United States Air Force Aeronautical Systems Center

AIR FORCE PLANT 4
FORT WORTH, TEXAS

INSTALLATION RESTORATION PROGRAM (IRP)

FIVE-YEAR REVIEW REPORT

Final

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FIVE-YEAR REVIEW REPORT

First Five-Year Review Report
for
Air Force Plant 4
Fort Worth, Tarrant County, Texas

October 2002

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Contract Number F41624-00-D-8031-D-0026

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List of Acronyms

AFCEE	Air Force Center for Environmental Excellence
AFP4	Air Force Plant 4
Air Force	United States Air Force
amsl	above mean sea level
ARAR	applicable or relevant and appropriate requirements
ASC	Aeronautical Systems Center
ATSDR	Agency for Toxic Substances and Disease Registry
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	contaminants of concern
COE	United States Army Corps of Engineers
COPC	chemicals of potential concern
DCA	dichloroethane
DCE	dichloroethene
DNAPL	dense non-aqueous phase liquid
EPA	United States Environmental Protection Agency
EPL	East Parking Lot
ERH	electrical resistive heating
ESE	Environmental Science and Engineering, Inc.
FDTA	Fire Department Training Area
FFA	Federal Facility Agreement
FS	Feasibility Study
FSA	fuel saturation area
ft	feet
FY	fiscal year
ILCR	incremental lifetime cancer risk
IRA	Interim Remedial Action

List of Acronyms

IRP	Installation Restoration Program
Jacobs	Jacobs Engineering Group Inc.
JRB	Joint Reserve Base
LM	Lockheed Martin
LF	landfill
LTM	long-term monitoring
MCL	maximum contaminant levels
mg/kg	milligrams per kilogram
MRC	Meandering Road Creek
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	not detected
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	operations and maintenance
OU	operable unit
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PHA	public health assessment
POTW	Publicly Owned Treatment Works
RA	Remedial Action
RAB	Restoration Advisory Board
RI	Remedial Investigation
RAO	remedial action objective
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SVE	soil vapor extraction
SVOC	semivolatile organic compounds
SWDA	Safe Drinking Water Act

List of Acronyms

TAC	Texas Administrative Code
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethene
TDH	Texas Department of Health
TNRCC	Texas Natural Resource Conservation Commission
TRC	Technical Review Committee
VOC	volatile organic compounds
µg/kg	micrograms per kilogram
µg/L	micrograms per liter

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EXECUTIVE SUMMARY

This document constitutes the first five-year review for Air Force Plant 4 (AFP4) located in Fort Worth, Tarrant County, Texas. The results of the five-year review indicate that the remedies, as described in the 1996 Record of Decision (ROD), are protective of human health and the environment. Overall, the remedial actions (RAs) appear to be functioning as designed, and no deficiencies were identified that impact the protectiveness of the remedies. The protectiveness of the RAs is being verified by the Long-Term Monitoring (LTM) program, which monitors sediment, surface water, and groundwater concentrations of chemicals of potential concern (COPCs).

Based on data reviewed, site familiarity, and interviews, the remedy is functioning as intended by the ROD. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Exposure assumptions used in the risk assessment have not changed. Toxicity factors have remained the same since the ROD, and there has been no change to the standardized risk assessment methodology that could affect protectiveness of the remedy. The review of documents, applicable or relevant and appropriate requirements (ARARs), and risk assumptions indicates that the remedies applied in the four areas of AFP4 are functioning as intended in the ROD or will meet the intent of the ROD when completed. Significant differences have been identified and have been addressed by implementation of the RAs.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Air Force Plant 4		
EPA ID *(from WasteLAN)*: TX7572024605		
Region: 6	**State:** TX	**City/County:** Fort Worth/Tarrant
SITE STATUS		
NPL status: ✓Final Deleted Other (specify)		
Remediation status (choose all that apply): Under Construction ✓Operating Complete		
Multiple OUs?* YES ✓NO	**Construction completion date:** 1998	
Has site been put into reuse? YES ✓NO		
REVIEW STATUS		
Lead agency: : EPA State Tribe ✓Other Federal Agency: United States Air Force		
Author name: United States Air Force and Jacobs Engineering		
Review period:** 11/30/01 to 5/31/02		
Date(s) of site inspection: 10/31/02		
Type of review: ✓Post-SARA Pre-SARA NPL-Removal only Non-NPL Remedial Action Site NPL State/Tribe-lead Regional Discretion		
Review number: : ✓1 (first) 2 (second) 3 (third) Other (specify)		
Triggering action: Actual RA On-site Construction at OU #___ ✓Actual RA Start at FSA-1 Construction Completion Previous Five-Year Review Report Other (specify)		
Triggering action date *(from WasteLAN)*: 1998		
Due date *(five years after triggering action date)*: 2003		

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

FIVE-YEAR REVIEW SUMMARY FORM (cont'd.)

Issues:

Trees used in the phytoremediation project along Bomber Road are being damaged/consumed by beavers.

One East Parking Lot (EPL) extraction well (TA-83) may have casing breach or collapse.

Real field data should be compared to the USGS groundwater model. The model needs to be updated if the Air Force wants to see what is going on in the subsurface. The model was the basis for the well field design.

Recommendations and Follow-up Actions:

Trees used in the phytoremediation project along Bomber Road need to be protected from beavers. Some type of cost effective protection for the trees should be added.

EPL extraction well TA-83 should be replaced, if necessary.

After one year of EPL operation, real operational data should be compared to the United States Geological Survey (USGS) groundwater model used to design the system.

Protectiveness Statement(s):

The remedy is expected to be protective of human health and the environment upon remediation of the soil, surface water, and groundwater. Human and ecological exposure pathways that could result in unacceptable risks are being managed by institutional controls to prevent exposure to contaminated sediment, soil, surface water, and groundwater. All threats at the site are being addressed by the various remedial projects, institutional controls, and voluntary actions.

Long-term protectiveness of the RAs will be verified by the Long-Term Monitoring program, which monitors sediment, surface water, and groundwater concentrations of COPCs.

Long-Term Protectiveness:

Long-term protectiveness of the RAs will be verified by the Long-Term Monitoring program, which monitors sediment, surface water, and groundwater concentrations of COPCs. Current monitoring data indicate that the remedy is functioning as required to achieve clean-up goals.

Other Comments:

None.

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I. INTRODUCTION

This report documents the five-year review conducted by the U.S. Air Force (Air Force) at the Air Force Plant 4 (AFP4) Site in Fort Worth, Texas. Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and Part 40 CFR §300.430(f)(4)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) require that periodic (at least once every five years) reviews be conducted for sites where hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use or unrestricted exposure following the completion of all RAs for the site. The purpose of this review is to determine if the implemented RAs at the site remain protective of human health and the environment.

Statutory five-year reviews are required no less often than every five years after the initiation of the RA.

The review is based on site-specific considerations, including the nature of the response action, the status of response activities, and the proximity to populated areas and sensitive environmental areas. A significant volume of information on the site has been collected over the period. The Air Force has considered available information in preparing this review including, but not limited to, the Record of Decision (ROD), the Remedial Investigation/Feasibility Study (RI/FS), the Long-Term Monitoring (LTM) Plan, Remedial Action Reports, LTM Reports, and other correspondence with the various parties involved with the response actions. While not referenced specifically, information contained in the ROD was excerpted from and used throughout this document. The reference list at the end of the text lists the principal documents used in preparing this report. Not all of these documents are referenced specifically in the text; however, they were considered in the formation of the five-year review.

This report was prepared by the Federal Operations Division of Jacobs Engineering Group Inc. (Jacobs) under Contract F41624-00-D-8031-D-0026 with the Air Force Center for Environmental Excellence (AFCEE).

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II. SITE CHRONOLOGY

Table 1 – Chronology of Significant Events

Event	Date
Potential contamination noted by private citizen	1982
French Drain No. 1 at Landfill No. 1 (LF-1) constructed	1982
Investigation of groundwater contamination conducted	1982
Technical Review Committee (TRC) established	1983
Phase I records search as part of the Installation Restoration Program (IRP) conducted	1984
Further investigation of groundwater contamination by Corps of Engineers (COE) along southern boundary and East Parking Lot	1985
IRP Phase II, Stage I, Confirmation/Quantification conducted	1985
Placed on U.S. Environmental Protection Agency (EPA) National Priorities List	1990
Federal Facility Agreement (FFA) signed	1990
Voluntary Interim Remedial Action (IRA) at Fuel Saturation Area (FSA) 1 and FSA-3 groundwater treatment system	1992
IRA began in Building 181 with operation of a soil vapor extraction system (SVE)	1993
IRA began in the East Parking Lot with the installation and operation of a groundwater extraction and treatment system	1993
Voluntary IRA at Landfills 4 (LF-4) and 5 (LF-5) Naval Air Station Joint Reserve Base (NAS JRB Ft. Worth)	1993
Voluntary IRA at AFP4 Landfill 3 (LF-3) began with installation of a vacuum enhanced extraction system	1993
RI/FS approved by EPA, Texas Water Commission, predecessor to the Texas Natural Resource Conservation Commission (TNRCC), and Texas Commission of Environmental Quality (TCEQ).	1995
The Proposed Plan issued	1995
The TRC is converted to the Restoration Advisory Board (RAB)	1995
ROD selecting the remedy is signed	1996
LTM Plan approved and program begins	1998
Site Investigations at LF-1 and LF-3 begin	1998
Remedial Design of Building 181 SVE System completed	1998
Dense Non-aqueous Phase Liquid (DNAPL) discovered in the Walnut Formation near LF-1 and LF-3	1998
Building 181 SVE System upgrade constructed and begins operation	1999
Remedial design of the East Parking Lot/Window Area Groundwater Pump and Treat System completed	1999

Event	Date
Construction begins on East Parking Lot/Window Area Groundwater Pump and Treat System	2000
Pilot Electrical Resistive Heating (ERH) system built at Building 181	2000
Fish advisory issued for Lake Worth	2000
DNAPL extraction completed at LF-1	2000
East Parking Lot/Window Area Groundwater Pump and Treat System completed and started	2001
Permeable Reactive Barrier (PRB) built	2002
Full scale ERH system built at Building 181	2002

III. BACKGROUND

PHYSICAL CHARACTERISTICS

AFP4 is located in Tarrant County, Texas, approximately 7 miles northwest of downtown Fort Worth. The facility occupies 760 acres adjacent to the northwest boundary of the city of Fort Worth (Figure 1). The plant is bounded on the north by Lake Worth, on the east by NAS JRB Ft. Worth (formerly known as Carswell Air Force Base), and on the south and west by the city of White Settlement. The facility shares active runways and taxiways with NAS JRB Ft. Worth.

The topography of the land surrounding AFP4 is generally flat, with the exception of areas adjacent to Meandering Road Creek and Lake Worth. Elevations at the site range from 590 feet (ft) above mean sea level (amsl) along the shore of Lake Worth to approximately 670 ft amsl at the southwest corner of the facility. Based on the results of a 1982 flood insurance study, neither a 100- nor 500-year flood event will directly affect AFP4 (Rust, July 1996).

LAND AND RESOURCE USE

AFP4 and the surrounding areas to the south and east are highly urbanized and, consequently, do not contain much natural vegetation or wildlife. Approximately 70 percent of the AFP4 surface area is covered by buildings, concrete or asphalt. The remaining 30 percent of the surface area (the west and north portions of the facility) is primarily grass-covered soil. The area west of AFP4 is mainly residential with an abundance of natural vegetation. Lake Worth (to the north) provides recreational boating, fishing, and water skiing. The lake also furnishes municipal water to the city of Fort Worth and is a recharge source to the underlying Paluxy aquifer, which supplies municipal water to the city of White Settlement (Rust, July 1996).

Residential housing is immediately adjacent to AFP4 to the south and west. Five schools are within a 2-mile radius of AFP4. The area is served by two major interstate highways, I-820 from the north and south, and I-30 from the east and west. The communities of White Settlement, Lake Worth Village, Westworth Village, River Oaks, and Sansom Park Village lie within a 3-mile radius of AFP4 (Rust, July 1996).

HISTORY OF CONTAMINATION

Waste oil, solvents, and fuels generated during operations at AFP4 were disposed of in on-site landfills or were used as fuel for fire training exercises. Chemical process wastes were initially discharged directly to the sanitary sewer for treatment by the Fort Worth Publicly Owned Treatment Works (POTW) until the 1970s, when wastes were sent to an on-site chemical waste treatment system prior to discharge to the sanitary sewer. Chemical process wastes are still treated on-site, and the use of fire training burn pits has been discontinued. Potential contamination at AFP4 was initially observed by a private citizen in September 1982 (Rust, July 1996).

INITIAL RESPONSE

Since the discovery of a potential release of contaminants in 1982, a series of focused site investigations and interim remedial actions (IRAs) have been completed. A site investigation was conducted in 1982 to investigate potential groundwater contamination at AFP4. In March 1984 an IRP Phase I Records Search was conducted. Several additional site investigations and RAs were performed including the RI/FS completed in 1995. IRAs conducted include the AFP4 LF-3 vacuum enhanced extraction system, French Drains 1 and 2 (located at LF-1), the Building 181 soil vapor extraction pilot system, the East Parking Lot groundwater treatment pilot system, FSA-1 and FSA-3 groundwater treatment systems, and NAS JRB Ft. Worth LF-4 and LF-5 groundwater treatment system.

The site was placed on the National Priorities List (NPL) in August 1990. The Air Force, U. S. Environmental Protection Agency (EPA), and the State of Texas entered into a Federal Facility Agreement (FFA) in November 1990 to address environmental impacts of operations and waste disposal practices at AFP4 (Rust, July 1996).

BASIS FOR TAKING ACTION

The following sites and media were identified as having contaminant concentrations that potentially pose an excess risk to human health or the environment or exceed the lower threshold of the acceptable risk range (Rust, July 1996):

- Soil associated with AFP4 LF-3 and AFP4 LF-4,
- Sediment along Meandering Road Creek and the inlet of Meandering Road Creek to Lake Worth,
- Soil under Building 181,
- Groundwater in the Terrace Alluvial Flow System, and
- Paluxy Aquifer and Upper Sand groundwater.

The chemicals of potential concern (COPC) concentrations shown in the Basis for Taking Action sections are taken directly out of the ROD and were collected in 1994-1995. In many cases different COPC concentrations have been observed at these sites.

AFP4 Landfill No. 3

AFP4 LF-3, located along the western boundary of AFP4 adjacent to Meandering Road Creek, is a grass-covered area approximately 3 acres in size (Figure 2). The landfill is presently enclosed by a chain link fence. Miscellaneous wastes, including mixed oils and solvents, were discarded at this site from 1942 to 1945; the landfill was inactive from 1945 to 1966. Dirt and rubble were used to fill and grade the landfill during 1966 and 1967.

The highest metal concentrations were detected in samples collected on the western edge of the landfill and east of Meandering Road Creek. The highest concentrations of the other constituents were detected in samples collected in historic drainage ditches that have been filled. According to the ROD (Rust, July 1996), the ranges of concentrations for key COPCs detected in samples from AFP4 LF-3 are:

- Trichloroethene (TCE) (not detected [ND]-19 milligrams per kilogram [mg/kg]),
- Cadmium (ND-96.2 mg/kg),
- Copper (ND-5,590 mg/kg;),
- Lead (2-10,400 mg/kg), and
- Zinc (3.8-17,400 mg/kg).

AFP4 Landfill No. 4

AFP4 LF-4, located near the southwest boundary of the AFP4 facility, occupies approximately 2 acres of land between Bomber Road (sometimes referred to as Meandering Road) and

Meandering Road Creek (Figure 2). AFP4 LF-4 is grass covered but is not capped with an engineered cap. This landfill was used for disposal of construction rubble from 1956 to the early 1980s. Other types of wastes may have been disposed there between 1966 and 1973. These wastes are thought to have included small quantities of solvents, oils, fuels, and thinners.

The highest concentrations of metals and semivolatile organic compounds (SVOCs) were detected in samples collected along the western shoulder of the landfill. According to the ROD (Rust, July 1996), the ranges of concentrations for key COPCs detected in all samples from AFP4 LF-4 were:

- TCE (ND-0.03 mg/kg),
- Benzo[*a*]pyrene (ND-13 mg/kg),
- Arsenic (2.4-170 mg/kg),
- Cadmium (ND-160 mg/kg),
- Copper (ND-3,200 mg/kg), and
- Zinc (4.6-12,200 mg/kg).

Meandering Road Creek

According to the ROD (Rust, July 1996), the ranges of concentrations for key COPCs detected in samples of Meandering Road Creek sediments were:

- Arsenic (3.1-6.1 mg/kg),
- Cadmium (ND-2.4 mg/kg),
- Copper (13.4-17.8 mg/kg),
- Lead (10-77.4 mg/kg),
- Silver (ND-6.9 mg/kg), and
- Zinc (17.8-87 mg/kg).

Lake Worth

Lake Worth sediment samples were collected offshore north of AFP4, in a cove at the northwest corner of AFP4, and in the inlet that connects to Meandering Road Creek (Figure 2). Several volatile organic compounds (VOCs) were detected in the sediment samples at concentrations less than 1.0 mg/kg. SVOCs were detected at concentrations between 1.3 and 7.9 mg/kg. Two polychlorinated biphenyl (PCB) compounds, Aroclor-1254 and Aroclor-1260, were detected in

two sediment samples at concentrations of 0.1 and 0.11 mg/kg, respectively. Only three Meandering Road Creek and Lake Worth samples had concentrations high enough to potentially cause excess risk. According to the ROD (Rust, July 1996), the ranges of concentrations for key metal COPCs detected in samples of Lake Worth sediments were:

- Arsenic (3.5-6 mg/kg),
- Cadmium (0.4-11.4 mg/kg),
- Copper (8.5-88.4 mg/kg),
- Lead (8-444 mg/kg),
- Silver (ND-13 mg/kg), and
- Zinc (21.9-303 mg/kg).

The USGS recently completed additional sampling of the surficial sediments in Lake Worth. The results are presented in Figure 3. Note that the units shown on the figure are in μg/kg.

Building 181

Building 181, the Chemical Process Facility, is part of the Assembly Building/Parts Plant, which is a mile-long building located in the approximate center of AFP4 (Figure 2). Spills of TCE reportedly occurred within the Chemical Process Facility. Trenches, sumps, floor drains, and buried pipelines are present throughout this manufacturing facility and are possible pathways for contamination migration under this building.

The key COPC at Building 181 is TCE, which was detected at concentrations ranging from ND to 0.22 mg/kg in soil samples collected from borings up to depths of approximately 59 ft near the perimeter of Building 181. Soils saturated with TCE were also found during the installation of a soil-vapor extraction system under Building 181. TCE in the soil under Building 181 is the main source of TCE contamination in the Basewide TCE Groundwater Plume (formerly referred to as the East Parking Lot Plume).

Terrace Alluvial Flow System

Three flow directions within the Terrace Alluvial flow system beneath the Assembly Building/Parts Plant have resulted in three separate organic constituent plumes (Figure 4). The plumes are:

- Basewide TCE Groundwater Plume,
- West Plume, and
- North Plume.

The largest plume of groundwater contamination is the Basewide TCE Groundwater Plume. This plume begins at the groundwater divide located south and west of the Assembly Building/Parts Plant and Building 12. The plume extends in an easterly and northeasterly direction toward the East Parking Lot and later spreads east and southeast in the direction of NAS JRB Ft. Worth (Figure 4). On NAS JRB Ft. Worth, the plume has merged with source areas located at NAS JRB Ft. Worth LF-4 and LF-5, Landfill No. 6 (LF-6) north of Farmers Branch Creek, and the North Apron.

The Basewide TCE Groundwater Plume appears to have several sources of contamination including degreaser tanks Chrome Pits Nos. 1, 2, and 3; Die Yard Chemical Pits; Fire Department Training Area (FDTA) No. 5 (FDTA-5); and the Wastewater Collection Basins. These potential sources are located along the groundwater divide in the south-central portion of AFP4.

The extent of the Basewide TCE Groundwater Plume is defined by elevated concentrations of TCE, cis- and trans-1,2-dichloroethene, vinyl chloride, 1,1,2-trichloroethane (TCA), 1,1-dichloroethane (DCA), 1,1-dichloroethene, methylene chloride, tetrachloroethene (PCE), benzene, toluene, xylene, acetone, chlorobenzene, and chloroform. However, by far the greatest occurrence of any single organic compound is TCE. TCE concentrations in excess of 100,000 micrograms per liter (μg/L) have been detected in groundwater samples from the Basewide TCE Groundwater Plume.

The second largest plume of groundwater contamination in the Terrace Alluvial flow system is the West Plume (Figure 4). The West Plume extends from near the Assembly Building/Parts

Plant westward toward Meandering Road Creek. Groundwater flow is toward the west. TCE concentrations in samples from the West Plume range from ND to 490,000 µg/L. Potential source areas for the West Plume include solvent contamination from FDTA-2, leachate contamination from AFP4 LF-1 and AFP4 LF-3, and leaking fuel-line contamination from an area between Building 14 and the Parts Plant. Because of the groundwater divide, Chrome Pit No. 3, the Die Yard Chemical Pit, and FDTA-5 are also considered potential source areas.

The North Plume underlies the north portion of the Assembly Building/Parts Plant (Figure 4). Groundwater flow in the North Plume is generally north toward Lake Worth, but the flow is restricted by higher elevations of bedrock. TCE concentrations in samples from this plume range from ND to 530 µg/L. In addition, JP-4 jet fuel has been identified on top of the groundwater in monitoring wells in the vicinity of the North Plume. The potential source of this contamination is leaking fuel supply lines and storage tanks surrounding the Jet Engine Test Stand. Contaminant concentrations in samples from Lake Worth have not exceeded Maximum Contaminant Levels (MCLs).

Paluxy Aquifer and Upper Sand Groundwater

TCE has been detected in samples of the Upper Sand groundwater beneath AFP4 in the vicinity of the Window Area (Figure 4). Vertical migration of TCE from the Terrace Alluvial flow system has likely occurred through the Window Area into the Upper Sand groundwater. TCE concentrations in samples of the Upper Sand groundwater range from ND to 11,000 µg/L.

TCE has been detected in Paluxy aquifer samples from an area near AFP4 LF-3 and near the East Parking Lot (Figure 4). TCE most likely reached the area under AFP4 LF-3 by vertical migration down a monitoring well that may not have been constructed according to design specifications. This well has been abandoned and sealed, thus preventing further TCE contamination. TCE concentrations in samples from the Paluxy aquifer near AFP4 LF-3 range from ND to 100 µg/L. As shown in Figure 4, the lateral extent of TCE in the Paluxy aquifer is relatively small. TCE concentrations in the Paluxy aquifer near the East Parking Lot currently are less than MCLs.

SITE RISKS

An evaluation of the potential risks to human health and the environment from site contaminants was conducted as part of the Baseline Risk Assessment (BRA), which was part of the RI. The objectives of the BRA were:

- Identify COPCs for human health and ecological risk,
- Provide a basis for determining residual chemical levels that are adequately protective of human health and the environment,
- Help determine if response actions are necessary at the site, and
- Provide a basis for comparing the various remedial alternatives and potential effects on human health.

Results of the BRA are presented in Table 2 below.

Table 2 - Summary of Baseline Risk Assessment Results

Site	Human Health Risk	Ecological Risk
AFP4 LF-3	Contaminants do not pose an excess risk to human health.	Concentrations of copper, lead, and zinc exceed ecological risk thresholds.
AFP4 LF-4	Concentrations of benzo[a]pyrene exceed human health-risk thresholds.	Concentrations of arsenic, cadmium and copper exceed ecological risk thresholds.
Meandering Road Creek/ Lake Worth Inlet	Contaminants do not pose an excess risk to human health.	Concentrations of silver and Aroclor-1254 exceed ecological risk thresholds.
Building 181	Contaminants do not pose an excess risk to human health, although the presence of TCE in the vadose zone causes groundwater contamination.	Contaminants do not pose an excess risk to the environment, although the presence of TCE in the vadose zone causes groundwater contamination.
Terrace Alluvial Flow System	TCE and DCE contamination is the source of contamination in the Paluxy aquifer. Suspected dense non-aqueous phase liquids (DNAPLs) at the Assembly Building and Window Area. Upper zone flow system is hydraulically connected to the Paluxy aquifer.	Contaminants do not pose an excess risk to the environment.

Site	Human Health Risk	Ecological Risk
Paluxy Aquifer/Upper Sand Groundwater	Presence of TCE and 1,2-DCE may cause excess human health risk in the future in the Basewide TCE Groundwater Plume and in the West Plume under AFP4 LF-3.	Contaminants do not pose an excess risk to the environment.

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IV. REMEDIAL ACTIONS

REMEDIATION OBJECTIVES

The ROD for AFP4 was signed by all parties in July and August 1996. No previous ROD or decision documents have been issued for AFP4. The entire plant site is considered as a single Operable Unit (OU) and has been divided into four different areas where potential excess risk or risk that exceeds the lower threshold level of 1.0×10^{-6} incremental lifetime cancer risk (ILCR). The areas requiring remedial action are:

- AFP4 LF-3, AFP4 LF-4, Meandering Road Creek, and Lake Worth,
- Paluxy Aquifer and Upper Sand Groundwater,
- Terrace Alluvium Flow System/Basewide TCE Groundwater Plume, and
- Building 181.

The remedial objectives for the AFP4 site were established in the ROD. As required by the NCP, the general goal and objective of the response action is to effectively mitigate and minimize damage to and provide adequate protection of public health and the environment. The specific goals and objectives of the response actions for the AFP4 site are as follows:

- AFP4 LF-3. Prevent ecological exposure to concentrations of copper, lead, and zinc in soil.
- AFP4 LF-4. Prevent human ingestion of soil with benzo[*a*]pyrene at concentrations that cause an excess ILCR. Prevent ecological exposure to arsenic, cadmium and copper at concentrations greater than ecological risk thresholds.
- Meandering Road Creek and Lake Worth. Prevent ecological exposure to concentrations of silver in Meandering Road Creek sediments and Aroclor-1254 in Lake Worth sediments.
- Building 181. Prevent TCE concentrations in the soil from causing unacceptable groundwater contamination in the Paluxy aquifer. A TCE soil contamination level of 11.5 mg/kg was established on the basis that it was a concentration of TCE in the soil that would not allow leachate from the soil to migrate to the Terrace Alluvial groundwater and thereby exceed the Terrace Alluvial groundwater cleanup levels.
- Terrace Alluvial Flow System/Basewide TCE Groundwater Plume. Prevent concentrations in the Window Area of the Basewide TCE Groundwater Plume from exceeding 400 µg/L.
    - Remove DNAPL from the groundwater in the area under Building 181 and under the southern portion of the Assembly Buildings/Parts Plant.

- Prevent groundwater in the Basewide TCE Groundwater Plume and Terrace Alluvial flow system with contamination above MCLs from migrating off AFP4 or NAS JRB Ft. Worth and prevent groundwater contamination from causing excess risk in surface water.

- Paluxy Aquifer and Upper Sand Groundwater
  - Prevent future human exposure by ingestion, inhalation during showering, and dermal exposure during showering to TCE concentrations exceeding 5.0 µg/L and to concentrations of 1,2-DCE isomers exceeding 70 µg/L for cis-1,2-DCE and 100 µg/L for trans-1,2-DCE.
  - Prevent contamination in the Upper Sand from causing TCE contaminant levels in the Paluxy Aquifer to exceed 5.0 µg/L. A TCE level of 400 µg/L in the Upper Sand groundwater was determined adequate to prevent contaminant levels in the Paluxy Aquifer from exceeding 5.0 µg/L.

REMEDY SELECTION AND IMPLEMENTATION

AFP4 LF-3, AFP4 LF-4, Meandering Road Creek, and Lake Worth Sediments

These sites were grouped together in the ROD because they have similar soil contamination issues. No Action is the selected remedy. The selected remedy does not take any action to mitigate risk but rather monitors contaminant levels to ensure that the risk remains within acceptable levels for both human health and the environment.

The selected remedy ensures that the remediation goals are met by monitoring the contaminant levels in the surface water and sediments of Meandering Road Creek and Lake Worth, and groundwater samples collected from monitoring wells in and around AFP4 LF-3 and AFP4 LF-1. Monitoring is conducted semiannually and samples are analyzed for VOCs, PCBs, and metals.

If monitoring indicates an increase in the concentrations of contaminants of concern (COCs), contingency measures will be implemented. Contingency measures may include capping of the landfills or removal or containment of the source material that is causing the increase in surface-water contamination.

In conjunction with monitoring of AFP4 LF-4, AFP4 LF-3, and Meandering Road Creek, two remediation systems were voluntarily installed and operated by the Air Force. These systems are the AFP4 LF-3 vacuum-enhanced extraction system and the FSA-1 groundwater treatment

system. The AFP4 LF-3 system was installed at AFP4 LF-3 to reduce contamination in the Terrace Alluvial groundwater that may discharge to seeps along Meandering Road Creek. The FSA-1 system is a Pump and Treat system that treats Terrace Alluvium groundwater collected by two French drains and Upper Paluxy groundwater from a single well. Operation of these systems is not required by the selected remedy for groundwater under AFP4 LF-3 (i.e., the West Plume of the Terrace Alluvial flow system), but the systems are operated to help prevent concentrations of COPCs from exceeding established levels in Meandering Road Creek surface water and sediments**.** A phytoremediation system was also installed along Bomber Road to assist in keeping contaminants from Meandering Road Creek. Additionally, the Air Force installed a fence around AFP4 LF-3 and across Meandering Road Creek as a physical barrier to prevent access to the creek.

These systems may continue to be operated or may be shut down in the future. The AFP4 LF-3 system is currently shut down for the evaluation of COPC concentrations in seeps along Meandering Road Creek. The AFP4 LF-3 system was shut down due to a remedial process optimization recommendation since the system was found to be inefficient, but Meandering Road Creek is still within surface water discharge criteria. TNRCC and EPA regulators agreed with the recommendation to shut down the AFP4 LF-3 system.

Paluxy Aquifer and Upper Sand Groundwater.

The selected remedy for the Paluxy Aquifer and Upper Sand Groundwater is enhanced Groundwater Extraction and Treatment With Near-Zero Off-Gas Emissions. The remedy includes:

- Extracting contaminated Paluxy aquifer groundwater from under AFP4 LF-3. This will be performed with one extraction well estimated to pump at 45 gallons per minute (gpm).

  Aquifer tests performed after the signing of the ROD indicated that the Paluxy and Upper Paluxy Aquifers were hydraulically connected. This recent understanding of the aquifer characteristics has raised concerns that pumping groundwater from the Middle Paluxy Aquifer may cause concentrations of VOCs to increase in that aquifer. As groundwater is pumped from the Middle Paluxy, drawdown occurs in the Upper Paluxy. The Upper Paluxy Aquifer has higher VOC concentrations than the Middle Paluxy Aquifer. As the

Middle Paluxy groundwater is extracted, Upper Paluxy groundwater may be drawn down, causing VOC concentrations in the Middle Paluxy to increase (ITC, October 1998). Due to concern that groundwater extraction from the Middle Paluxy Aquifer may cause downward migration of VOCs from the Upper Paluxy, Middle Paluxy wells PM001 and PM002 were turned of in November 1998. This change was carried out with regulatory concurrence.

- Extracting contaminated Paluxy Aquifer groundwater from beneath the Window Area of the East Parking Lot. At the time the ROD was signed, contamination in the Window Area of the East Parking Lot was below MCLs, but if MCLs were ever exceeded, then extraction of groundwater would be initiated.

  Concentrations of COCs have generally remained below MCLs with the exception of well P-8UN (Figure 2). Concentrations of TCE in that well exceeded MCLs from April 1998 to April 1999, and in October 2000 (Attachment 4). Two relatively large TCE concentration swings occurred in November 1998 and October 2000 of 156 µg/l and 170 µg/l, respectively. Concentrations of TCE at Well P-8UN have remained below the MCLs since May 2001. Concentrations of TCE are inconsistent at P-8UN and require close scrutiny.

- Extracting contaminated Upper Sand groundwater to minimize contamination moving vertically from groundwater in the Terrace Alluvial flow system to the Paluxy Aquifer. This will be performed with eight wells: five existing monitoring wells and three new wells. Pumping rates are expected to vary from 1 to 19 gpm.

  The East Parking Lot/Window Area Groundwater Pump and Treat System was completed and turned over to the operation and maintenance contractor in November 2001. Groundwater collected from the Upper Sand Unit is treated by this system. The system includes five Paluxy Upper Sand extraction wells installed during the construction of the system. Existing Upper Sand wells were not used in the system. Two of the Upper Sand extraction wells are known to be dry, but groundwater may enter these wells in the future. The remaining three wells produce very low flow rates on the order of 0.1 to 1

gpm. Because of these conditions, operational information should be used to optimize the pumping of groundwater from the Paluxy Upper Sand.

- Treating extracted groundwater with ultraviolet oxidation or another technology that would result in near zero off-gas emissions with discharge of the treated water to the POTW.

  The East Parking Lot/Window Area Groundwater Pump and Treat System uses air stripping with an off-gas treatment train of vapor phase carbon.

- Installing additional monitoring wells in the Paluxy Aquifer and the Upper Sand groundwater to monitor contaminant movement and concentrations. Monitoring will continue as long as contamination exceeds remediation goals in the Paluxy Aquifer and Terrace Alluvial flow system. At the time the ROD was signed, this time frame was estimated at 15 years.

  Several Paluxy and Upper Sand monitoring wells have been installed since the signing of the ROD. These wells are associated with remedial activities on the west side of the plant and with the East Parking Lot and the Window Area. Some of these wells have been added to the LTM program as appropriate.

- Sampling will be conducted semiannually during remediation and then annually after remediation is complete. Monitoring will be discontinued when contaminant levels have been shown to remain below remediation goals.

  The LTM program requires that samples be collected semi-annually. Treatment systems have been operating for a short time, and significant changes in COPC concentrations have not been observed. Semi-annual sampling according to the current LTM Plan is scheduled to continue.

- Sampling will be discontinued in the Paluxy Aquifer near AFP4 LF-3 if contamination levels remain below remediation goals.

- Sampling in the Paluxy Aquifer near the East Parking Lot will be discontinued if contamination levels remain below remediation goals after remediation of the Upper Sand groundwater is completed.

  Remediation of the Paluxy Upper Sand is not complete. Therefore, sampling will continue.

- Sampling of the Upper Sand groundwater will be discontinued if contamination remains below remediation goals after remediation of the Upper Sand groundwater in the Window Area of the East Parking Lot is completed.

Basewide TCE Groundwater Plume/Terrace Alluvial Flow System

The selected remedy for the Basewide TCE Groundwater Plume is enhanced DNAPL/ Groundwater Extraction and treatment with destruction of contaminants. The remedy includes:

- Removing DNAPL by enhanced dissolution into the groundwater and then extracting the groundwater.

  When the ROD was signed, the apparent best remedy for the removal of DNAPL from under Building 181 was surfactant-enhanced dissolution into groundwater combined with pumping and treating of groundwater. This approach was considered an innovative technique. Electrical resistive heating (ERH) has seen improvements in recent years, with concerns about the safety of the technique being alleviated. A pilot study was conducted in the Building 181 area to evaluate the effectiveness of ERH in the setting at AFP4. The results of the pilot study indicated that ERH would be an appropriate choice for removing DNAPL in the subsurface beneath Building 181 (URS, May 2001). The ERH process beneath Building 181 will be used in conjunction with SVE. The Building 181 SVE treatment system is currently being expanded to incorporate additional vents associated with the installation of the ERH system. This approach to removing the DNAPL beneath Building 181 will also enhance the removal of soil contamination intended to be remediated by the Building 181 SVE System.

An Explanation of Significant Difference (ESD) is in progress and will be made available to the public in the Administrative Record and notice will be published in the *Star-Telegram*.

- Treating the extracted groundwater by first passing it through an oil/water separator, then through an air stripper. Treated groundwater will be discharged to the POTW. Air discharged from the air stripper passes through a vapor-phase carbon adsorption unit before discharging to the atmosphere.

  The East Parking Lot/Window Area Groundwater Pump and Treat System and the Building 181 SVE System do not incorporate the use of oil/water separators. There was no design basis for the use of separators with the final design of these systems since the recovery of DNAPL is not the intent of the East Parking Lot (EPL) System, and DNAPL will be recovered as a vapor phase in the Building 181 SVE System.

- Use of a barrier to separate the Window Area from high TCE concentrations in the area of Building 181.

  A barrier has been installed in the EPL as part of the East Parking Lot/ Window Area Groundwater Pump and Treat System. The barrier is comprised of a line of interceptor wells installed in the EPL, across the main paleo-channel controlling dissolved TCE migration.

- Institutional controls to restrict future use of the Terrace Alluvium groundwater at AFP4 and NAS JRB Ft. Worth.

  AFP4 is currently operated by Lockheed Martin Aeronautics Company, and access to the plant is restricted. Future land use is not expected to change; however, if land use does change, deed restrictions may be required to limit the use of Terrace Alluvium groundwater and prevent exposure. Deed restrictions can only occur if all or a portion of the property is transferred. Without a transfer of property, other measures may be needed such as a Base Comprehensive Plan.

- Installation of additional monitoring wells. A number of additional monitoring wells have been installed by Jacobs, IT, HydroGeoLogic, and SAIC.

- Monitoring to track the areal extent and movement of contamination, the contaminant levels within and around the DNAPL remediation area, and the changes in contaminant concentrations within the plume. Monitoring also includes the North Plume, West Plume, Meandering Road Creek, Lake Worth, and Farmers Branch Creek.

- If migration of contamination in the groundwater appears to be moving off site at concentrations above MCLs, corrective actions will be taken to stop the plume. Corrective actions may include various containment measures such as interceptor wells, interceptor trench, combined wells and trench, a slurry wall, or operation of the pump and treat system at NAS JRB Ft. Worth LF-4 and LF-5.

  Historic groundwater monitoring results suggested that a plume of dissolved chlorinated hydrocarbons was very close to migrating off Air Force property. However, more recent monitoring results indicate the plume has retracted over 500ft and no longer appears to be a threat to offsite properties (HGL, October 2002). The pump and treat system at NAS JRB Ft. Worth LF-4 and LF-5 was previously operated as an interim measure to control the further migration down-gradient. Phytoremediation has also been used near the Carswell Golf Course as a means of plume containment.

  As a potential solution to the continued migration of the dissolved plume, a 1126-foot long, 2-foot wide, permeable reactive barrier (PRB) composed of 50% zero valent iron and 50% sand was installed at the property boundary between the NAS JRB Ft. Worth and the BRAC property during April and May 2002. The objective of the PRB is to remediate the TCE plume and help prevent migration onto the BRAC property slated for transfer. Quarterly sampling will provide more accurate information to predict the impact of the PRB on the TCE, cis-1,2-DCE and vinyl chloride plumes (HGL, September 2002).

Building 181

The selected remedy to prevent soil contamination from leaching to the Terrace Alluvium groundwater is soil vapor extraction.

The Building 181 SVE pilot system was installed by Environmental Science and Engineering, Inc. (ESE) and started operation in June 1996. Jacobs expanded and upgraded the system in 1998 and 1999 and operated the system until March of 2000. IT Corporation began operation of the expanded system on March 28, 2000. The extraction of soil contamination will be enhanced by the ERH. The remedy includes:

- Vapor recovery wells to extract volatilized TCE.

- Removal of contaminants from the extracted air prior to release to the atmosphere by catalytic oxidation.

- Vacuum enhanced recovery wells to remove groundwater within the vadose zone.

  The Building 181 Soil Vapor Extraction Treatment System includes a component of dual-phase recovery in three wells. These dual-phase enhanced recovery wells have run intermittently in the past and are generally dry or do not have a high enough water level for pumping. Additionally, condensate from the Terrace Alluvium is collected in the system. This water is also treated using an air stripper and off-gas treatment with vapor phase carbon.

- Treatment of the groundwater with air stripping and near-zero off-gas emissions. Contaminants in the off-gas are treated with vapor phase carbon. The treated groundwater is then discharged to the POTW.

  Water that is collected in the form of vapor or steam from the SVE will also be treated with the vapor phase carbon.

  The installation of the ERH System is expected to greatly enhance the extraction of TCE and other VOCs from the soil under Building 181.

SYSTEM OPERATION / OPERATION AND MAINTENANCE

AFP4 LF-3

Normal monthly system operation and maintenance (O&M) is performed by Shaw Environmental and Infrastructure, Inc. (Shaw) and the activities include:

- Checking system for leaks and making repairs;
- Recording well field and treatment system operational data;
- Measuring monthly AFP4 LF-3 recovery and monitoring well water levels;
- Collecting monthly, bimonthly, and semiannual system performance air and water samples;
- Collecting monthly TNRCC surface water discharge monitoring water samples;
- Taking weekly TNRCC surface water discharge requirement pH measurements at the Meandering Road Creek (MRC) outfall;
- Changing bag filters;
- Refilling the acid storage tank;
- Monitoring acid injection pump operation;
- Checking and adjusting system components, including the recovery wells, the knock-out tanks and associated header piping, the vacuum pumps, the air stripper, the acid injection system, and the liquid-phase and vapor-phase carbon polishing systems; and
- General site and AFP4 LF-3 ground maintenance.

Since start-up, the hours of operation for the AFP4 LF-3 system are as follows:

3/97-12/97	2900 hours
1/98-12/98	3812 hours
1/99-12/99	5560 hours
1/00-12/00	7474 hours
1/01-3/01*	1824 hours

*Latest Operation and Sampling Report from IT Corporation. No operational data past 3/01 because system was shut down.

Lower hours of operation during 1997 and 1998 were due to the need to limit discharge water flow to MRC in order to comply with the TNRCC surface water discharge flow restrictions at that time. In April 1998, TNRCC allowed for higher daily average discharge flow rates to MRC under the new combined AFP4 LF-3 and FSA-1 discharge agreement.

IT Corporation provided the following cost summary by reviewing their fiscal year (FY) 2000 (January 2000 through January 2001) costs for the O&M of the AFP4 LF-3 system. IT Corporation tracks project management, labor, and subcontractor costs on a site-wide basis rather than on a system-specific basis; therefore, exact costs are not available. However, IT Corporation did provide, based on their field experience at AFP4, approximate costs for work performed at the AFP4 LF-3 and FSA-1 locations.

Project Management (Includes project management, cost control and reporting, contract and government property administration, procurement, preparation of invoices and payment of subcontractors, record maintenance and control, and clerical support.)	$37,534
Field Office Costs (Includes trailer rental of two (2) trailers, computer and office equipment, truck rentals and fuel, tools and supplies, health and safety equipment, and electrical and telephone service.)	$27,300
Field Labor	$74,000
System Costs:	
Engineering support, labor & travel	$15,000
Capital Equipment	$14,000
Materials	$18,000
Carbon changeouts (subcontractor)	$30,928
Subcontractor, miscellaneous	$5,000
Electrical costs (including man-charge)	$60,000
Laboratory analytical costs	$16,164
Reporting Costs	$5,350
Total Annual O&M Cost (FY2000), AFP4 LF-3 System	**$303,276**

LF-4 and LF-5

The LF-4 and LF-5 systems were shut down in March 2002 prior to construction of the PRB.

Meandering Road Creek and Lake Worth

This system was monitoring only.

Building 181

The normal Building 181 operation and maintenance (O&M) is done by Shaw, and the activities include:

- Checking system for leaks and making repairs;
- Recording SVE well field and treatment system operational data;
- Measuring monthly recovery and monitoring well water levels;
- Collecting monthly, bimonthly, and semiannual system performance air and water samples;
- Collecting monthly city of Fort Worth POTW discharge monitoring water samples;
- Changing bag filters;
- Refilling the caustic storage tank; and
- Checking and adjusting system components, including SVE recovery wells and blowers, transfer pumps and associated header piping, CATOX unit and scrubber, the air stripper, the caustic injection system, and the liquid-phase carbon polishing unit.

Three total-flow readings are collected at the Building 181 plant each business day. The first total flow reading is potable water, which is used for the scrubber quench and acid gas neutralization columns. A significant portion of this water is lost to the atmosphere through evaporation. The second total-flow reading is for the amount of groundwater and condensate recovered by the SVE wells. The third total-flow reading is for the discharge to the POTW. The discharge includes the remaining potable water after scrubbing and treated groundwater/SVE condensate.

Costs to operate the Building 181 SVE system were estimated by Shaw based on known individual system costs and prorated management and other site costs. The total includes all labor, analytical, reporting, field costs, and some performance evaluation activities. An allowance of 15% was added for spare parts. The total annual cost was estimate at approximately $268,000 (Shaw, May 2002).

East Parking Lot

Jacobs completed system construction and system startup operations for the SVE Groundwater Treatment Plant for the East Parking Lot/Window Area in October of 2001. IT Corporation

(now Shaw) took over the operation and maintenance of this RA on November 1, 2001. Operating and monitoring data were not yet available for the writing of this report.

FSA-1

Normal FSA operation and maintenance (O&M) is done by Shaw, and the activities include:

- Checking the system for leaks and making repairs;
- Recording Paluxy well field, French drains, and treatment system operational data;
- Measuring monthly West Parking Lot area recovery and monitoring well water levels;
- Changing treatment system bag filters;
- Collecting MRC discharge water samples;
- Checking and adjusting system components, including French drain pumps, Upper Paluxy well PU001, treatment system components, and well pumps; and
- Checking product levels and emptying the Petrotrap bailer in Terrace well F-203.

IT Corporation provided the following cost summary by reviewing their FY2000 costs for the O&M of the FSA-1 system. IT Corporation tracks project management, labor, and subcontractor costs on a site-wide basis rather than on a system-specific basis; therefore, exact costs are not available. However, IT Corporation did provide, based on their field experience at AFP4, approximate costs for work performed at the AFP4 LF-3 and FSA-1 locations.

Project Management (Includes project management, cost control and reporting, contract and government property administration, procurement, preparation of invoices and payment of subcontractors, record maintenance and control, and clerical support.)	$37,534
Field Office Costs (Includes trailer rental of two (2) trailers, computer and office equipment, truck rentals and fuel, tools and supplies, health and safety equipment, and electrical and telephone service.)	$27,300
Field Labor	$35,592
System Costs:	
Engineering support, labor & travel	$5,000
Capital Equipment	$7,710
Materials	$5,246
Carbon changeouts (subcontractor estimate)	$20,000

Electrical (subcontractor)	$2,300
Laboratory analytical costs	$9,322
Electrical costs (estimate)	$6,100
Reporting Costs	$9,500
Total Annual O&M Cost (FY2000), FSA-1 System	**$165,604**

V. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for AFP4.

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VI. FIVE-YEAR REVIEW PROCESS

ADMINISTRATIVE COMPONENTS

Members of the RAB and regulatory agencies were notified of the initiation of the five-year review at a public meeting in August 2001. The AFP4 Five-Year Review Team was led by Mr. George Walters of the Aeronautical Systems Center (ASC), the Air Force's Remedial Project Manager for the AFP4 site. Mr. Walters was assisted by technical staff from Jacobs.

The review schedule extended from August 2001 through June 2002.

COMMUNITY INVOLVEMENT

The community was notified of the initiation of the five-year review at a public meeting in August 2001. No public concerns were identified at that meeting.

DOCUMENT REVIEW

This five-year review consisted of a review of numerous relevant documents including, but not limited to groundwater monitoring data (see Attachment 4), pilot scale testing reports, RA work plans and construction completion reports, meeting minutes, and memoranda. Applicable soil and groundwater cleanup levels as specified in the ROD (see Attachment 3) were reviewed as well as the BRA. A complete list of documents reviewed is shown in Attachment 2.

DATA REVIEW

Groundwater Monitoring

The LTM program objectives are to monitor for contaminants in groundwater, surface water, and sediments associated with contaminated sites in order to provide data necessary to recognize if additional RAs are needed to protect public health and the environment. LTM at AFP4 began with semi-annual sampling in April 1998. Previous to this, quarterly monitoring was completed since 1991.

The current LTM program includes sample collection from 13 Middle Paluxy wells, nine Upper Paluxy monitoring wells, seven Paluxy Upper Sand monitoring wells, 17 AFP4 Terrace Alluvium monitoring wells, and 11 NAS JRB Ft. Worth Terrace Alluvium monitoring wells. The monitoring wells are located at AFP4, NAS JRB Ft. Worth, Carswell Golf Course, and in the community of White Settlement. Attachment 4 contains charts illustrating general trends in groundwater quality at selected locations where TCE or its degradation products have been detected since Jacobs began sampling at AFP4 in October 1991.

As illustrated in Attachment 4, all Middle Paluxy monitoring wells have remained below remediation goals since October 1999. One Middle Paluxy well, USGS09PM located on the west side of the plant, had a concentration of 8.7 µg/L TCE in the April 1999 sampling round. Several Upper Paluxy monitoring wells have historically had concentrations of TCE and cis-1,2-DCE above remediation goals of 5 µg/L and 70 µg/L, respectively. Several Paluxy Upper Sand wells also have historically had concentrations of TCE above the remediation goal of 400 µg/L. However, a couple of the Paluxy Upper Sand wells have recently shown a strong downward trend. In particular, TCE concentrations in P-8US have been below 400 µg/L for five semi-annual sampling rounds after being above for many years.

Many of the Terrace Alluvium monitoring wells on the AFP4 property remain above remediation goals for TCE. The charts in Attachment 4 show that TCE concentrations and related compounds continue to remain within historic values. Several Terrace Alluvium wells located in the vicinity of the EPL (F-218, HM-88, and W-149) exhibit a slight downward trend of concentrations since April 2000. Terrace Alluvium wells located on the west side of the plant near AFP4 LF-3 (HM-36 and HM-50) do not indicate a distinct trend over the history of LTM sampling; the concentrations in these wells are highly variable from one sampling round to the other. One of the more pronounced upward trends is in Flightline monitoring well HM-95, which had an increase in TCE to 2,200J µg/L in October 2001 after reaching a new low of 260 µg/L in April 2000. Conversely, the most dramatic decrease was in well MW-5 inside Building 181 in the source area. This well has decreased from a concentration of 920,000 µg/L in May 2001 to 330,000J µg/L in October 2001.

TCE concentrations in the sample collected from NAS JRB Ft. Worth Terrace Alluvium monitoring well USGS06T have been increasing since April 2000. Concentrations in well WHGLTA009 continue to remain consistent with historical results. Well WHGLTA048 is the downgradient sentry well and has only been sampled twice. TCE concentrations in the first sample collected in May 2001 were found to be at 8.1 µg/L. The TCE concentration in the October 2001 sampling event decreased to 3.4J µg/L TCE.

Surface Water and Sediment Monitoring

The LTM includes surface water sample collection from Meandering Road Creek, Farmers Branch, West Fork of the Trinity River, and Lake Worth; and sediment sample collection from Meandering Road Creek and the inlet to Lake Worth. The charts in Attachment 4 illustrate the general trends in surface water quality at selected locations where TCE or its degradation products have been detected since Jacobs began sampling at AFP4 in October 1991.

Concentrations of TCE and related compounds have remained below remediation goals at all surface water sampling locations along Farmers Branch, Meandering Road Creek, Lake Worth, and the West Fork of the Trinity River.

Sediment samples are collected and analyzed for PCB Arochlor-1254 and silver at Lake Worth locations C-5 and LW-03, and at the Meandering Road Creek location SW-08. Arochlor-1254 was identified as a potential risk during the Remedial Investigation (Rust, September 1995). Arochlor-1254 has been detected six times above the remediation goal of 100 µg/kg: three times at sample location SW-08 (1350FJ, 351F, and 250J µg/kg), twice at sample location C-5 (5009FJ µg/kg), and once at sample location LW-03 (215 µg/kg).

SITE INSPECTION

Jacobs conducted the site inspection in conjunction with other AFP4 projects completed throughout the facility over the past year. During that time, all of the current treatment systems were observed, and no significant issues affecting the protectiveness of the remedy were noted. Additionally, EPA, TNRCC, and City of Fort Worth representatives regularly visit the site.

INTERVIEWS

Interviews were conducted with several parties familiar with AFP4 through an emailed questionnaire. The interviewees were chosen to reflect a cross-section of viewpoints from interested and informed individuals representing their organizations. The following people were interviewed:

- Ruben Moya, EPA;
- Luda Voskov, TNRCC;
- Richard Wice, Shaw Environmental and Infrastructure; and
- Fred Novak, Lockheed Martin.

Overall, there were no significant problems identified in the interviews. The general impression of the project was that it was progressing satisfactorily, but a few areas of concern were expressed. Richard Wice, of Shaw, said the AFP4 LF-3 system was a quick and costly reaction to the alleged need to protect Meandering Road Creek, and that using the old air stripper system was more expensive in the long run than utilizing new equipment. The AFP4 LF-3 system was shut down due to a remedial process optimization recommendation since the system was found to be inefficient, but Meandering Road Creek is still within surface water discharge criteria. TNRCC and EPA regulators agreed with the recommendation to shut down the AFP4 LF-3 system. According to the interviewees, the remedial systems are for the most part functioning adequately and as expected. O&M of the remedial systems are carried out by a two-person crew. Generally, the systems require a daily check and periodic maintenance, which includes activities like changing bag filters, changing carbon, checking water/DNAPL levels, and sampling surface water/seep.

The EPA representative meets with his Air Force counterpart to monitor the progress of the remedial activities and also is present at the regularly scheduled public meetings. The only complaint from the public reported by the EPA is in regards to the long duration of the remedial activities. No problems were identified which would require a change in the remedial design or the ROD. An ESD is in progress regarding the enhanced DNAPL removal. Both the EPA and Lockheed representatives said they feel well informed about site activities and progress. Lockheed expressed a concern that the USAF, through its contractor, has been found by the city

of Fort Worth to be in violation of IRP unit monitoring requirements resulting in an Notice of Violation (NOV) being issued to Lockheed Martin because the SVE system is carried under the state agency's Lockheed Martin air account number. Lockheed is not the owner or operator of the SVE system and thus feels that the NOV should be issued to the USAF and that the USAF should obtain their own state air account number. The USAF is working to resolve the issue and is in the process of attempting to obtain its own state air account number and have the NOV transferred to that account.

Richard Wice commented that the EPL system electrical and control system has had problems. It appears in preliminary assessment that the electrical grounding as installed does not protect the well field I/O modules and some of the system control boards. After electrical storms modules and boards fail. Shaw is currently consulting with subcontractors about the surge protection, grounding, and the cause of the I/O module failures. Significant moisture corrosion is also observed in some of the recovery well vaults. One of the wells (TA-83) may have a casing breach or collapse and may need replacement.

Mr. Wice also recommends that after 1 year (assuming all the wells are up and somewhat stable operations are achieved) the real field data should be compared to the USGS groundwater model. The model needs to be updated if the Air Force wants to see what is going on in the subsurface. The model was the basis for the well field design.

Fred Novak commented that an effort needs to be made to protect the trees used in the phyto-remediation project from beavers along Bomber Road. He suggested that a heavy wire cage around the trees would prevent the beavers from chewing them down.

COMMUNITY RELATIONS

In February 2001, Air Force representatives interviewed members of the public and local authorities regarding the remediation activities at AFP4 as part of the preparation of an updated Community Relations Plan (ASC, February 2002). The following general comments from the interviewees were summarized by Don Yates of ASC Public Affairs (ASC, March 2002):

As with most Air Force plants, the community is largely unaware of the actual plant ownership. Locally, the facility is referred to as Lockheed or General Dynamics. Additionally, most of those interviewed seemed unconcerned with the distinction between NAS JRB Ft. Worth and AFP4. Both entities have been there for so long that this distinction is blurred. Simply put, this isn't an issue and isn't really thought about. During the interviews, we were careful to explain the Air Force's involvement in AFP4 as well as the distinction between NAS JRB Ft. Worth and AFP4. These discussions also covered the current involvement by the various entities in the clean-up process.

Overall, the local communities are comfortable with the environmental clean-up of NAS JRB Ft. Worth and AFP4. While there are concerned individuals within the communities, generally there are no serious concerns. This held true even among those with limited or no knowledge of clean-up activities. Historically, there had been a higher level of concern, but with establishment of the RAB and other informational activities as well as the ongoing clean-up effort, these concerns have eased considerably. Most people now think the Air Force is doing a good job with the clean-up. The issues and concerns mentioned most frequently during the interviews were the fish consumption advisory, Lake Worth contamination and silting, aircraft noise complaints, and the hospital/prison issue. This last issue stems from the late ‘80s when then Secretary of Defense Cheney closed the military hospital and converted it to a prison for women.

White Settlement, Lake Worth, River Oaks, Westworth Village, Sansom Park and Lakeside are primarily residential communities with close ties to both the base and the businesses located there. None of the communities are experiencing any large degree of economic growth or influx of people, though that is expected to change over the next few years. Interest in environmental issues, while present, does not seem to be a strong consideration for most people. Most of those interviewed expressed environmental concern when there was a potential of direct effect. City officials’ concerns centered on the aquifer, as the cities pump their own drinking water and many residents have private wells on Lake Worth.

Reduced attendance at RAB meeting seems to reflect the comfort level expressed during the interviews. The issue of clean-up at NAS JRB Ft. Worth/AFP4 is no longer the "hot" issue it

once was. People perceive the clean-up is going well and is successful and are content to let the work progress. All that was asked is for the Air Force to keep them informed.

From a communications standpoint, the responses indicate that most people feel the Air Force is doing a good job in getting information out. The existence of the RAB takes credit for much of this, as does Anita Baker for her interest in following the clean-up and reporting for the *Star-Telegram*. While the respondents were satisfied with the information they were receiving, almost all asked to be kept informed. Additionally, there were suggestions on ways that the Air Force could provide more information to the communities.

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VII. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision document?

The review of documents, applicable or relevant and appropriate requirements (ARARs), and risk assumptions indicates that the remedies applied in the four areas of AFP4 are functioning as intended in the ROD or will meet the intent of the ROD when completed. Significant differences have been identified and have been addressed by implementation of the RAs.

AFP4 LF-3, AFP4 LF-4, AND MEANDERING ROAD CREEK

The RA at the AFP4 LF-3 site is a voluntary action to minimize the contamination, and reporting on the protectiveness of this action is not required. As noted in the ROD (Rust, July 1996) the AFP4 LF-3 system was installed by the Air Force as a voluntary action to "minimize contamination in the Terrace Alluvial groundwater that may discharge to Meandering Road Creek." The ROD also states that corrective measures will be necessary if "monitoring indicates the concentration of contaminants in Meandering Road Creek are increasing to levels that may cause excess risk or MCLs are being exceeded in Lake Worth." A TCE concentration of approximately 5,000 µg/L is the level that may cause excess risk in Meandering Road Creek surface water, based on ecological risk. The primary MCLs of concern for Lake Worth are TCE with an MCL of 5 µg/L, cis-1,2-DCE with an MCL of 70 µg/L, trans-1,2-DCE with an MCL of 100 µg/L, and vinyl chloride with an MCL of 2 µg/L.

In addressing the Terrace Alluvial groundwater contamination, the primary focus of the system was to prevent groundwater seeps along the cliff face located adjacent to the southern portion of the AFP4 LF-3 system and Meandering Road Creek. However, IT Corporation identified seeps along the cliff face in February 2001. Although undocumented, the seeps were likely active during the entire operational period of the AFP4 LF-3 system. A water sample from the seeps was collected by IT Corporation and analyzed for VOCs. TCE was detected in the sample at an estimated concentration of 2.6J µg/L, and cis-1,2-DCE was detected in the sample at an estimated concentration of 0.92J µg/L. TCE was detected in subsequent seep samples (collected during the RPO fieldwork) at a maximum concentration of 82 µg/L. As a result, the remediation

goals of the system have been reevaluated in Section 6 of the Final Remedial Process Optimization Report (Earth Tech, December 2001), which defines the remediation goals for each of the remediation options identified and evaluated during the RPO.

The RA at the LF-4 and LF-5 sites is a voluntary action to minimize the contamination, and reporting on the protectiveness of this action is not required. The LF-4/5 system was constructed by IT in 1993 as an interim remedial measure. IT operated the system from 1993 until the summer of 1996, when it was turned off at the direction of the Tulsa District (on behalf of the Aeronautical Systems Center (ASC)). The AFP4 ROD concluded that the east end of the plume was a "no further action" item unless contamination migrated off Air Force property. Carswell Base Realignment and Closure (BRAC) took over and ran the system from 1996 until December 1999 with HydroGeoLogic Inc. operating this system. IT resumed operation in December 1999 under BRAC. On January 22, 2001, the LF-4/5 system operation by IT for ASC was conducted under contract to AFCEE. The LF-4 and LF-5 systems were shut down in March 2002 prior to construction of the PRB.

PALUXY AQUIFER AND UPPER SAND GROUNDWATER

The East Parking Lot/Window Area Groundwater Pump and Treat System was completed and turned over to the O&M contractor in November 2001. Groundwater collected from the Upper Sand Unit is treated by this system. The system includes five Paluxy Upper Sand extraction wells installed during the construction of the system. Existing Upper Sand wells were not used in the system. Two of the Upper Sand extraction wells are known to be dry, but groundwater may enter these wells in the future. The remaining three wells produce very low flow rates on the order of 0.1 to 1 gpm.

EAST PARKING LOT AND WINDOW AREA

Jacobs Engineering Group completed the construction of the groundwater treatment plant for the East Parking Lot and Window Area in October of 2001. IT Corporation (now Shaw) took over the operation of this RA on November 1, 2001. As of the writing of this report, data from Shaw for the period November 2001 to June 2002 had not been interpreted.

BUILDING 181

The Building 181 SVE System was installed by ESE and started operation in June 1996. Jacobs expanded and upgraded the system in 1998 and 1999, and operated it until March of 2000. IT began operation of the expanded system on March 28, 2000. The extraction of soil contamination will be enhanced by the ERH. The remedy includes:

- Vapor recovery wells to extract volatilized TCE;
- Removal of contaminants from the extracted air prior to release to the atmosphere by catalytic oxidation; and
- Vacuum enhanced recovery wells to remove groundwater within the vadose zone. These dual-phase enhanced recovery wells are currently part of the Building 181 System. These wells have run intermittently in the past, and are generally dry or do not have a high enough water level for pumping.
- Treatment of the groundwater with air stripping and near-zero off-gas emissions. Contaminants in the off-gas are treated with vapor phase carbon. The treated groundwater is then discharged to the POTW.

Water, which is collected in the form of vapor or steam from the SVE, will also be treated with the vapor phase carbon.

The installation of the ERH system is expected to greatly enhance the extraction of TCE and other VOCs from the soil under Building 181. An ESD will be made available to the public in the Administrative Record and notice will be published in the *Star-Telegram*.

Question B: Are the exposure assumptions , toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Exposure assumptions used in the risk assessment have not changed.

CHANGES IN STANDARDS TO BE CONSIDERED

The methods used in completion of the baseline risk assessment (BRA) for AFP4 have not significantly changed since 1995. Hence the approach for completion of the human health and ecological BRAs is generally consistent with current EPA guidance.

The only risk-based standards that have been updated and are currently in use address ecological receptors. These ecological benchmark values are published by the Oak Ridge National Laboratories and were not published in 1995 when the RI risk assessment was performed. These ecological benchmark values are not site-specific and are used in support of screening-level risk assessments. Because an ecological BRA was completed, the development of these values has no bearing on the outcome of the BRA.

As remedial work is ongoing, all ARARs (with revisions) and To-Be-Considereds (TBCs) cited in the ROD still apply. ARARs and TBCs that still must be met at this time and that have been evaluated include:

- Texas Drinking Water Standards (TAC, Title 30, Part IX, Chapter 290), effective date 16 May 2002.
- Safe Drinking Water Act, National Primary and Secondary Drinking Water Standards (40 CFR 141, 143)
- Texas Surface Water Quality Standards (TAC, Title 30, Part II, Chapter 307), effective date 17 August 2000.
- National Pollutant Discharge Elimination System (40 CFR Part 403), General Pretreatment Regulations for Existing and New Sources of Pollution.
- Control of Pollution from Volatile Organic Compounds (TAC, Title 30, Chapter 115), effective date 16 May 2002.
- Contaminated Water and Soil Remediation Equipment, previously Standard Exemption 68 (TAC, Title 30, Chapter 106.533), effective date 4 September 2000.
- Remedial Action Objectives (final ROD, AFP4, TX), effective date July 1996.

There have been several revisions/amendments to the ARARs cited in the ROD since the signing of the original document in July 1996, as noted by the effective dates above. None of the amendments or revisions to the standards or ARARs cited in the ROD constitutes significant

changes or impacts the protectiveness of the selected remedies. Additionally, there have been no changes in TBCs affecting the protectiveness of the selected remedies.

A list of ARARs and TBCs applicable to the selected remedies is included in Attachment 3.

CHANGES IN EXPOSURE PATHWAYS, TOXICITY, AND OTHER CONTAMINANT CHARACTERISTICS

A public health assessment (PHA) was completed by the Texas Department of Health under cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) in 1998. The PHA agreed with the conclusions and recommendations of the RI risk assessment with the exception for the need to complete fish tissue sampling from Lake Worth and the confluence of Meandering Creek Road. This pathway was deemed complete based on Lake Worth sediment concentrations and determined to exist in Lake Worth. The objective of the fish tissue sampling was to determine if site contaminants are accumulating in fish species that people eat.

Fish tissue sampling was performed in 1999 and a report submitted in 2000. A total of 55 fish samples were collected from Lake Worth representing six species. Tissue samples were submitted for trace metals and organic analysis. Based on the average levels of PCBs found in fish from Lake Worth, it was concluded that chronic ingestion of fish poses a public health hazard. This conclusion was based on the potential for immunologic effects associated with chronic exposure to PCBs. However, there is a low increased lifetime risk from cancer associated with long-term ingestion of PCB-contaminated fish from Lake Worth. Based on the fish tissue studies, the Texas Department of Health (TDH) issued a fish consumption advisory for Lake Worth effective April of 2000. That advisory is still in effect.

A BRA was completed in 2001 addressing potential risk pertaining to property being transferred under the BRAC program (HGL, November 2001). The risk assessment was conducted evaluating human health and ecological receptors. This risk assessment follows TNRCC risk assessment guidance that is consistent with EPA protocols. The exposure assumptions, toxicity assessments and risk characterization have been completed in a manner consistent with earlier risk assessments. The final BRA concluded that potential future residential cancer risk

associated with groundwater usage was in excess of 1×10^{-4} for TCE, vinyl chloride and 1,1-Dichloroethylene. However, recent evidence indicates that the model used to estimate soil vapor migration into homes underestimates the potential movement of VOCs from groundwater and soil into a basement.

Because the model potentially underestimates contaminant migration and subsequently the potential for risk, an addendum to the final 2001 risk assessment was completed (HGL, May 2002). To address this uncertainty, soil gas samples were collected that subsequently validated the earlier findings. An addendum to the BRA was then completed to reflect this new information. The addendum was completed using standard risk assessment protocols. Risks were calculated both including and excluding the foundation barrier effect. The geometric mean of the risk calculated by taking into account the foundation barrier effect is 5.1×10^{-8}. If the foundation barrier effect is not included in the risk calculation, the geometric mean is 2.7×10^{-6}.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Based on a review of the site risks and selected remedies for the site, it has been determined that the remedies selected in the ROD continue to be protective of human health and the environment.

TECHNICAL ASSESSMENT SUMMARY

Based on data reviewed, site familiarity, and interviews, the remedy is functioning as intended by the ROD. The physical conditions of the site have not changed, and the remedy remains protective. All ARARs cited in the ROD for soil, sediments, surface water, and groundwater are being met. Toxicity factors have remained the same since the ROD, and there has been no change to the standardized risk assessment methodology that could affect protectiveness of the remedy.

VIII. ISSUES

Table 3 - Issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Trees used in the phytoremediation project along Bomber Road are being damaged/consumed by beavers.	N	N
One East Parking Lot (EPL) extraction well (TA-83) may have casing breach or collapse.	N	N
Real field data should be compared to the USGS groundwater model. The model was the basis for the well field design.	N	N

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IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 4 - Recommendations and Follow-Up Actions

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Trees used in the phytoremediation project along Bomber Road need to be protected from beavers.	Install protection for trees.	USAF	USAF		N	N
One EPL extraction well may have casing breach or collapse.	If necessary, replace EPL extraction well TA-83.	USAF	USAF		N	N
Comparison of real EPL data to USGS model.	After one year of EPL operation, compare real data to USGS groundwater model.	USAF	USAF		N	N

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X. PROTECTIVENESS STATEMENT

The remedy is expected to be protective of human health and the environment upon remediation of the soil, surface water, and groundwater. Exposure pathways that could result in unacceptable risks are being managed by institutional controls to prevent exposure to contaminated groundwater. All threats at the site are being addressed by the various remedial projects, institutional controls, and voluntary actions.

Long-term protectiveness of the RAs will be verified by the Long-Term Monitoring program, which monitors sediment, surface water, and groundwater concentrations of COPCs.

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XI. NEXT REVIEW

The next five-year ROD review for AFP4 is required by June 2007, five years from the date of this review.

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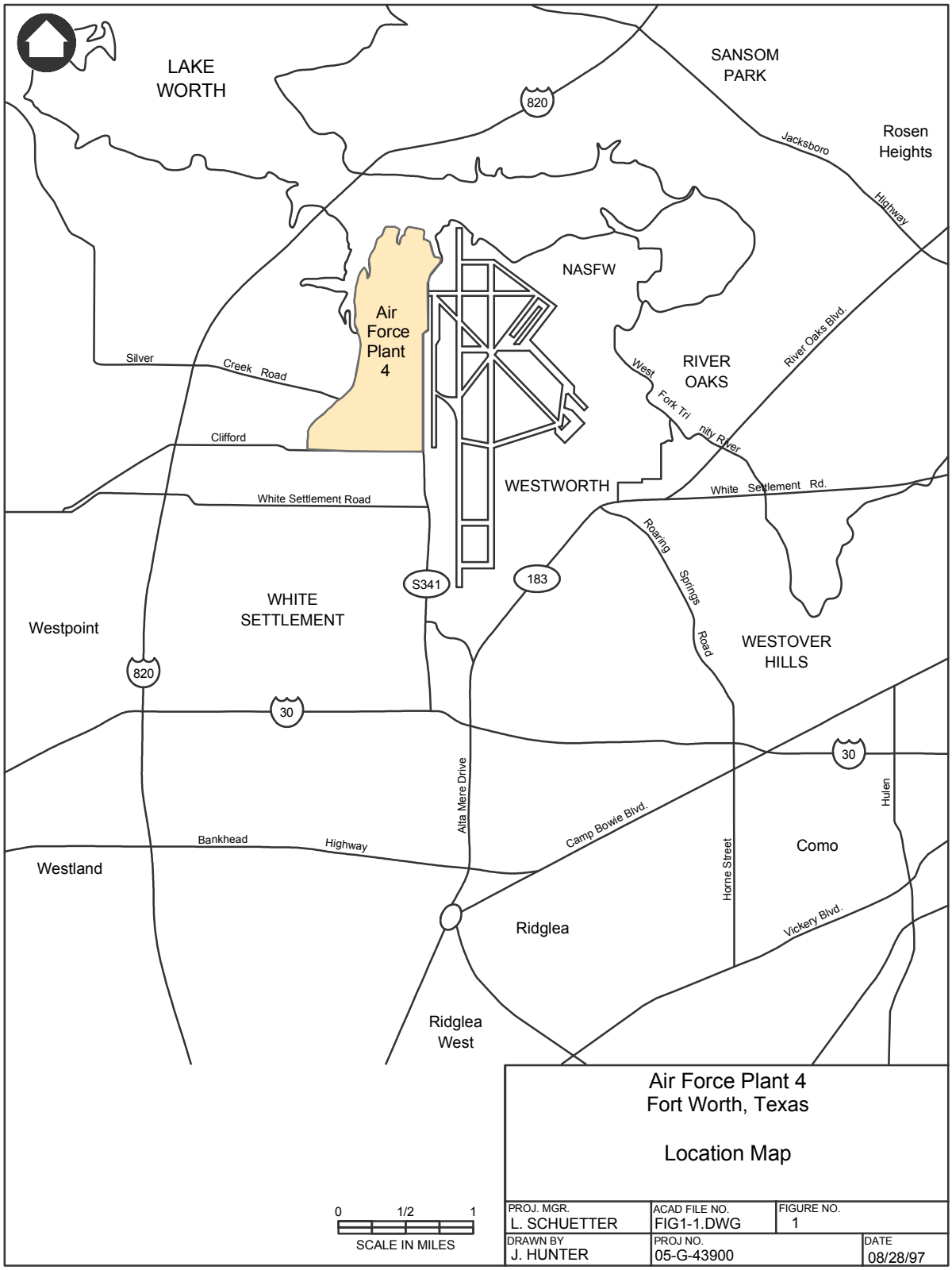
ATTACHMENT 1

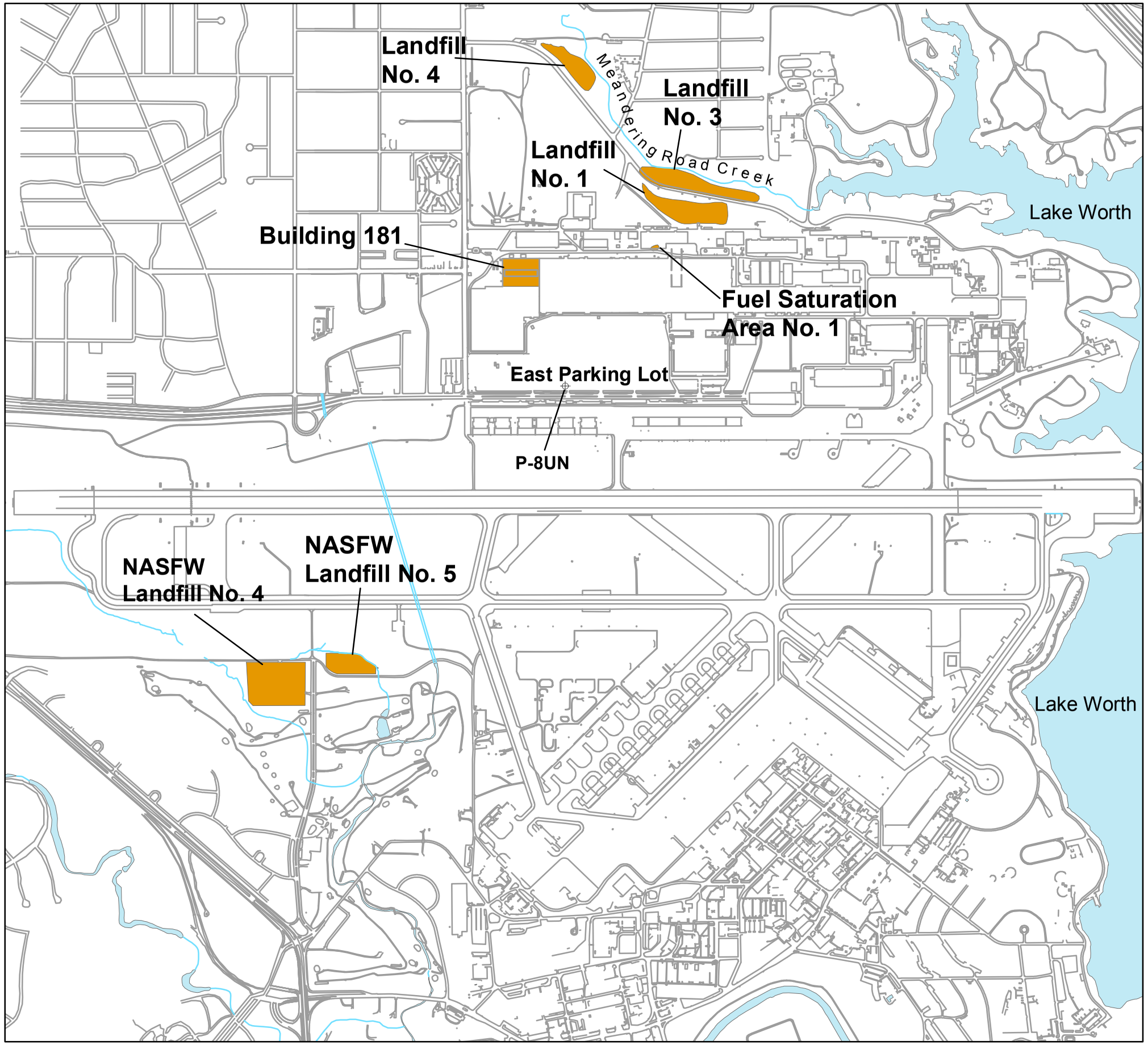
FIGURES



Air Force Plant 4
Fort Worth, Texas

Location Map

PROJ. MGR.	ACAD FILE NO.	FIGURE NO.
L. SCHUETTER	FIG1-1.DWG	1
DRAWN BY	PROJ NO.	DATE
J. HUNTER	05-G-43900	08/28/97



Area of Interest

N

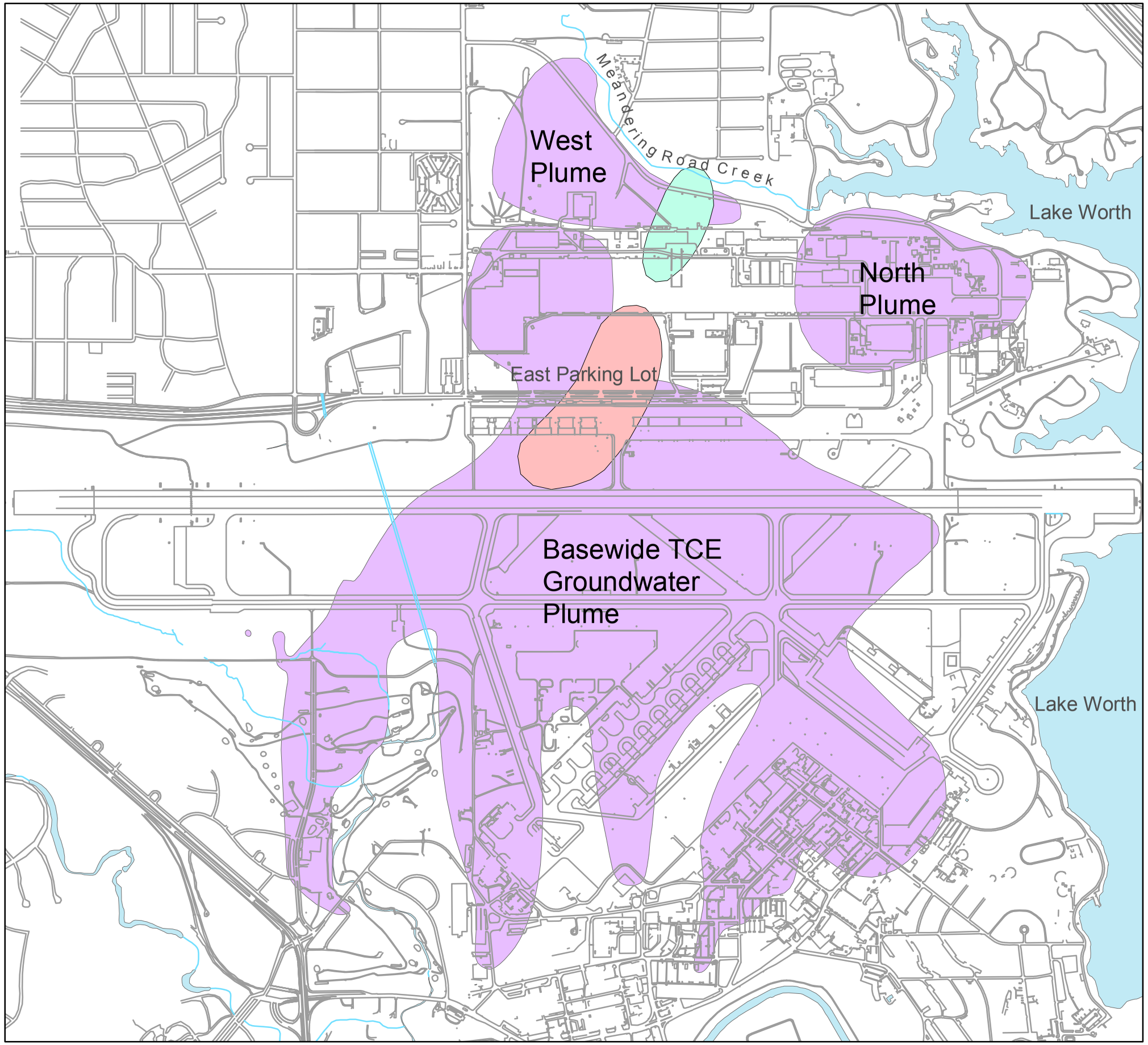
0 1,000 2,000 3,000 4,000
Feet

Figure 2

Areas of Interest

Figure 3
Total PCB Concentrations (µg/kg) in the Surficial Sediments of Lake Worth

Notes:
Minimum detection for individual PCB Aroclors was 5 – 30 µg/kg.
ND = not detected



TCE Plumes *

Paluxy Upper Sand Plume

Paluxy Plume

* Basewide TCE Groundwater Plume from HydroGeoLogic, Inc. 05/17/2002

N

0 1,000 2,000 3,000 4,000

Feet

Figure 4

Plume Map

ATTACHMENT 2

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www.tnrcc.state.tx.us/

www.epa.gov/safewater/mcl.html

ATTACHMENT 3

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Medium	ARAR	Citation	Status	Requirement Synopsis	Action to be Taken to Attain ARAR
Groundwater	Texas Drinking Water Standards	TAC, Title 30, Part IX, Chapter 290 (amended 2002)	Applicable	State regulation establishing Texas drinking water standards. These standards are written to comply with the requirements of the Safe Drinking Water Act and Federal Primary Drinking Water Regulations. The purpose of these standards is to ensure the safety of public water supplies.	Requirements for contaminant levels in the water supply of White Settlement (Paluxy Aquifer). Dissolved TCE contamination migrating to the Paluxy Upper Sand and then to the Paluxy Aquifer must be controlled to comply with this ARAR.
	Remedial Action Objectives.	Final ROD, AFP 4, Section 10.1	To Be Considered	Site-specific groundwater remediation goal(s) developed for the Paluxy Upper Sand, Terrace Alluvium – EPL Plume, and Terrace Alluvium – Window Area groundwater.	The selected remedies will attain RAOs for TCE in select groundwater zones after completion of remedial activities.
Soil	Remedial Action Objectives.	Final ROD, AFP 4, Section 10.1	To Be Considered	Site-specific TCE cleanup level developed for soil under Building 181 that represents the contaminant level protective of the underlying Terrace Alluvium and Paluxy groundwater.	The selected remedies will attain RAOs for TCE in the vadose zone soil under Building 181 after completion of remedial activities.
Sediment	Remedial Action Objectives.	Final ROD, AFP 4, Section 7.1	To Be Considered	Site-specific remediation goal(s) developed for sediment that represent contaminant levels preventative of excess ecological risk.	The selected remedy will attain RAOs for silver and PCB 1254 in the sediments of Meandering Road Creek. Exceedence of RAOs will be the target for determining if corrective action is needed.
Surface Water	National Pollutant Discharge Elimination System (NPDES)	40 CFR Part 403	Applicable	The NPDES was designed to regulate and reduce pollution discharges to navigable waters of the United States. Part 403 addresses pretreatment standards to control pollutants that pass through or interfere with treatment processes in POTW.	Remediation technologies that involve discharge to POTW must comply with these federal regulations during operation. The selected remedies will attain discharge requirements as set forth in the site-specific POTW Discharge Agreement.

Medium	ARAR	Citation	Status	Requirement Synopsis	Action to be Taken to Attain ARAR
	Texas Surface Water Quality Standards	TAC, Title 30, Part II, Chapter 307 (effective 2000)	Applicable	State regulation establishing quality standards for surface water. The goal of this chapter is to maintain the quality of surface water in the state consistent with public health and enjoyment, protection of the environment, and operation of existing industries and economic development.	Remediation technologies that involve discharge to surface water must comply with these state regulations during operation.
	Texas Drinking Water Standards	TAC, Title 30, Part IX, Chapter 290 (effective 2002)	Relevant and Appropriate	State regulation establishing Texas drinking water standards. These standards are written to comply with the requirements of the Safe Drinking Water Act and Federal Primary Drinking Water Regulations. The purpose of these standards is to ensure the safety of public water supplies.	The selected remedies will attain state MCLs in the water supply of Lake Worth and the West Fork of the Trinity River after completion of remedial activities. Exceedence of MCLs will be the target for determining if corrective action is needed.
	Safe Drinking Water Act (SDWA)	40 CFR 141, 143	Relevant and Appropriate	Federal regulations establishing national primary and secondary drinking water standards. The SDWA establishes MCLs and secondary MCLs for organics, inorganics, radioactivity, and turbidity.	The selected remedies will attain federal standards in the water supply of Lake Worth and the West Fork of the Trinity River after completion of remedial activities. Exceedence of standards will be the target for determining if corrective action is needed.
	Remedial Action Objectives	Final ROD, AFP 4, Section 7.4 and 9.1	To Be Considered	Site-specific remediation goal(s) developed for surface water that represent contaminant levels preventative of excess ecological risk.	The selected remedies will attain RAOs for TCE in the surface water of Meandering Road Creek and Farmers Branch Creek after completion of remedial activities. Exceedence of RAOs will be the target for determining if corrective action is needed.
Air	Texas Regulation V: Control of Pollution from Volatile Organic Compounds	TAC, Title 30, Part III, Chapter 115 (effective 2002)	Applicable	State regulation establishing standards for VOC emissions and controls.	Remediation technologies that emit VOCs to the air must comply with these state regulations during operation.

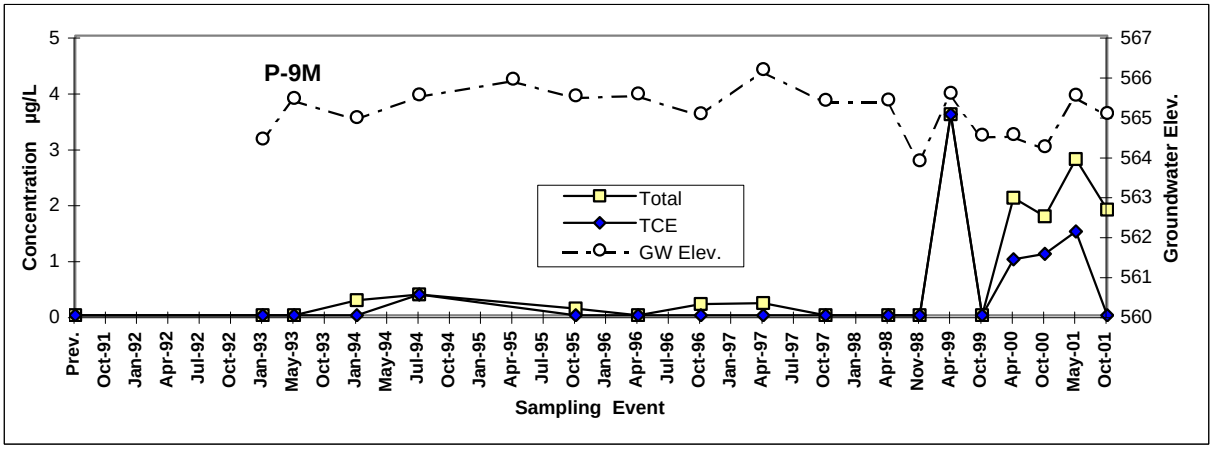
Medium	ARAR	Citation	Status	Requirement Synopsis	Action to be Taken to Attain ARAR
	Contaminated Water and Soil Remediation Equipment (Previously Standard Exemption 68)	TAC, Title 30, Chapter 106.533 (effective 2000)	Applicable	This document provides guidance for the air emissions from various treatment systems to be used on remediation projects.	Remediation technologies that emit air contaminants regulated under this document will attain the appropriate standard during operation.

Notes:

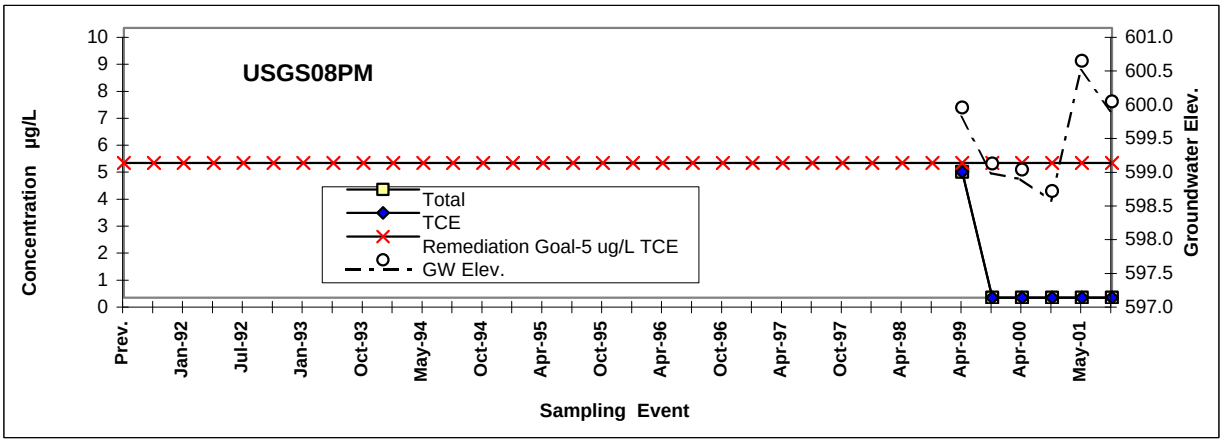
AFP 4 = Air Force Plant 4
ARAR = applicable or relevant and appropriate requirements
CFR = Code of Federal Regulations
MCL = maximum contaminant level
NPDES = National Pollutant Discharge Elimination System
PCB = polychlorinated biphenyl
POTW = Publicly Owned Treatment Works
RAO = remedial action objective
ROD = record of decision
SDWA = Safe Drinking Water Act
TAC = Texas Administrative Code
TCE = trichloroethylene
VOC = volatile organic compound

ATTACHMENT 4

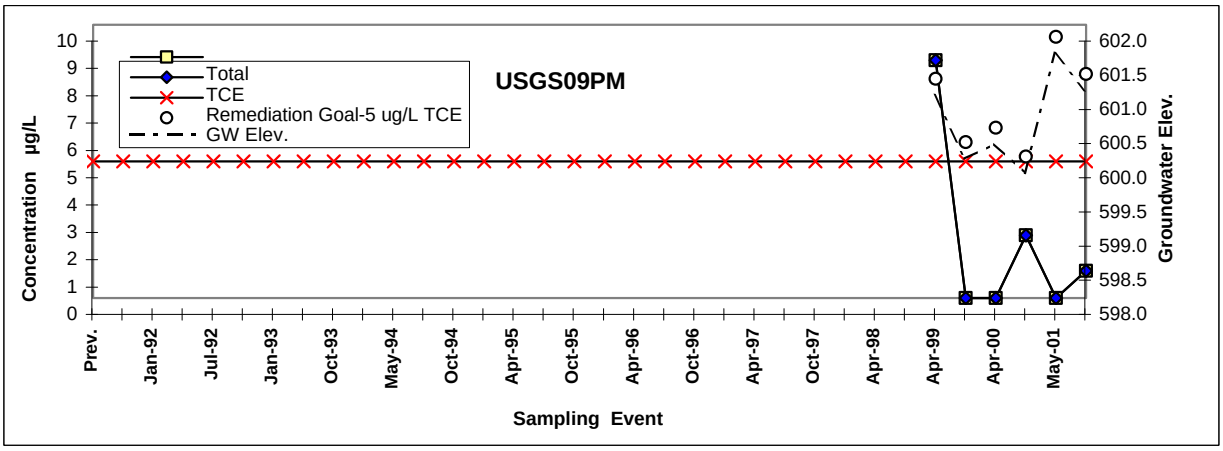
HISTORICAL RESULTS FOR TCE AND DEGRADATION PRODUCTS RELATIVE TO GROUNDWATER ELEVATIONS



Middle Paluxy well in East Parking Lot

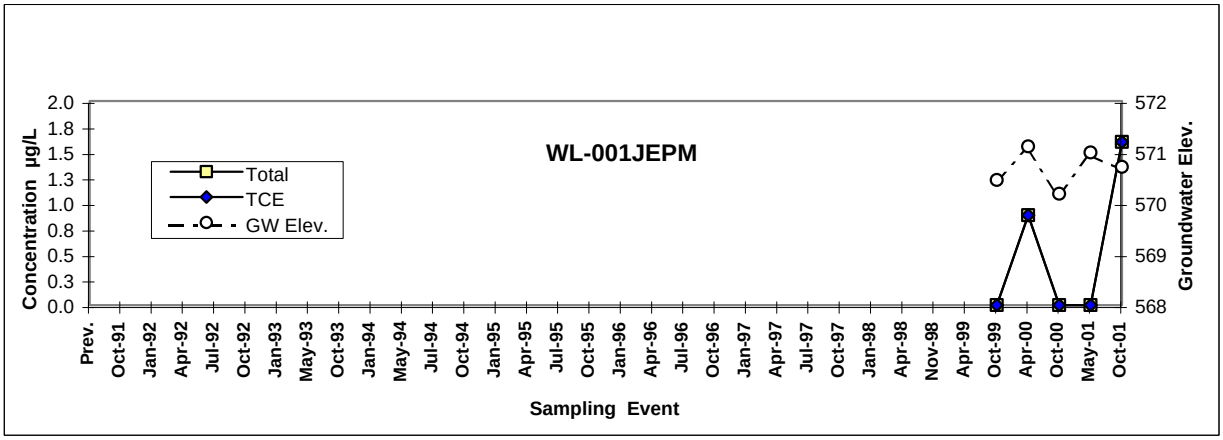


Middle Paluxy well west of Plant

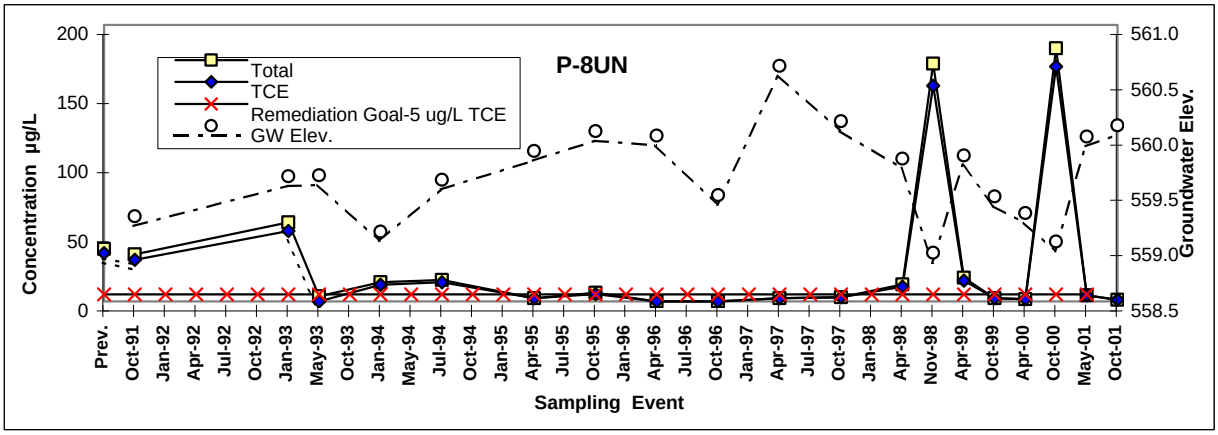


Middle Paluxy well at SW corner of Plant

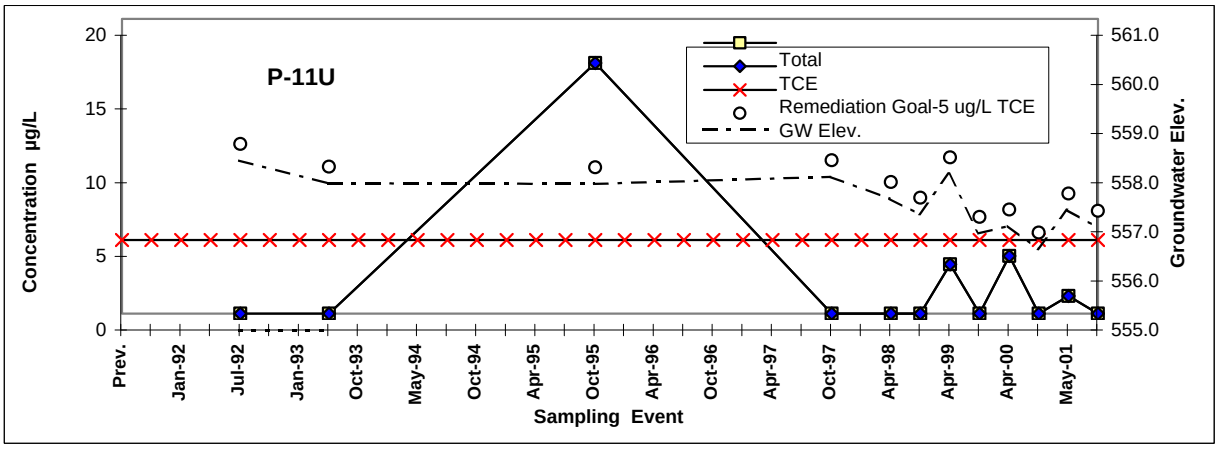
Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter



Middle Paluxy well East of Run Station 5

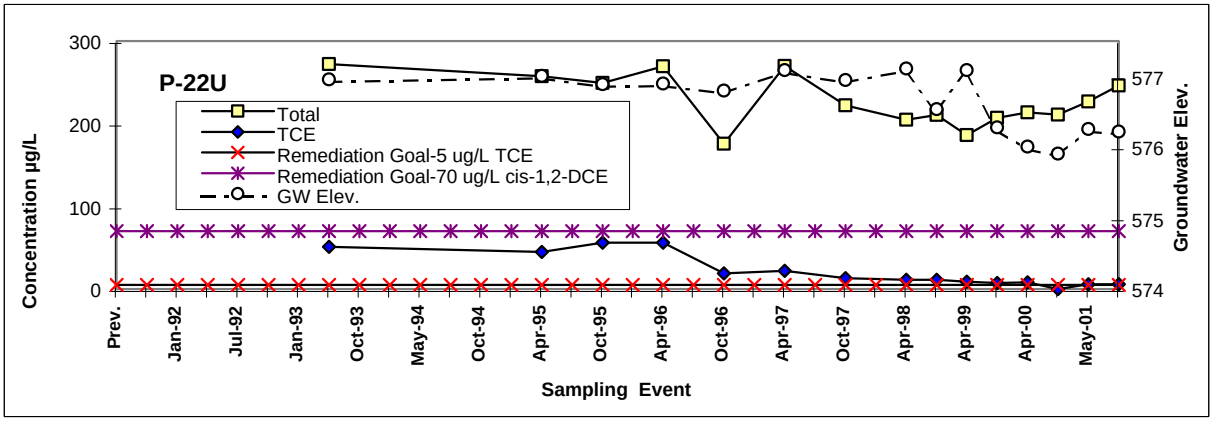


Upper Paluxy well along Lockheed-Martin Blvd.

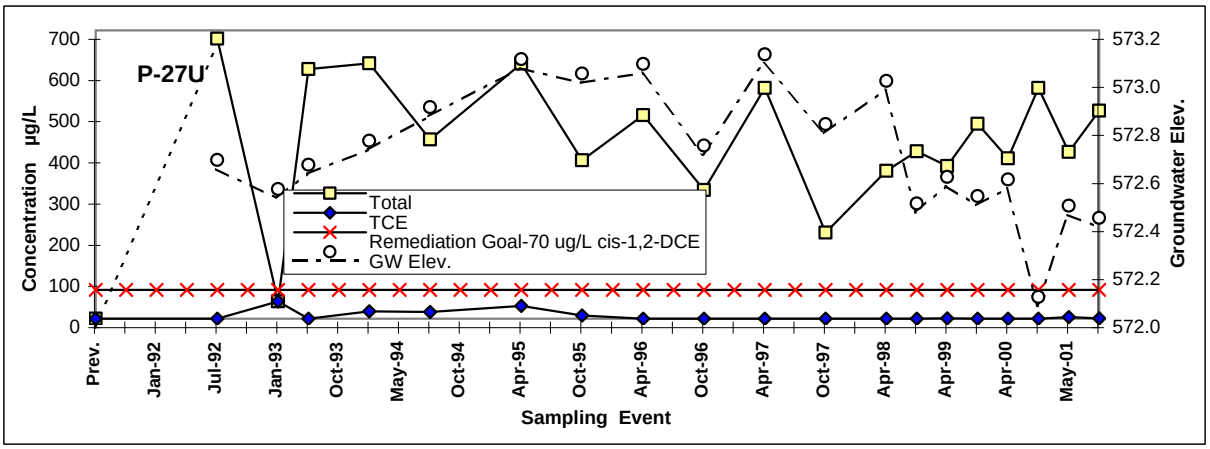


Upper Paluxy well in East Parking Lot

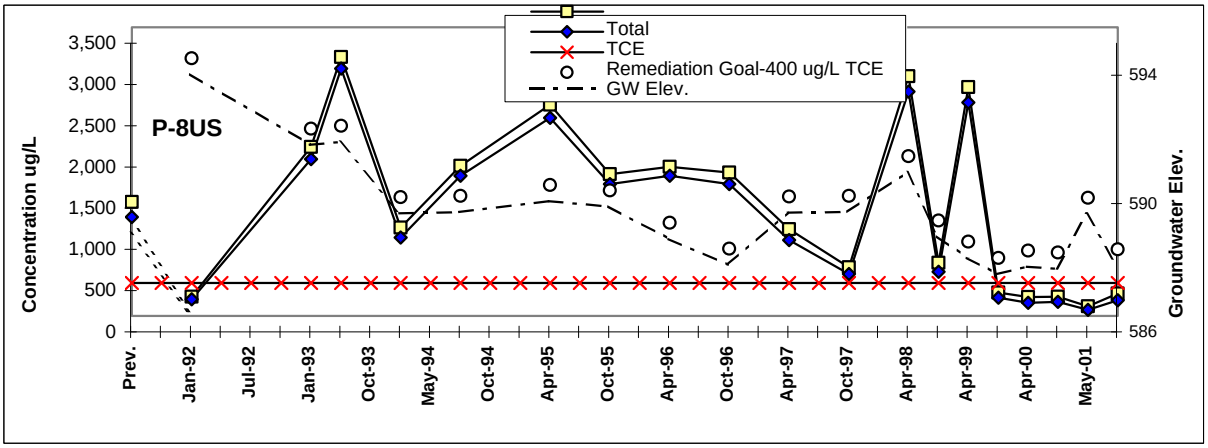
Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter



Upper Paluxy well in AFP4 Landfill 3

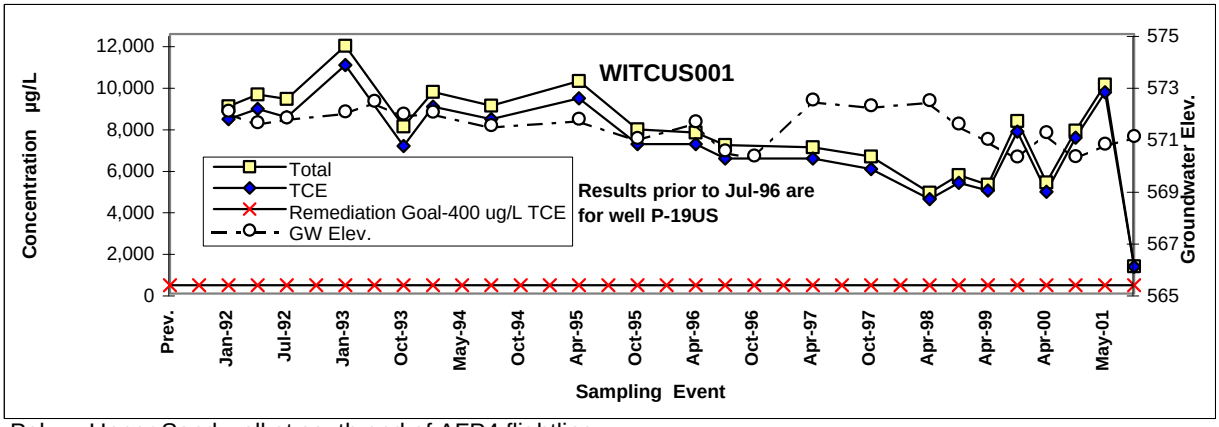


Upper Paluxy well along west side of Bldg. 14

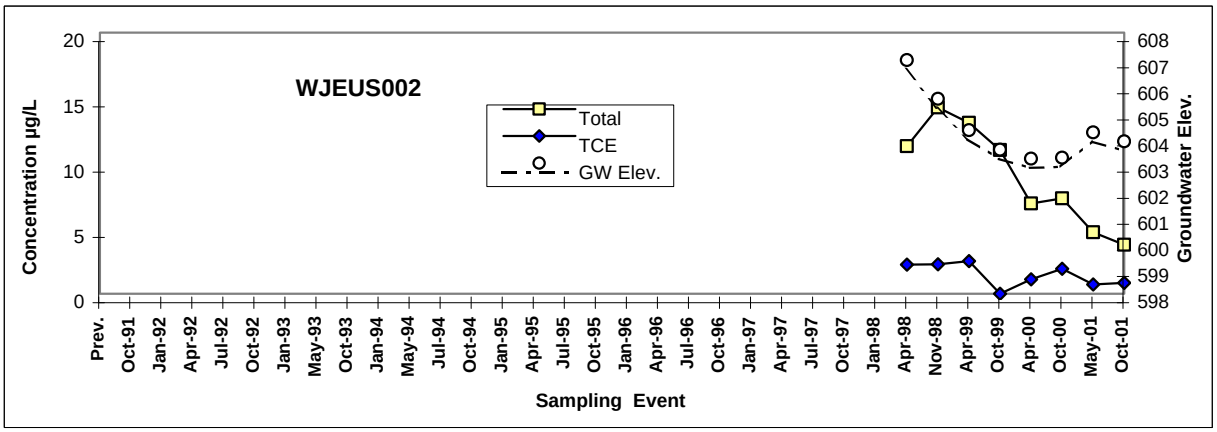


Paluxy Upper Sand well along Lockheed-Martin Blvd.

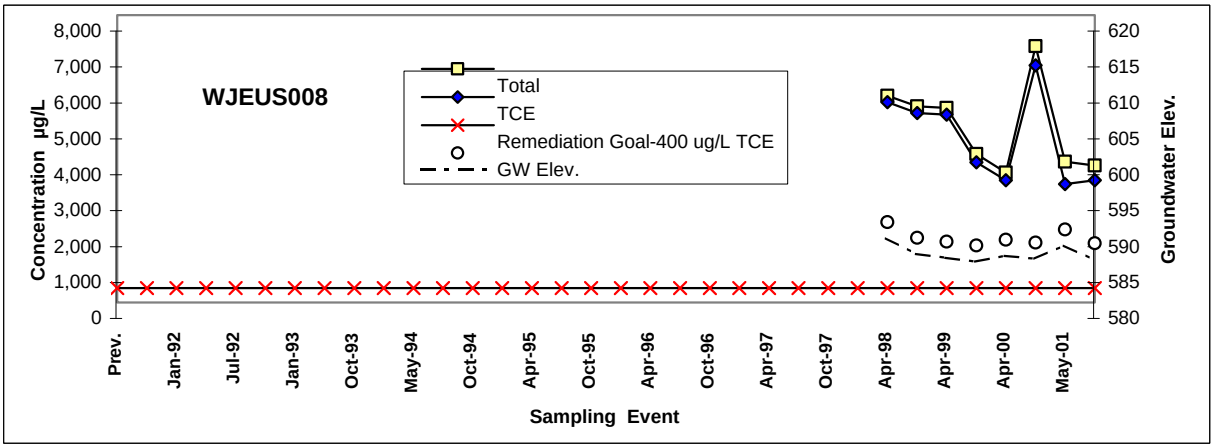
Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter



Paluxy Upper Sand well at south end of AFP4 flightline.

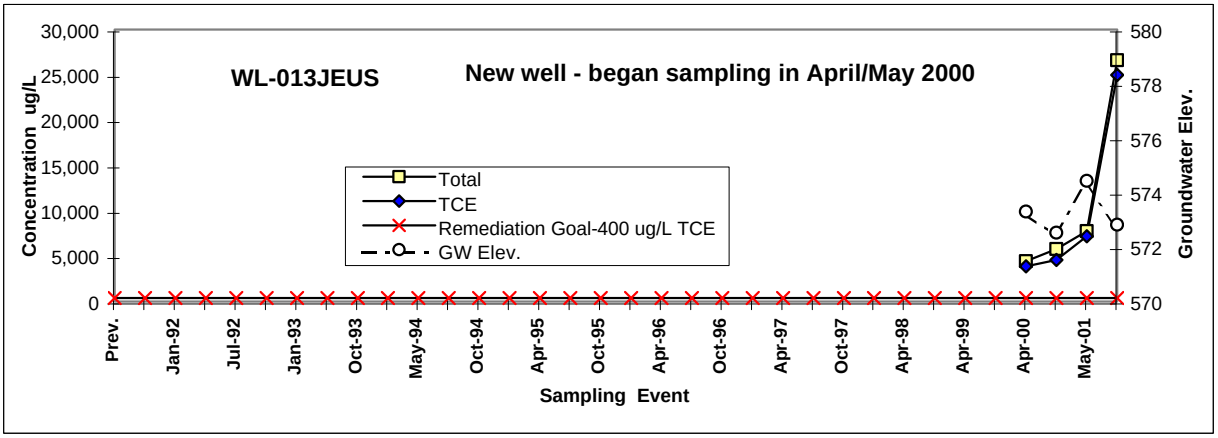


Paluxy Upper Sand well along Lockheed Boulevard.

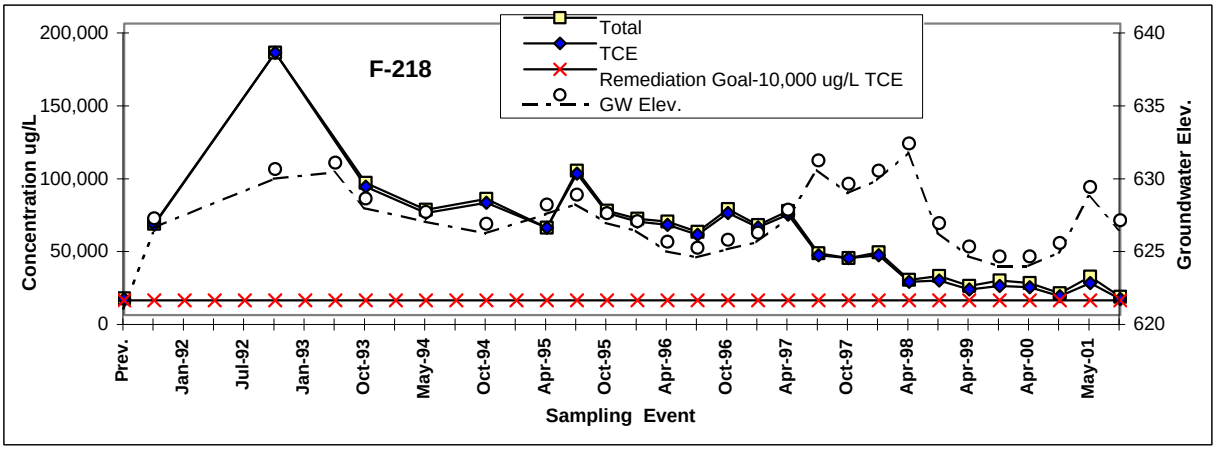


Paluxy Upper Sand well south of run station 12.

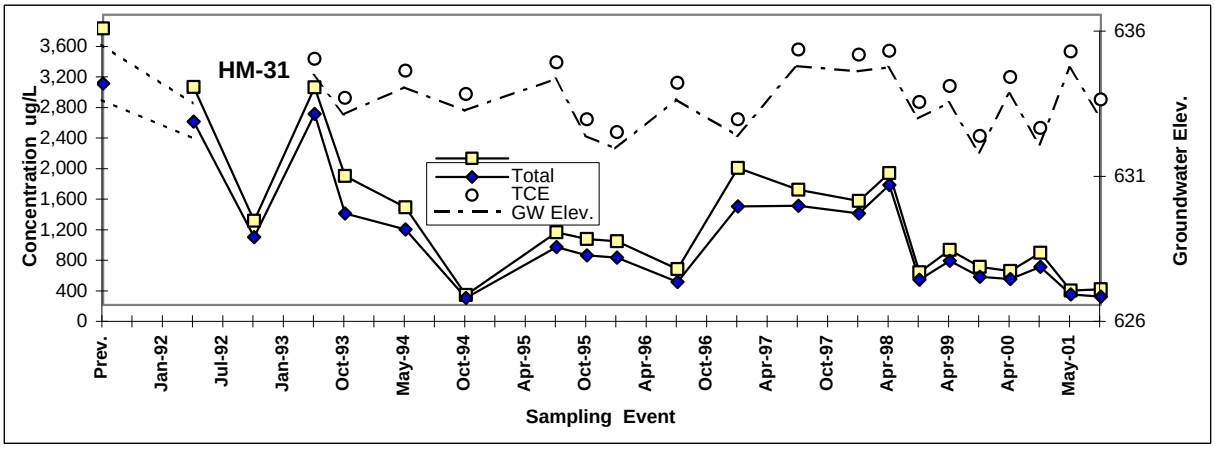
Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter



Paluxy Upper Sand well - AFP4 flightline

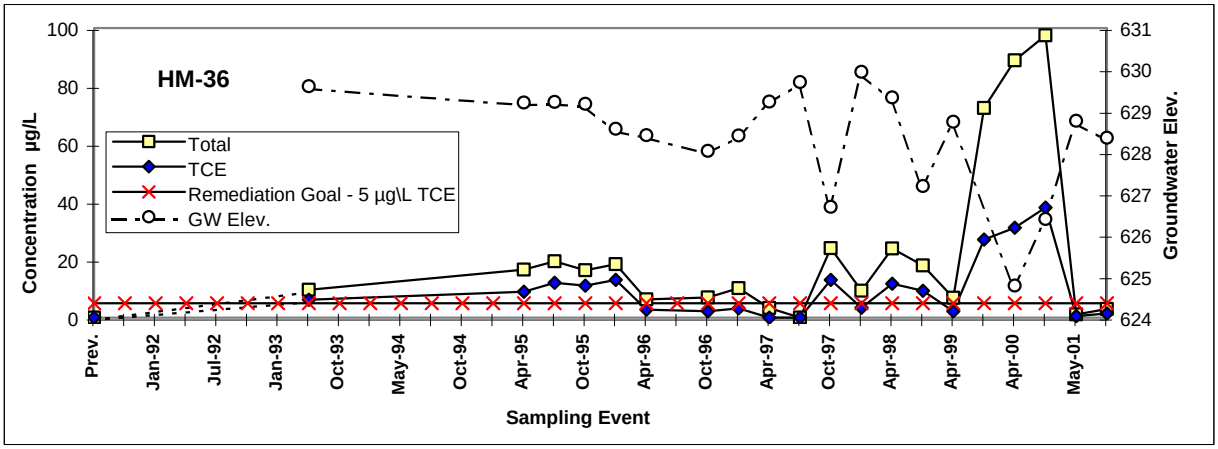


Terrace Alluvium well - East Parking Lot

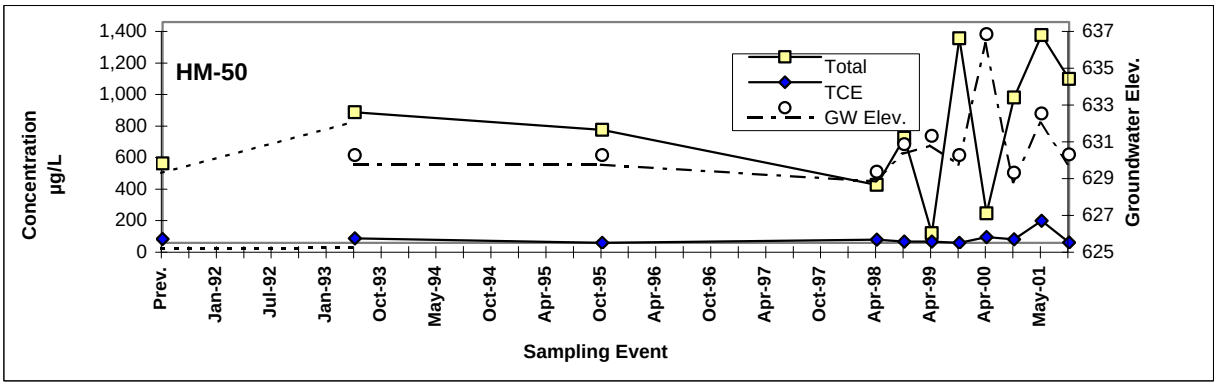


Terrace Alluvium well - adjacent to Clifford Ave.

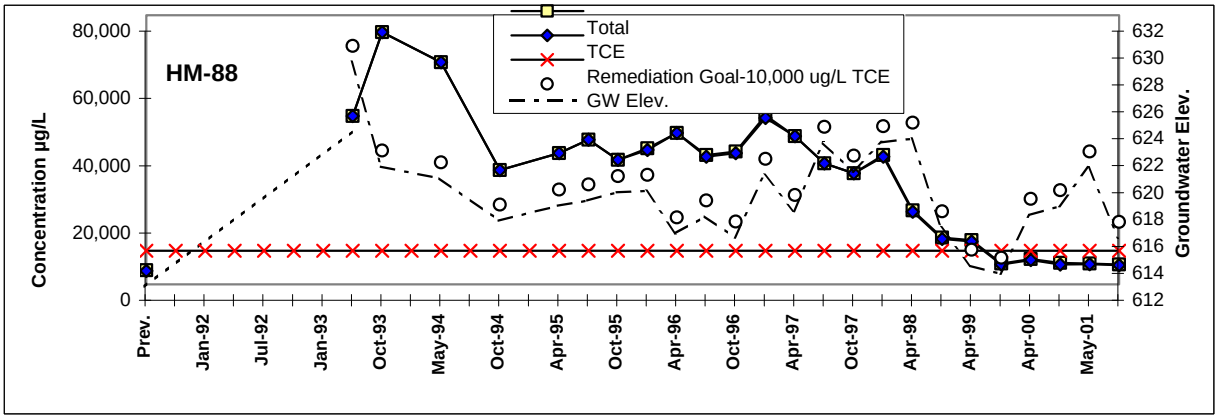
Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter



Terrace Alluvium well - AFP4 Landfill 3



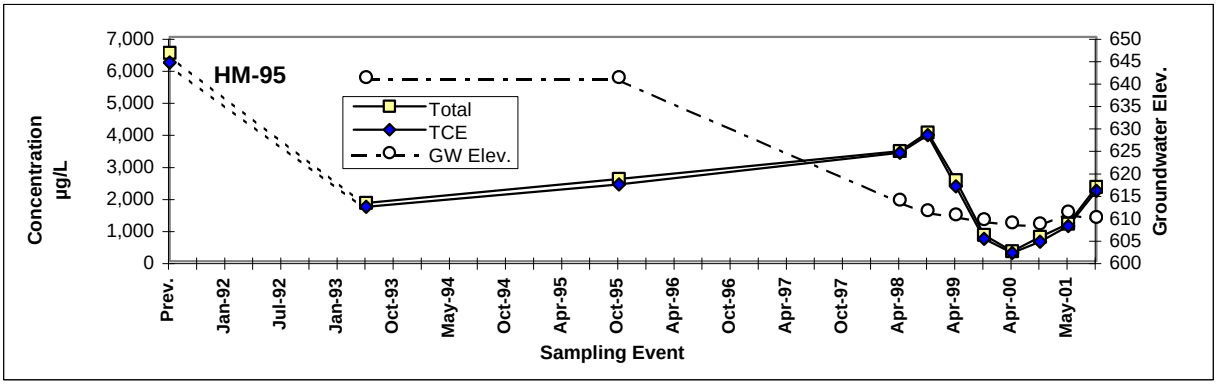
Terrace Alluvium well - west parking lot.



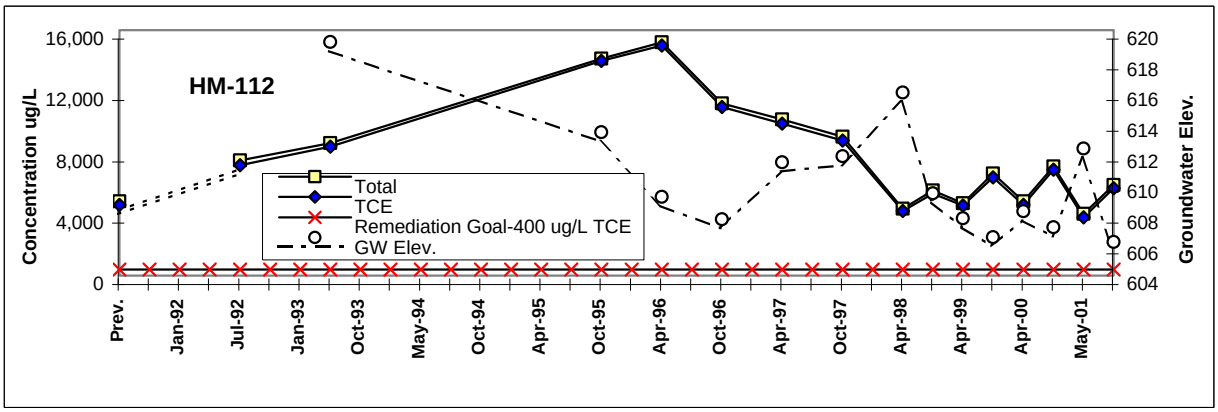
Terrace Alluvium well - East Parking Lot

Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene

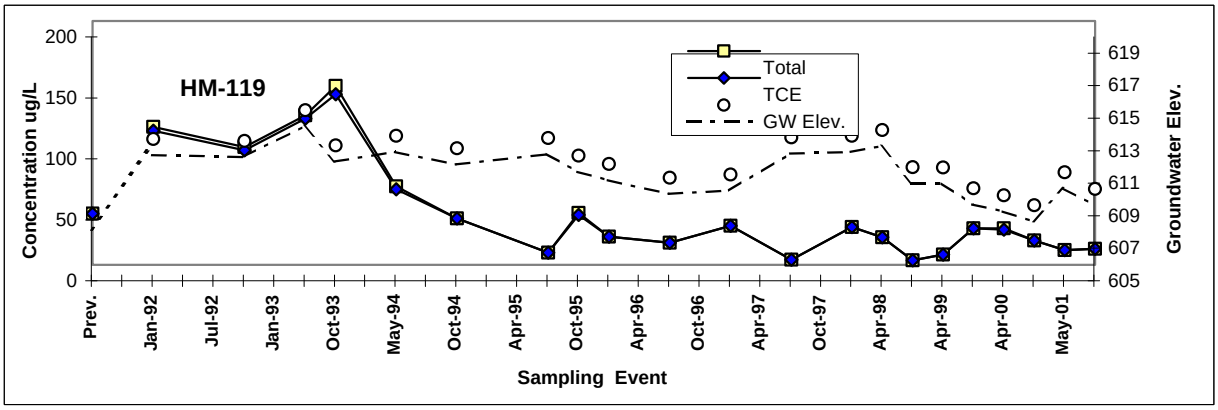
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter



Terrace Alluvium well - AFP4 flightline

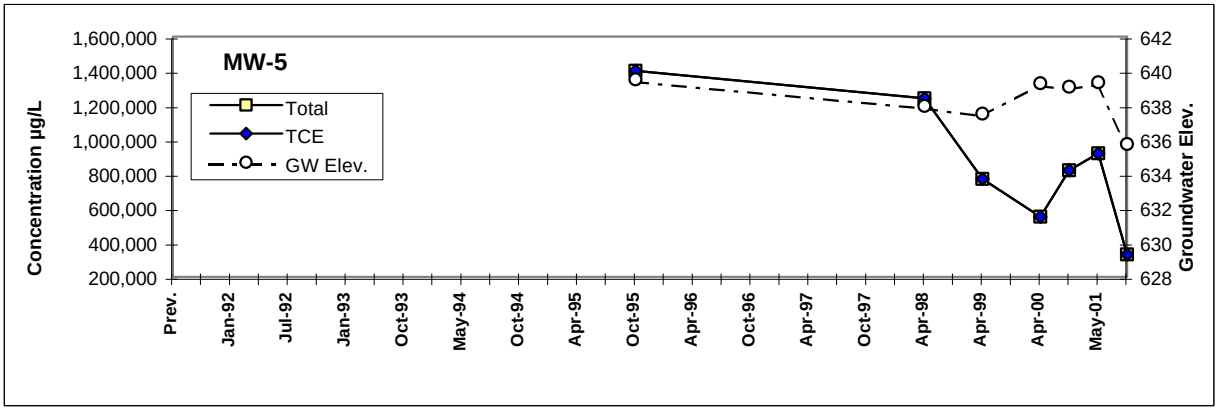


Terrace Alluvium well - AFP4 flightline

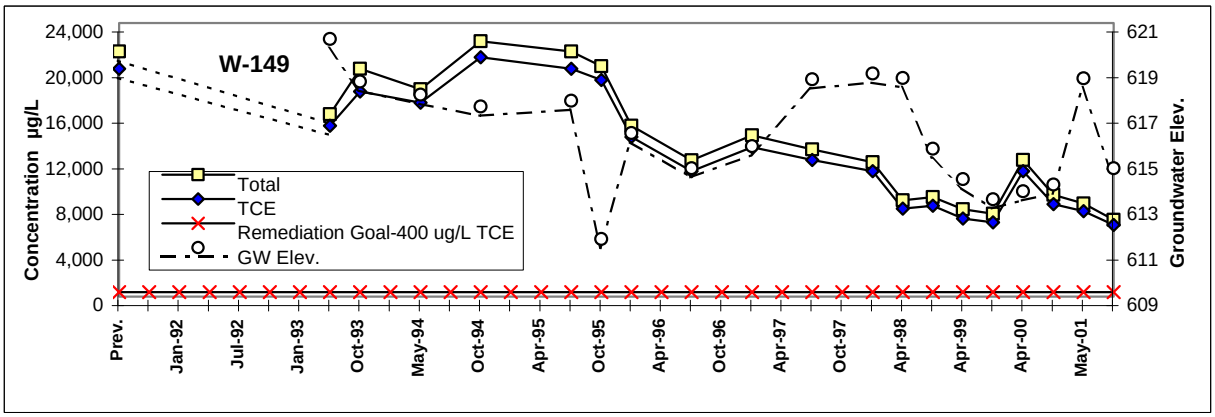


Terrace Alluvium well - NAS Fort Worth flightline

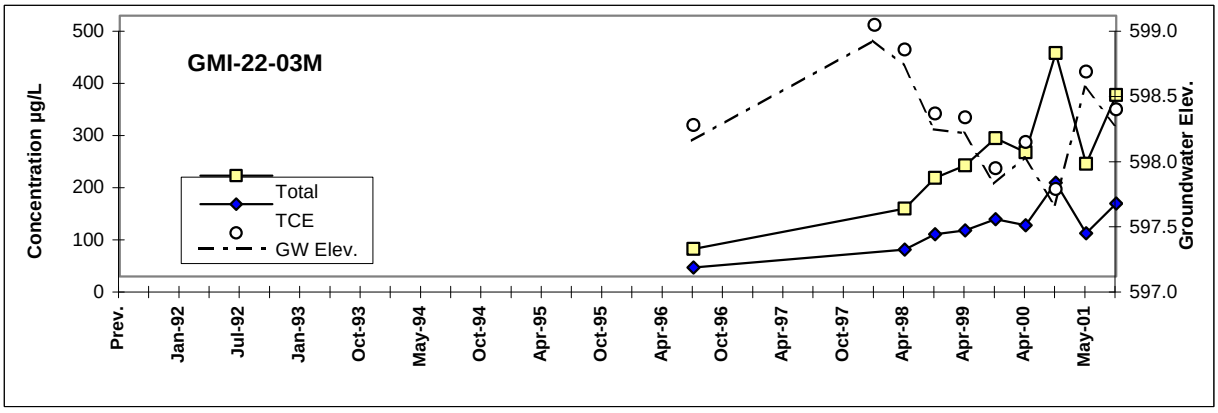
Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter



Terrace Alluvium well inside Building 181

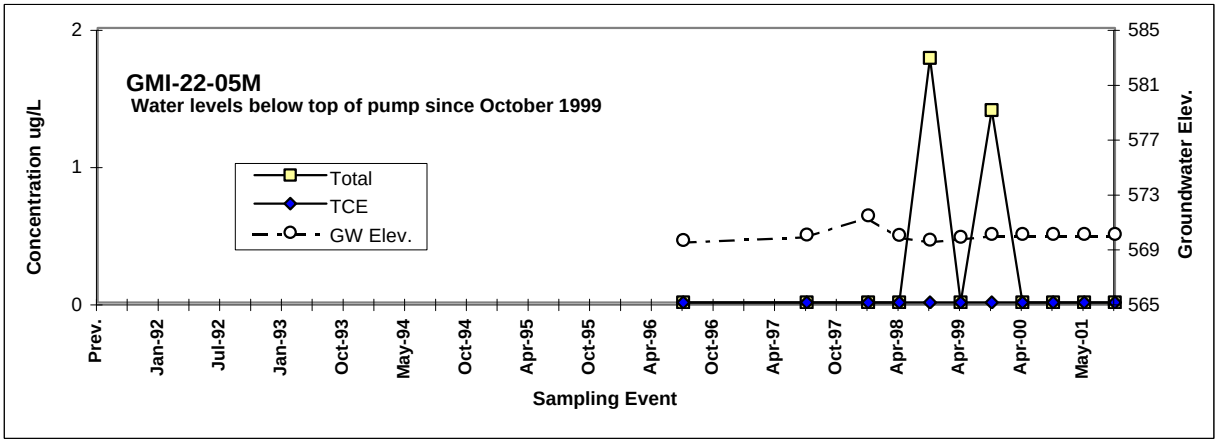


Terrace Alluvium well - East Parking Lot

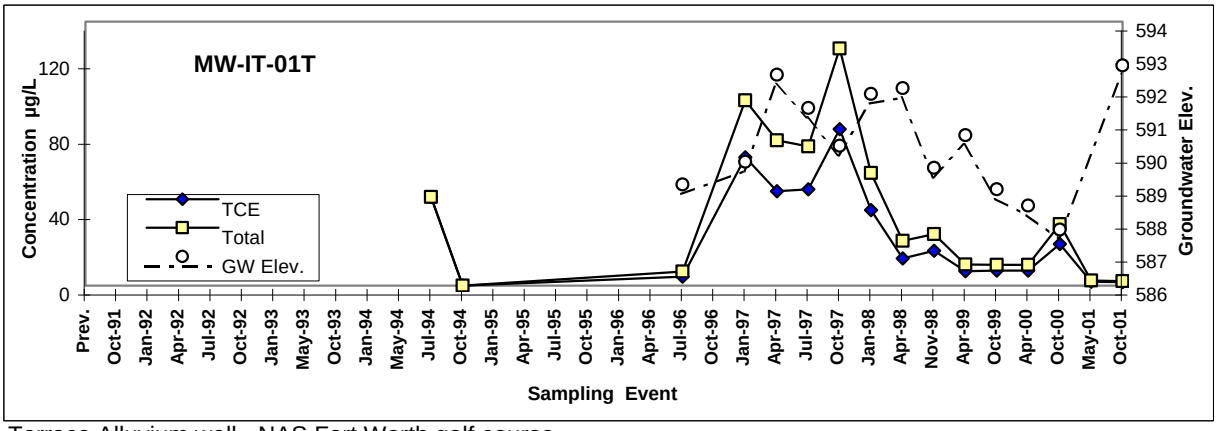


Terrace Alluvium well - NAS Fort Worth Base

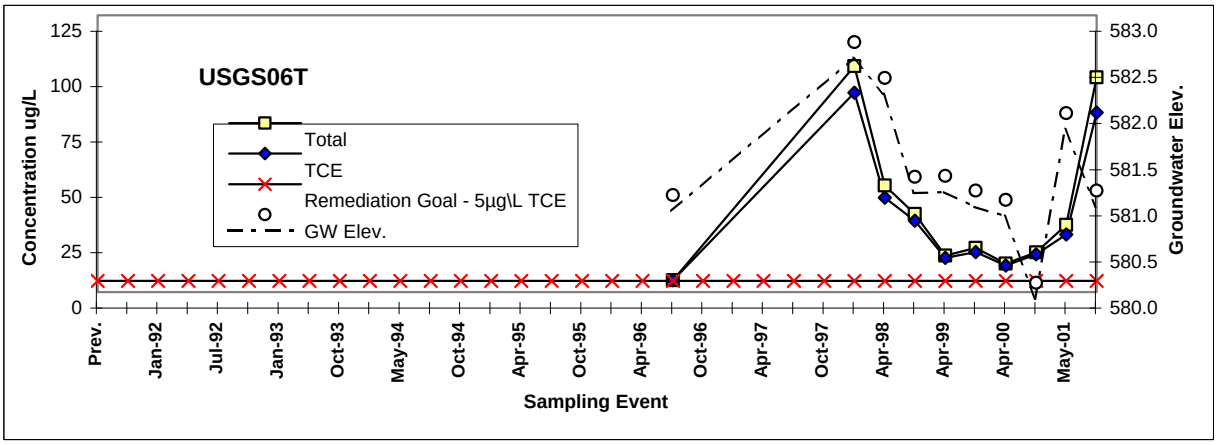
Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter



Terrace Alluvium well - NAS Fort Worth Base

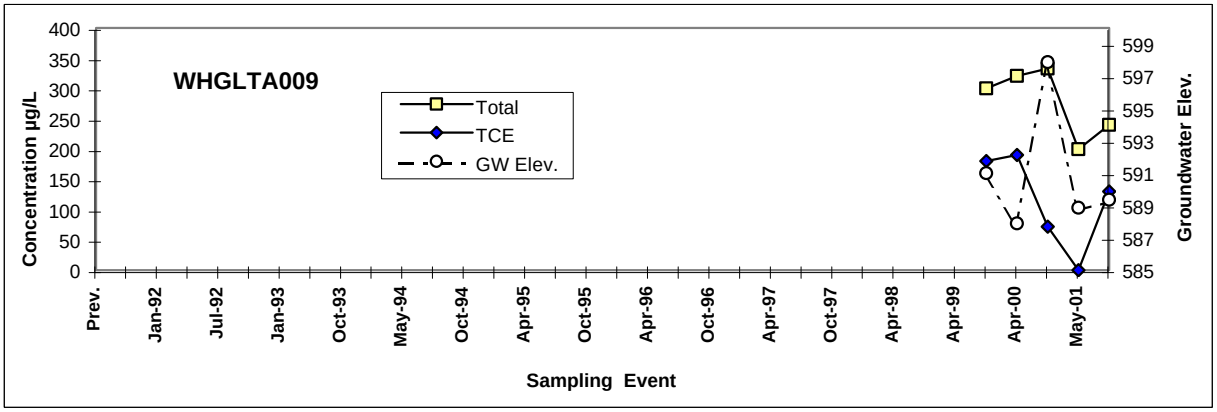


Terrace Alluvium well - NAS Fort Worth golf course

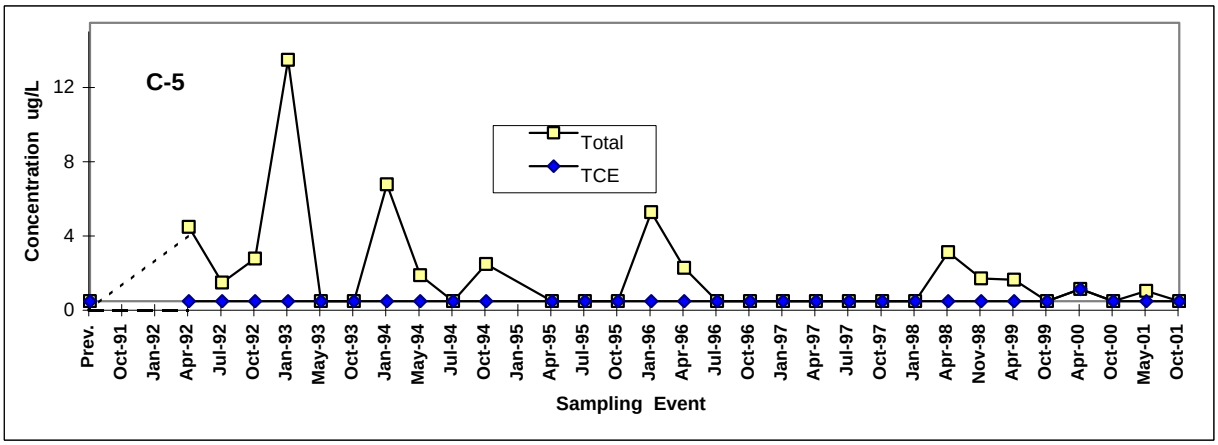


Terrace Alluvium well - NAS Fort Worth Base

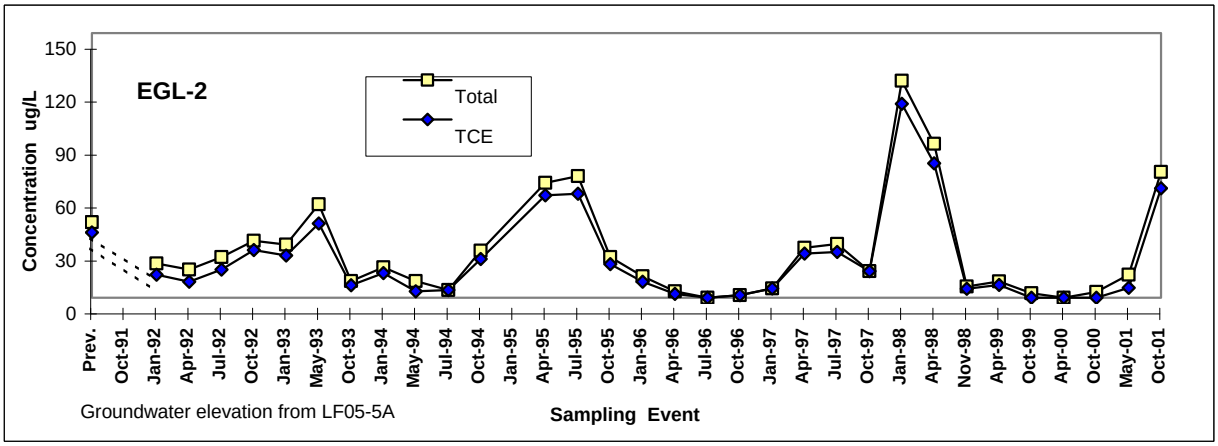
Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter



Terrace Alluvium well - NAS Fort Worth Base

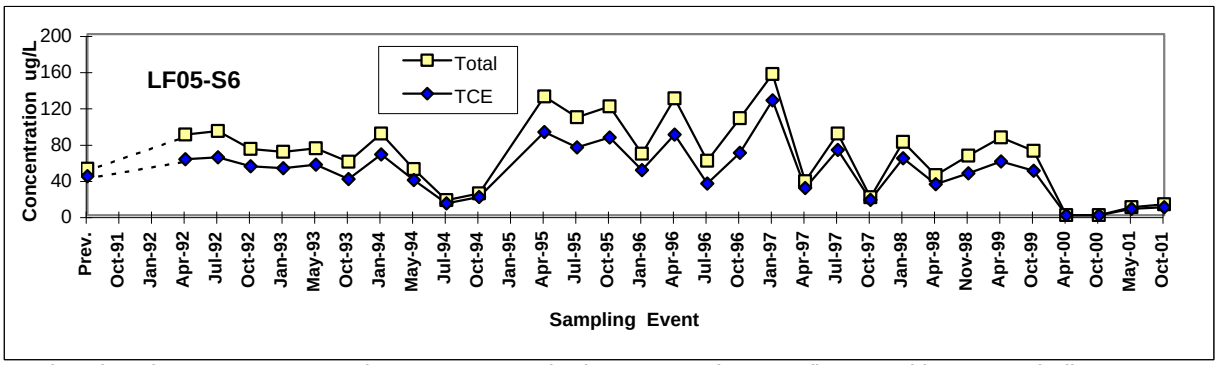


Surface location - Meandering Road Creek

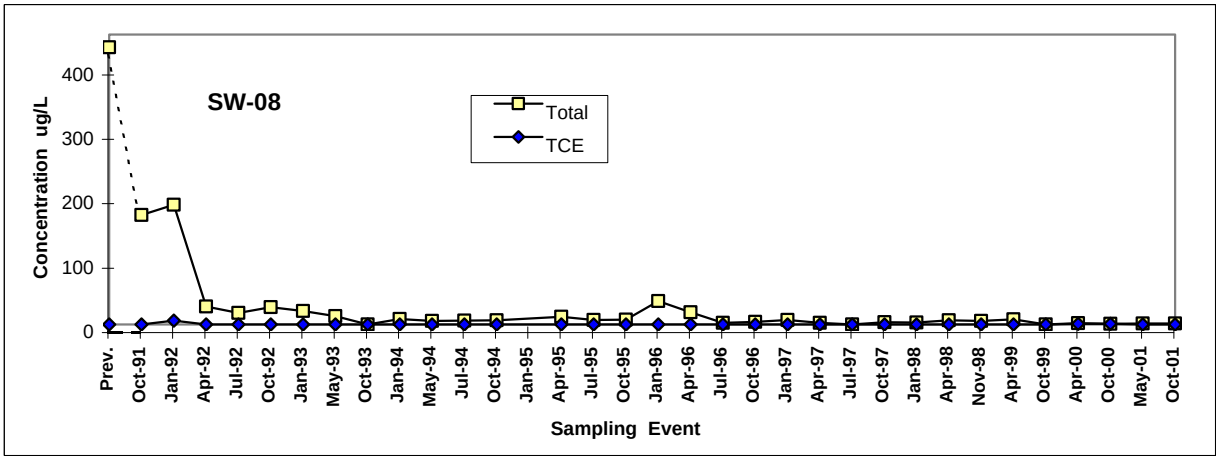


Surface location - Farmers Branch aqueduct outlet

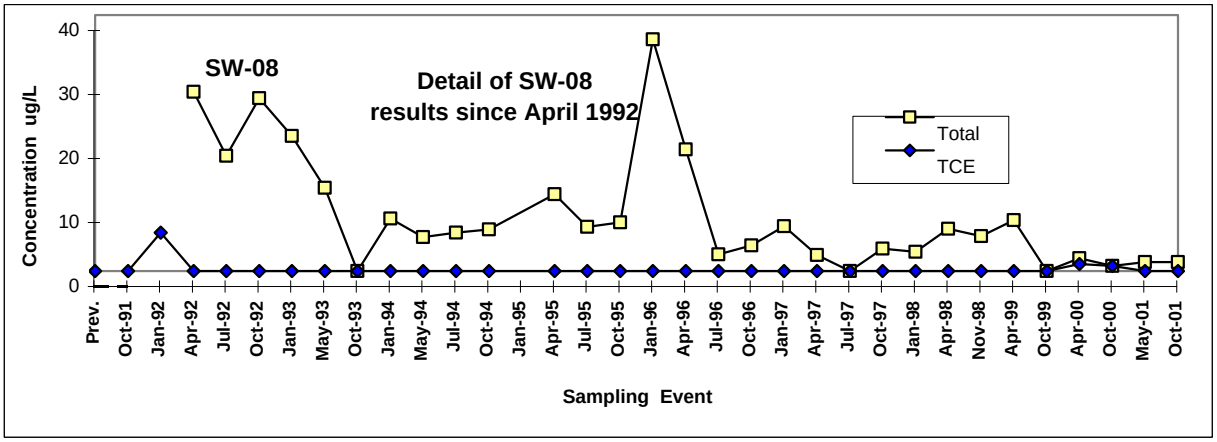
Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter



Surface location - Farmers Branch, NAS Fort Worth, downstream from confluence with unnamed tributary



Surface location - Meandering Road Creek



Surface location - Meandering Road Creek

Prev. data were acquired prior to Oct. 1991. cis-1,2-DCE = cis-1,2-dichloroethene TCE = trichloroethene
Total concentration = TCE plus its degradation products GW = groundwater ug/L = micrograms per liter