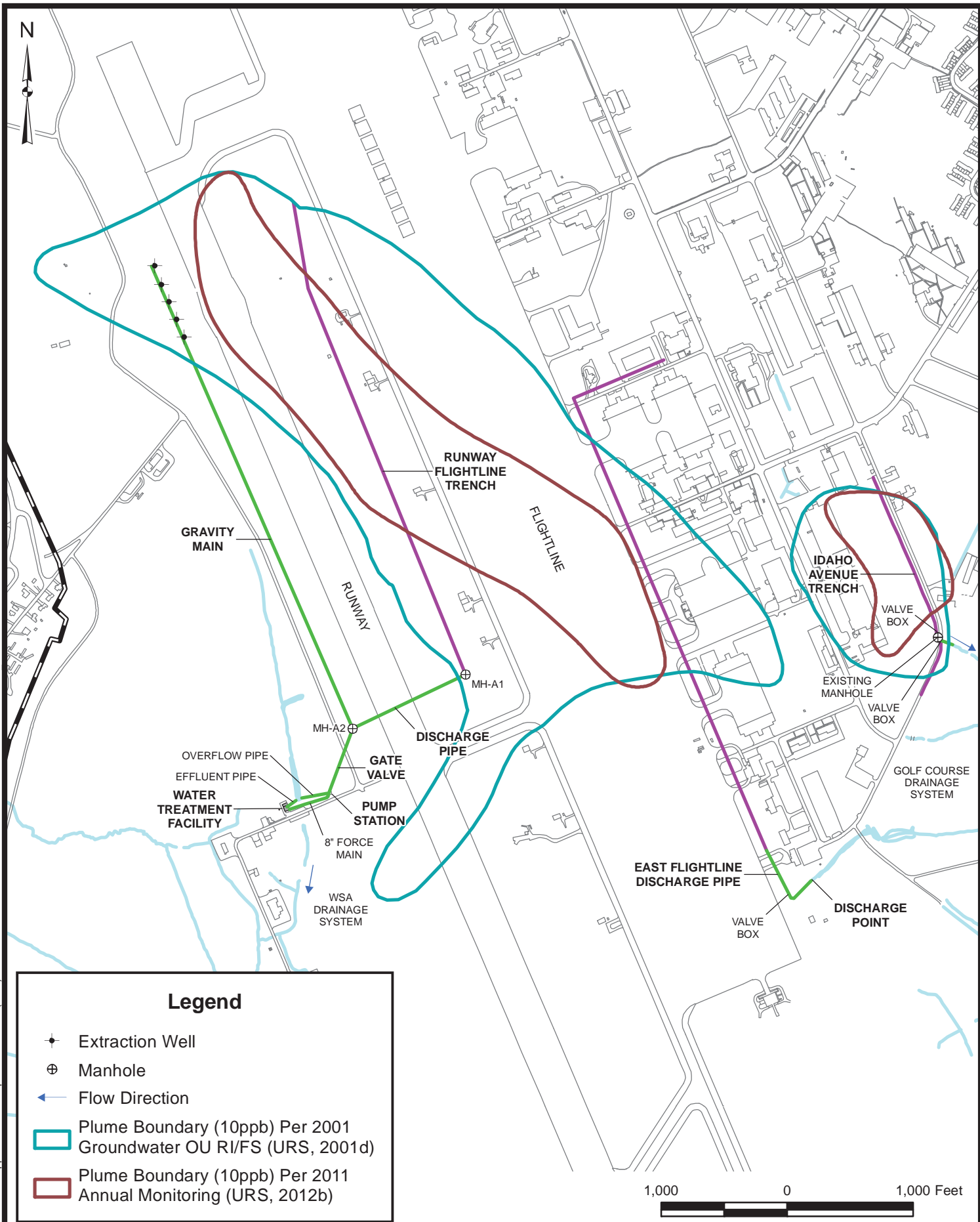
URS

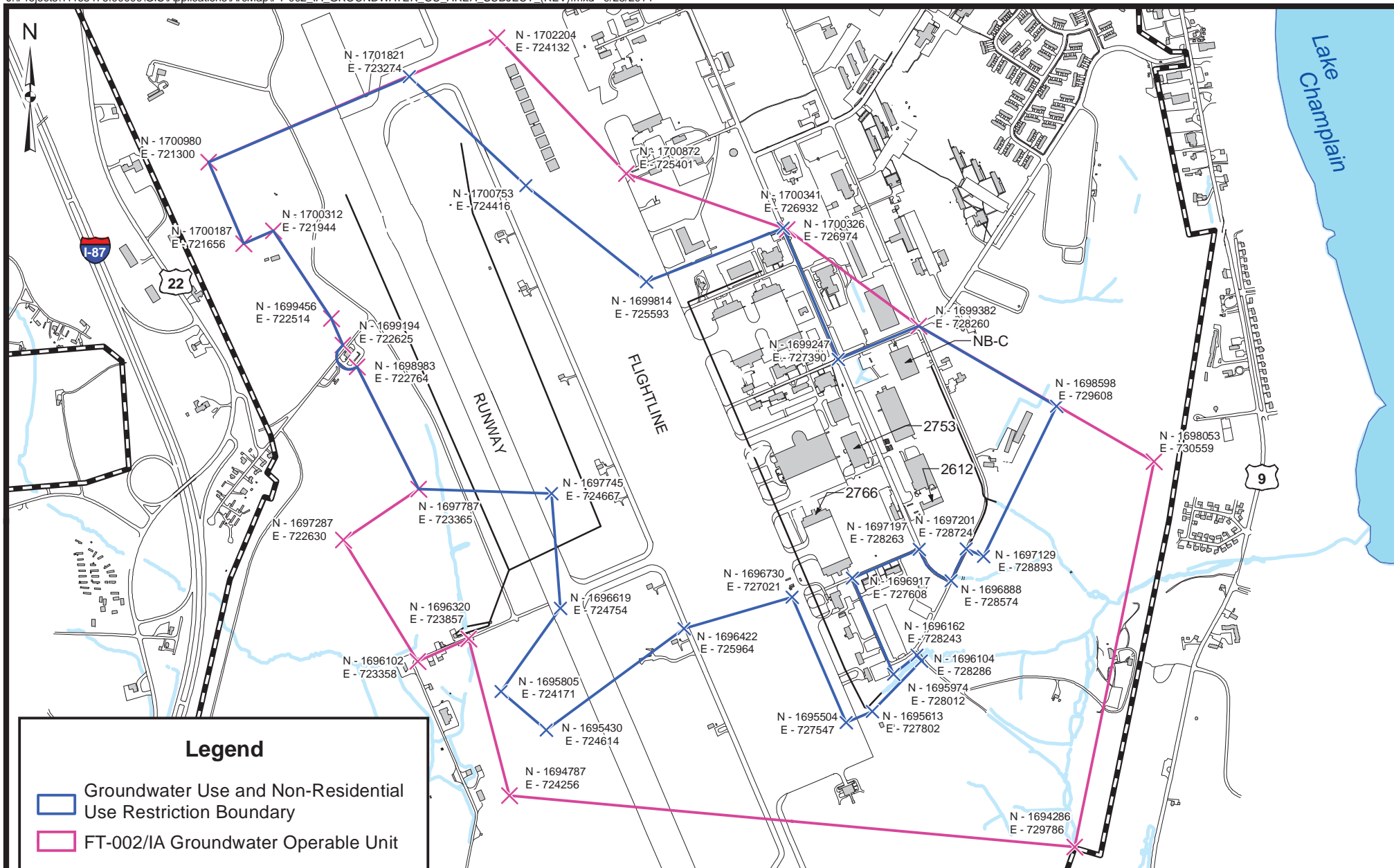
EXTENT OF INDUSTRIAL AREA CONTAMINATION
2001 FT-002/IA GROUNDWATER OU RI/FS

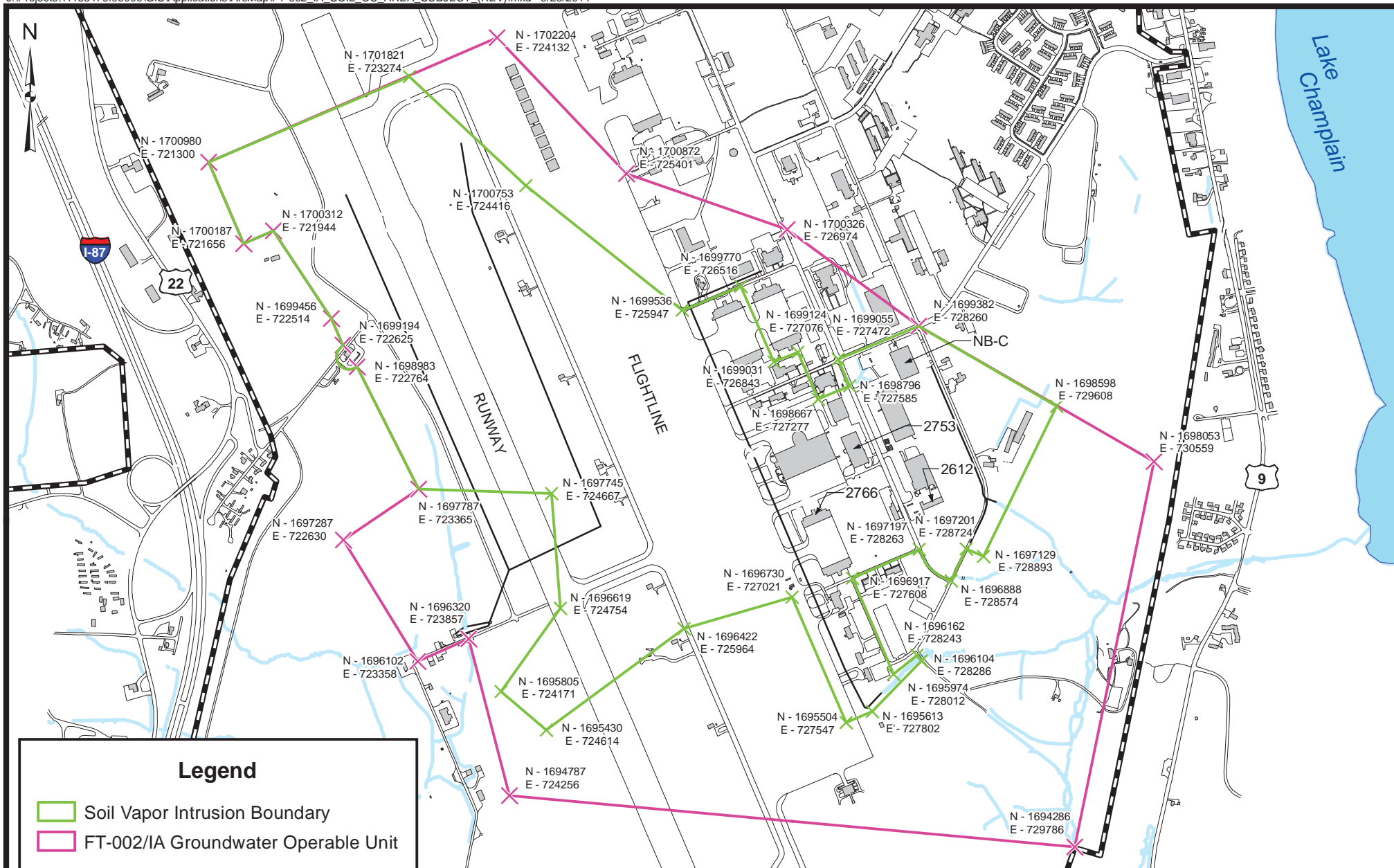
FIGURE 5d











APPENDIX A
TRANSCRIPT OF PUBLIC MEETING

1
2
3
4 IN THE MATTER OF
5
6 AIR FORCE CIVIL ENGINEER CENTER
7
8 FIRE TRAINING AREA (FT-002)/INDUSTRIAL AREA
9 GROUNDWATER OPERABLE UNIT
10
11 SUPPLEMENT TO THE JANUARY 2002 PROPOSED PLAN
12
13
14

10 DATE: September 18, 2013
11 TIME: 7:00 p.m. to 7:32 p.m.
12 LOCATION: 137 Margaret Street
13 Plattsburgh, New York
14 BEFORE: DAVID FARNSWORTH
15
16
17
18
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20
21
22
23
24
25

COPY

1 Public Hearing - 9-18-13

2 (The hearing commenced at 7:08
3 p.m.)

4 MR. FARNSWORTH: I think what I'd
5 like to do is just go ahead and get started. And I
6 can give this to you afterwards. I've actually got
7 a written script for the beginning and the end and
8 we'll give you a copy of the slides.

9 THE REPORTER: Okay.

10 MR. FARNSWORTH: Okay. I'd like
11 to begin the public meeting for the supplement for
12 the proposed plan for Site FT-002, industrial area
13 groundwater operable unit. I am Dave Farnsworth,
14 the BRAC environmental coordinator working for the
15 Air Force Civil Engineer Center at Plattsburgh. I
16 will be presiding over this meeting, the main
17 purpose of which is to allow the public the
18 opportunity to comment on the Air Force's actions
19 for the site.

20 Assisting me in tonight's
21 presentation is Don Hunt. He is the project
22 manager for U.R.S. We are here to provide answers
23 to technical questions you may have about the
24 remedial alternatives being considered by the Air
25 Force. Tonight's agenda will consist of a summary

1 Public Hearing - 9-18-13
2 of the data gathered at the site, a description of
3 the preferred remedial action. After that, we'll
4 move to the most important part of this meeting,
5 the part where you provide your comments on the
6 remedial action.

7 As you can see, everything being
8 said here tonight is being taken down, word for
9 word, by a professional court reporter. The
10 transcript will become part of the administrator of
11 record for the site. We would like everyone to
12 complete the sign-in sheet that's at the door. At
13 the conclusion of the presentation, we will open
14 the floor to comments and questions. We request
15 that all questions be held until the end of the
16 presentation.

17 If you have a prepared statement,
18 you may read it out loud or turn it in without
19 reading it. In any case, your comments will become
20 part of the record. We have comment forms at the
21 front table for your use for written comments. If
22 you turn in any written comments, please write your
23 name and address on them. If you later decide to
24 make a comment, you may send additional comments to
25 us at this address, either the mailing address or

1 Public Hearing - 9-18-13
2 the e-mail address you see below. We will accept
3 comments until September 27th, 2013 and I will show
4 this address slide again at the end of this
5 meeting.

6 The final point is that our
7 primary purpose tonight is to listen to you. We
8 want to hear your comments on any issues you are
9 concerned about and we will try to answer any
10 questions you may have. We want you to be
11 satisfied that the action we take will properly and
12 fully address the problems at the site.

13 Now I'd like to turn the meeting
14 over to Don Hunt.

15 MR. HUNT: Good evening. The --
16 the objective of tonight's meeting is -- as Dave
17 said, is to go over the remedy for the fire
18 training area groundwater O.U. But before we start
19 I'd like to go over the -- what I think the
20 objective of tonight's meeting is. In January
21 2002, a proposed plan was prepared and finalized.
22 And in February, there was a public meeting to
23 discuss that preferred alternative at the time.
24 And in June of 2003, a record of decision was
25 signed.

1 Public Hearing - 9-18-13

2 And so the objective of tonight's
3 meeting is to describe modifications and additions
4 to the selected remedies that were made since it
5 was originally described and finally designed and
6 fully implemented in 2005. And the reason for
7 tonight's meeting is that after publication of the
8 proposed plan, if new information becomes available
9 that changes the remedy or the preferred
10 alternative, and the changes could not have been
11 reasonably anticipated by the public, a revised
12 proposed plan must be issued for public comment,
13 which is what we did in August of this year.

14 Now as far as the agenda, I'll
15 speak to the site background a bit. I'll describe
16 the preferred alternative that was in the January
17 2002 proposed plan and the remedy that was selected
18 in the 2003 ROD. And I'll describe changes made to
19 the remedy during design and implementation and
20 also describe the remedy as it was finally
21 implemented. And I'll also discuss the potential
22 soil vapor intrusion pathway.

23 This FT-002 site was used from
24 1950 to 1989 for firefighting training on the base.
25 Combustible liquids were released into several pits

1 Public Hearing - 9-18-13
2 on the site and burned. And that resulted in a
3 groundwater contamination plume that extended more
4 than a mile from the site. And I'll show you the
5 site in a moment. The primary contaminants are the
6 fuel-related compounds, benzene, toluene,
7 ethylbenzene, and xylene, commonly called BTEX.
8 And also chlorinated compounds, trichloroethene,
9 dichloroethene, and vinyl chloride.

10 Now the fire training area site
11 was divided into two operable units. The first is
12 the source operable unit where the focus was on
13 free product recovery and soil contamination, and
14 the ROD for that site -- that operable unit was
15 signed in March 2001. The groundwater O.U., which
16 is the subject of this supplemental proposed plan,
17 addresses cleanup and control of groundwater
18 contamination resulting from fire training
19 activities.

20 Now this slide shows the
21 groundwater operable unit. The boundary around the
22 outside was the actual groundwater operable unit.
23 The fire training area site is up here in the
24 northwest corner. The plume that you see on here
25 is the plume from the 2001 R.A.F.S. which is

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2 actually data collected between about 1996 and
3 1999. And there's another plume over here in the
4 southeast portion of the operable unit.

5 Now the groundwater operable unit
6 also includes the groundwater at six other sites in
7 the industrial area and down-gradient of the fire
8 training area site. They're SS-004, 005, 006,
9 007 -- or 005, 006, 011, 017, and SS-041. Now
10 going back to this slide, 006, 005, 017, 011, and
11 SS-041. Now the groundwater boundary was extended
12 beyond the limits of the plume during -- during the
13 R.I.F.S. to account for uncertainties associated
14 with how far that plume would actually travel if
15 nothing was done. And that's based on groundwater
16 modeling.

17 Now thirteen alternatives were
18 described in that 2002 proposed plan, and they
19 included accommodations of various technologies
20 such as monitored natural attenuation, groundwater
21 collection trenches, permeable treatment walls,
22 groundwater pumping and treatment, groundwater
23 pumping treatment and reinjection, and also air
24 sparging.

25 Now these are the -- I'll go over

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2 the components of the preferred alternative in the
3 2002 proposed plan and then I'll show you a figure
4 which shows all of them. There was a thirty-eight
5 hundred foot groundwater collection trench between
6 the runway and the flight line, five groundwater
7 extraction wells downgradient of the FT-002 site,
8 an aeration basin to treat the groundwater from the
9 first two components, a groundwater collection
10 trench on the east side of the flight line ramp, a
11 permeable treatment wall along Idaho Avenue,
12 another permeable treatment wall at the weapon
13 storage area in the southwest portion of the base,
14 groundwater and surface water discharge monitoring.

15 It also included five-year
16 reviews, institutional controls which prohibited
17 the use of groundwater, controlled the discharge of
18 groundwater from construction activities,
19 prohibited land use from interfering with remedial
20 operations and systems.

21 And there were also two
22 contingencies. There was a groundwater collection
23 trench along Idaho Avenue, instead of the permeable
24 treatment wall if that became a more -- a better
25 solution, let's say, and groundwater collection

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2 from the trench -- or groundwater treatment,
3 rather, from the collection trench along the ramp
4 after its construction if it was determined that
5 the contamination levels were too high to just
6 discharge.

7 Now this slide shows the various
8 components. Again, here's the fire training area
9 up here, the five extraction wells in this area
10 with the discharge pipe leading to the aeration
11 basin down here, the collection trench between the
12 runway and the flight line which discharged to an
13 existing storm drain to this aeration basin, the
14 permeable treatment wall along the weapons -- near
15 the weapons storage area which was to treat this,
16 what we call the southwest arm of the plume at the
17 time, a collection trench on the east side of the
18 ramp, and another permeable treatment wall along
19 Idaho Avenue which is right here.

20 That ROD was signed in 2003. And
21 what it did, it allowed implementation of the
22 components that I just showed you, the -- what we
23 call the engineered components of the preferred
24 alternative in the proposed plan while negotiations
25 were ongoing between the Department of Defense and

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2 the E.P.A. on a national level concerning
3 institutional controls. And the remedy selected by
4 the ROD was identical to that of the proposed plan,
5 but changes were made during design and later
6 implementation. And I'll go over those changes in
7 the next couple of slides.

8 That aeration basin to treat the
9 water from the extraction wells and the collection
10 trench between the runway and flight line was
11 replaced by an actual groundwater treatment plant.
12 And that storm drain used to discharge the
13 groundwater from the trench between the runway and
14 the flight line was replaced by a gravity flow
15 discharge pipe to a pump station and then to a
16 forced main to the treatment plant.

17 The permeable treatment wall
18 along Idaho Avenue became a collection trench
19 because a treatability study showed that the amount
20 of iron needed, it was just too much. We had
21 anticipated only about a thirty-inch wall, and when
22 we did the treatability study with the actual water
23 and the soils from that area, it ended up being
24 about eight feet thick, which was just out of the
25 question. And the length of the trench along Idaho

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2 Avenue was shortened at the -- at the south end
3 because groundwater modeling during design showed
4 that the plume would not actually reach that
5 portion of the wall.

6 Other changes, that permeable
7 treatment wall at the weapon storage air -- area
8 was eliminated. It was found later that
9 groundwater samples collect -- showed that
10 concentrations in the plume, in that southwest
11 portion of the plume had decreased to levels that
12 were less than the NYSDEC groundwater quality
13 standards, so the wall was no longer necessary.

14 And three S.V.E. systems were
15 added in 2009 and '10 as a result of that S.V.I.
16 study that I mentioned, conducted to address the
17 S.V.I. pathway. And I'll get to that study a
18 little later.

19 The I.C.s were updated and the
20 I.C. boundaries were
21 Also changed because of that S.V.I. study and also
22 because the current extent of the groundwater plume
23 had shrunk.

24 And the five-year review was
25 eliminated as a remedy component, but it will still

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2 be done as legally required by CERCLA. It didn't
3 need to be an actual part of the remedy. So the
4 remedy now includes the following components, the
5 groundwater collection trench between the runway
6 and flight line, the five groundwater extraction
7 wells, a groundwater treatment system, the
8 groundwater collection trench east of the ramp, and
9 an aeration system to treat the water from that
10 collection trench, a groundwater collection trench
11 along Idaho Avenue, the three S.V.E. systems that I
12 mentioned, groundwater and surface water discharge
13 monitoring plus updating institutional controls and
14 use restriction boundaries.

15 Now in January 2004, the runway
16 flight line collection trench was completed and
17 operation of the groundwater treatment system
18 began. January 2000 -- or in 2004, the groundwater
19 monitoring and discharge monitoring from the
20 trenches also began. January 2005, the east flight
21 line collection trench was completed. And in
22 February 2005, the Idaho Avenue collection trench
23 was completed. October 2006 annual monitoring of
24 the I.C.s began to verify compliance with them.
25 August 2010, that aeration system was completed.

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2 It consists of three underwater diffusion pipes or
3 systems that bubble air up through the aeration
4 pond. And in December 2009, the S.V.E. system was
5 installed at Building 2753. And in 2010, the other
6 two systems were installed, and I'll show you where
7 they are.

8 You can see this is the -- this
9 is the groundwater plume and this is the
10 groundwater operable unit boundary. And the three
11 buildings that we installed the systems in are New
12 Building C, 2766, and 2753. And as a result of the
13 S.V.I. study that I'll talk about, there was also a
14 use restriction that was added for Building 2312.
15 Actually, it's an occupancy restriction.

16 These are the various components.
17 You can see the five extraction wells just
18 downgradient of the FT-002 source, which is in
19 here, a gravity main which runs to the -- where is
20 it -- pump station which is right here. And from
21 that pump station, it runs into the water treatment
22 facility, which is right here. The runway flight
23 line collection trench was extended a bit from what
24 was in the 2003 record of decision. And we added a
25 discharge pipe, instead of using that quadrant --

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2 couldn't retrieve it.

3 The collection trench on the east
4 side of the flight line discharges to an aeration
5 pond, which you can't see but it's right here, and
6 then the collection trench along Idaho Avenue. It
7 originally extended down to about here and it was
8 shortened. Plus, of course, the S.V.E. systems
9 which I just -- which I showed you a little while
10 ago.

11 Institutional controls, included
12 in the 2002 proposed plan and the 2003 ROD, were
13 updated. They now include prohibiting the use of
14 groundwater, restricting discharge of groundwater,
15 prohibiting interference with the remedial
16 operations. And the first -- the first three here
17 were actually included in the 2003 ROD. There's a
18 prohibition of penetrating clay confining layer
19 which is underneath the unconfined sand aquifer,
20 almost all over the base. And that prevents
21 vertical percolation of contaminated groundwater
22 into the underlying till and groundwater -- or
23 bedrock aquifer.

24 There's a prohibition of
25 residential use and there are now soil vapor

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2 intrusion restrictions such that new construction
3 or changes in building use or modification requires
4 mitigation or assessment of risk to be coordinated
5 with NYSDEC and E.P.A.

6 The -- as I said, the -- there's
7 an occupancy restriction for Building 2612 and
8 there are revised use restriction boundaries for
9 groundwater and S.V.I.

10 And this slide here just shows
11 how much the -- the chlorinated plume has changed
12 since the R.I.F.S. This is the R.I.F.S. boundary,
13 which, like I said, was data from 1996 through
14 1999. And this is the boundary based on annual
15 base-wide groundwater monitoring in 2011. And you
16 can see how both plumes have -- have decreased.
17 And as I said, this is no longer there or it's at
18 least less than the standards.

19 And this slide shows the revised
20 groundwater and nonresidential use boundary. And
21 it was changed to this green line largely because
22 of the reduction in the size of the plume. As I
23 said, there was a -- a soil vapor intrusion study
24 because a concern was raised by New York State
25 Department of Health concerning migration of

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2 E.O.C.s from groundwater and soil beneath the
3 building slabs into the interior of the buildings.

4 So between November 2006 and
5 April 2007, a soil vapor intrusion study was
6 conducted at fourteen of the base's industrial area
7 buildings that were in close proximity to the fire
8 training area groundwater plume. I'll show you the
9 locations of those buildings in a moment. Sub-slab
10 soil gas samples were collected from all fourteen
11 of the buildings, and then depending on the
12 concentrations in the -- in the sub-slab, that
13 determined whether or not to also collect indoor
14 air samples to see if S.V.I. was an issue. And
15 that was done for six of the buildings -- or six of
16 the buildings actually were low enough that S.V.I.
17 was not a risk and indoor air samples were not
18 collected. But they were collected at the eight
19 other buildings.

20 And this slide just shows all of
21 the buildings that were part of that study. The
22 green is sub-slab soil gas only, and the sub-slab
23 plus indoor air were collected at the building
24 shown in red. And I won't go into the details of
25 that study because the supplemental proposed plan

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2 gives all of the results and summarizes them, so I
3 won't mention them here.

4 Follow-up sampling also occurred
5 at some of these buildings periodically through
6 March 2010. And as a result, the study concluded
7 that volatilization of contaminants from the
8 groundwater plume was not an issue except at four
9 buildings. Building 2612, like I said that's an
10 unheated well-ventilated warehouse in which an
11 occupancy restriction was placed. And then, of
12 course, three S.V.E. systems were installed at
13 2753, 2766, and New Building C. And a -- a soil
14 vapor intrusion restriction boundary was also
15 established. And that's shown in this slide. It's
16 almost the same as the groundwater restriction
17 boundary and it's a little -- it's a little
18 different up in here. And, again, the -- the
19 actual operable unit boundary remain the same.

20 Now as far as the -- the
21 schedule, the proposed plan public notice was
22 published on August 29th, which started the public
23 comment period. Of course, we're having the public
24 meeting tonight. And the end of the comment period
25 is September 27th. And public comments will be

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2 reviewed prior to their documentation of the
3 selected remedy in the record of decision. And
4 the -- the public comments will actually be
5 included in the -- in the record of decision as a
6 responsiveness summary. The Air Force will respond
7 to all of the public's comments.

8 The documents for this site are
9 also available at the Air Force Civil Engineer
10 Center Plattsburgh office or online at the website
11 that you see here. And, of course, when we get all
12 this done, we'll finalize the ROD for this site.

13 And I'll turn this back over to
14 Dave.

15 MR. FARNSWORTH: At this point,
16 I'd like to open up the meeting for comments or
17 questions. Since everything being said here
18 tonight is being taken down, please state your name
19 for the record before you make your comment.

20 I think with that, there does not
21 appear to be public comments at this point.

22 I can see I've got additional
23 script. I don't know if it applies at this point
24 since, you know, based on the sign -- based on the
25 sign-in and the attendance here, we don't -- don't

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2 have anyone from the public. But if someone should
3 decide to make additional comment and proposed
4 plan, they can be mailed to this address up here by
5 September 27th and we'll add that the -- and I will
6 add that the supplement to the proposed plan, as
7 Don stated just a minute ago, is available for
8 review at the Air Force Civil Engineer Center
9 office here in Plattsburgh or online at the Air
10 Force Civil Engineer Center's administrative record
11 website which we showed in the preceding slide.
12 And that concludes this meeting.

13 (The hearing concluded at 7:32
14 p.m.)

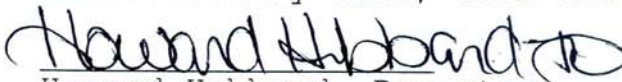
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2 STATE OF NEW YORK

3 I, Howard Hubbard, do hereby certify that the foregoing
4 was reported by me, in the cause, at the time and place,
5 as stated in the caption hereto, at Page 1 hereof; that
6 the foregoing typewritten transcription consisting of
7 pages 1 through 18, is a true record of all proceedings
8 had at the hearing.

9 IN WITNESS WHEREOF, I have hereunto
10 subscribed my name, this the 2nd day of October, 2013.

11 
12 Howard Hubbard, Reporter

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SIGN-IN SHEET

[illegible]

APPENDIX B
NYSDEC CONCURRENCE LETTER