N83447.AR.000045
NAS FORT WORTH
5090.3a

FINAL WORK PLAN FOR PRELIMINARY ASSESSMENT SITE INVESTIGATION AND REMEDIAL INVESTIGATION FEASIBILITY STUDY AT PLANT 4 VOLUME 1 OF 4 NAS FORT WORTH TX

8/1/1990

UNC GEOTECH

File: 17G
A.F.
52 0

NAVAL AIR STATION FORT WORTH JRB CARSWELL FIELD TEXAS

ADMINISTRATIVE RECORD COVER SHEET

AR File Number 50

Air Force Plant 4

Preliminary Assessment/ Site Inspection and Remedial Investigations/ Feasibility Studies

Volume I

Final Work Plan

Prepared for
U.S. Department of the Air Force
Headquarters Aeronautics Systems Division
Wright-Patterson Air Force Base, Ohio

Submitted by UNC Geotech under
DOE Contract No. DE-AC07-86ID12584 for the
U. S. Department of Energy

CNG/WMP/PN-9

52 2

FINAL WORK PLAN

for

Preliminary Assessment/Site Inspection
and
Remedial Investigation/Feasibility Studies

at

U.S. Air Force Plant 4
Tarrant County, Texas

August 1990

Prepared for

U.S. Department of the Air Force
Headquarters Aeronautics Systems Division
Wright-Patterson Air Force Base, Ohio

Prepared by

UNC Geotech
P.O. Box 14000
Grand Junction, Colorado 81502

TABLE OF CONTENTS

		Page
1.0	Introduction	1
2.0	Site Background	5
	2.1 Location	5
	2.2. Site History	5
	2.3 Previous Investigations	5
3.0	Environmental Setting	7
	3.1 Physiography	7
	3.2 Meteorology	7
	3.3 Geologic Setting	7
	3.3.1 Surficial Deposits	7
	3.3.2 Fredericksburg Group	8
	3.3.2.1 Goodland Limestone	8
	3.3.2.2 Walnut Formation	8
	3.3.3 Trinity Group	8
	3.3.3.1 Paluxy Formation	8
	3.3.3.2 Glen Rose Formation	9
	3.4 Hydrologic Setting	9
	3.4.1 Upper Zone	9
	3.4.2 Walnut Aquitard	10
	3.4.3 Paluxy Aquifers	10
	3.4.3.1 Upper Paluxy Aquifer	11
	3.4.3.2 Lower Paluxy Aquifer	12
	3.4.4 Glen Rose Aquitard	12
	3.4.5 Twin Mountains Aquifer	12
	3.5 Surface Water	12
4.0	Conceptual Site Model	14
	4.1 Sources of Contaminants	14
	4.1.1 Landfills	14
	4.1.1.1 Landfill No. 1	14
	4.1.1.2 Landfill No. 2	19
	4.1.1.3 Landfill No. 3	21
	4.1.1.4 Landfill No. 4	21
	4.1.2 Fire Department Training Areas (FDTAs)	24
	4.1.2.1 FDTA No. 2	24
	4.1.2.2 FDTA No. 3	24
	4.1.2.3 FDTA No. 4	24
	4.1.2.4 FDTA No. 5	27
	4.1.2.5 FDTA No. 6	27
	4.1.3 Process waste disposal sites	27
	4.1.3.1 Chrome Pit No. 1	27
	4.1.3.2 Chrome Pit No. 2	30
	4.1.3.3 Chrome Pit No. 3	30
	4.1.3.4 Die Yard Chemical Pits	30
	4.1.4 Fuel Spill Areas	33
	4.1.4.1 Fuel Saturation Area No. 1	33
	4.1.4.2 Fuel Saturation Area No. 2	33
	4.1.4.3 Fuel Saturation Area No. 3	36
	4.1.4.4 Former Fuel Storage Site	36

Contents (Continued)

Page

4.1.4.5 Solvent Lines 36
4.1.4.6 Jet Engine Test Stand 38
4.1.4.7 Underground Storage Tanks (removed) 38
4.1.5 Other areas 41
4.1.5.1 Nuclear Aerospace Research Facility 41
4.1.5.2 Waste Water Collection Basins 41
4.1.5.3 Assembly Building/Parts Plant Perimeter . . . 41
4.1.5.4 East Parking Lot 43
4.1.6 Summary of Contaminant Sources 43
4.2 Evaluation of Contaminant Pathways 43
4.2.1 Air 45
4.2.1.1 Volatilization 45
4.2.1.2 Solid Phase Transport 45
4.2.2 Surface Water 45
4.2.3 Groundwater 46
4.2.3.1 Upper Zone 46
4.2.3.2 Paluxy Aquifer 51
4.2.4 Summary of Contaminant Pathways 53
4.3 Assessment of Potential Receptors (by pathway). 53
4.3.1 Air 53
4.3.2 Surface Water 54
4.3.3 Groundwater 55
4.3.4 Summary of Potential Receptors 55

5.0 Objectives and Rationale 56
5.1 Preliminary Assessment/Site Inspection (PA/SI). 56
5.1.1 Assembly Building/Parts Plant 56
5.1.2 Underground Storage Tanks (USTs) 56
5.2 Remedial Investigation (RI) Studies 56
5.2.1 Landfill No. 1 57
5.2.2 Landfill No. 3 57
5.2.3 Landfill No. 4 57
5.2.4 FDTA No. 2 58
5.2.5 FDTA No. 3 58
5.2.6 FDTA No. 5 58
5.2.7 FDTA No. 6 58
5.2.8 Chrome Pit No. 3 59
5.2.9 Die Yard Chemical Pits 59
5.2.10 Fuel Saturation Area No. 1 59
5.2.11 Fuel Saturation Area No. 2 60
5.2.12 Fuel Saturation Area No. 3 60
5.2.13 Former Fuel Storage Area 60
5.2.14 Jet Engine Test Stand 60
5.2.15 Waste Water Collection Basins. 61
5.2.16 East Parking Lot/Flight Line TCE Plume 61
5.2.17 Site-Wide Investigations 61
5.2.17.1 Lake Worth 61
5.2.17.2 Air Quality Monitoring 62
5.2.17.3 Continuous Groundwater Elevation Monitoring. 62
5.2.17.4 Paluxy Aquifer System Characterization . . . 62
5.2.17.5 Archaeological Survey. 62

Contents (Continued)

Page

5.2.17.6 Ecological Survey. 63
5.2.17.7 Meandering Road Creek. 63
5.2.17.8 Background Sampling. 63
5.2.17.9 Leachability Testing 63
5.2.17.10 Common Ions. 64

6.0 PA/SI and RI/FS Work Tasks 65
6.1 Subtask 1.1 Project Planning. 65
6.2 Subtask 1.2 Community Relations 65
6.3 Subtask 1.3 No Further Action Documentation 66
6.4 Subtask 1.4 Field Investigations. 66
6.4.1 Assembly Building/Parts Plant. 66
6.4.2 Underground Storage Tanks (removed). 69
6.4.3 Landfill No. 1 69
6.4.4 Landfill No. 3 70
6.4.5 Landfill No. 4 71
6.4.6 FDTA No. 2 71
6.4.7 FDTA No. 5 71
6.4.8 FDTA No. 6 72
6.4.9 Chrome Pit No. 3 72
6.4.10 Die Yard Chemical Pits 72
6.4.11 FSA No. 1 73
6.4.12 FSA No. 2 73
6.4.13 FSA No. 3 74
6.4.14 Former Fuel Storage Area 74
6.4.15 Jet Engine Test Stand 75
6.4.16 Wastewater Collection Basins 75
6.4.17 East Parking Lot/Flight Line TCE Plume 75
6.4.18 Site-Wide Investigations 76
6.4.18.1 Lake Worth 76
6.4.18.2 Air Quality Monitoring 76
6.4.18.3 Continuous Groundwater Elevation Monitoring. 76
6.4.18.4 Paluxy Aquifer System Characterization . . . 76
6.4.18.5 Archaeological Survey. 77
6.4.18.6 Ecological Survey. 77
6.4.18.7 Meandering Road Creek Survey 77
6.4.18.8 Background Sampling. 77
6.4.18.9 Leachability Testing 77
6.4.18.10 Common Ions. 77
6.5 Subtask 1.5 Sample Analysis/Validation 78
6.6 Subtask 1.6 Data Evaluation. 78
6.7 Subtask 1.7 Assessment of Risks. 79
6.8 Subtask 1.8 Treatability Study/Pilot Testing 80
6.9 Subtask 1.9 Alternative Development and Screening. 80
6.9.1 Interim Remedial Action Alternatives 80
6.9.2 Alternative Development and Screening. 81
6.9.2.1 Developing a Range of Remedial Action alternatives 81
6.9.2.2 Alternative Screening 81
6.10 Subtask 1.10 Detailed Analysis of Alternatives. 82
6.10.1 Detailed Technical Evaluation 82

Contents (Continued)

Page

6.10.2 Evaluation of Institutional Requirements. 83
6.10.3 Evaluation of Public Health Protection. 83
6.10.4 Detailed Cost Analysis. 84
6.10.5 Regulatory and Community Acceptance 85
6.11 Subtask 1.11 Draft Remedial Investigation and Feasibility Study Reports 85

7.0 Proposed Schedule 87

8.0 References 89

9.0 Acronyms 92

APPENDIX A COMMUNITY RELATIONS PLAN FOR AFP 4. . . . . A-1
APPENDIX B EPA REGION VI AND TEXAS WATER COMMISSION PRELIMINARY ARARS B-1

FIGURES

Figure 1. Location Map for AFP 4 2
Figure 2. Phase I IRP Sites. 3
Figure 3. Surface Water Drainage AFP 4 13
Figure 4. Location Map for Landfill No. 1. 18
Figure 5. Location Map for Landfill No. 2. 20
Figure 6. Location Map for Landfill No. 3. 22
Figure 7. Location Map for Landfill No. 4. 23
Figure 8. Location Map for FDTA No. 2. 25
Figure 9. Location Map for FDTA No. 3. 26
Figure 10. Location Map for FDTA No. 5. 28
Figure 11. Location Map for FDTA No. 6. 29
Figure 12. Location Map for Chrome Pit No. 3 31
Figure 13. Location Map for Die Yard Pits 32
Figure 14. Location Map for FSA No. 1 34
Figure 15. Location Map for FSA No. 2 35
Figure 16. Location Map for FSA No. 3 37
Figure 17. Location Map for Jet Engine Test Stand 39
Figure 18. Location Map of USTs (removed) 40
Figure 19. Location Map for the Wastewater Collection Basins. 42
Figure 20. Location of the East Parking Lot/Flight Line Area. 44
Figure 21. Location Map of Geologic Cross Sections. 47
Figure 22. North-South Cross Section, East Parking Lot Area 48
Figure 23. Northeast-Southwest Cross Section, Meandering Road Creek to Flight Line Area. 49
Figure 24. Water-table Contour Map of Upper Zone. 50
Figure 25. Water-level Contour Map of the Paluxy Formation. 52
Figure 26. Schedule of RI/FS Activities at AFP. 88

TABLES

Table 1. Summary of Previous Investigations. 15
Table 2. Summary of Field Investigation Activities at AFP 4. 67

1.0 INTRODUCTION

This Work Plan outlines the activities designed to bring previously identified waste disposal and spill sites at U.S. Air Force Plant No. 4 (AFP 4), Fort Worth, Texas (Figure 1), into compliance with environmental laws and regulations promulgated by the U.S. Government and the State of Texas. This work is being performed in support of the Aeronautic Systems Division of U.S. Air Force Systems Command. The locations identified during the Air Force Installation Restoration Program (IRP) are as follows:

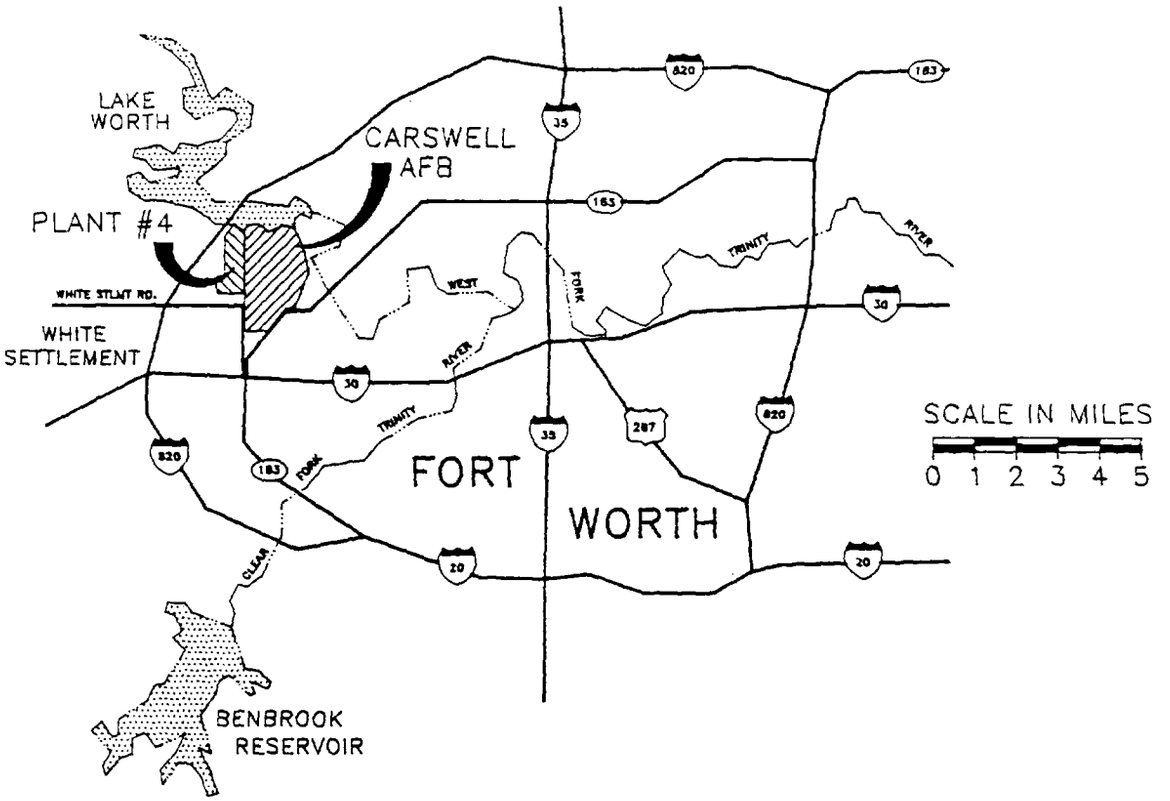
- Landfill No. 1 (Site 1)
- Landfill No. 2 (Site 2)
- Landfill No. 3 (Site 3)
- Landfill No. 4 (Site 4)
- Fire Department Training Area No. 2 (Site 5)
- Fire Department Training Area No. 3 (Site 6)
- Fire Department Training Area No. 4 (Site 7)
- Fire Department Training Area No. 5 (Site 8)
- Fire Department Training Area No. 6 (Site 9)
- Chrome Pit No. 1 (Site 10)
- Chrome Pit No. 2 (Site 11)
- Chrome Pit No. 3 (Site 12)
- Die Yard Chemical Pits (Site 13)
- Fuel Saturation Area No. 1 (Site 14)
- Fuel Saturation Area No. 2 (Site 15)
- Fuel Saturation Area No. 3 (Site 16)
- Former Fuel Storage Site (Site 17)
- Solvent Lines (Site 18)
- Nuclear Aerospace Research Facility (Site 19)
- Waste Water Collection Basins (Site 20)
- Jet Engine Test Stand (Site 21)

In addition to the above sites, the following study areas have been added as a result of a review of previous data and records and from on-site observations:

- Assembly Building/Parts Plant Perimeter
- East Parking Lot/Flight Line
- Underground Storage Tanks 19, 20, 24A, 24B, 25A, and 30 (removed)

Previous studies at AFP 4 concluded that activities at the locations (Figure 2) listed above may have placed contaminants into environmental pathways at the site. Following an extensive review of data generated during previous investigations, this Work Plan proposes the following to ensure that there is no risk to human health or safety and to ensure compliance with federal and state laws:

- Lateral and vertical limits of contamination at each site be determined.
- "Pathways" or mechanisms through which contamination might affect humans or the natural environment be identified.
- Assessments of risk or harm to health, safety, public welfare, and the environment from the current conditions at AFP 4 be prepared.
- If warranted by the conditions at AFP 4, a range of alternatives to reduce or eliminate the possible effects of contamination on humans or the natural environment be developed, screened, or evaluated.



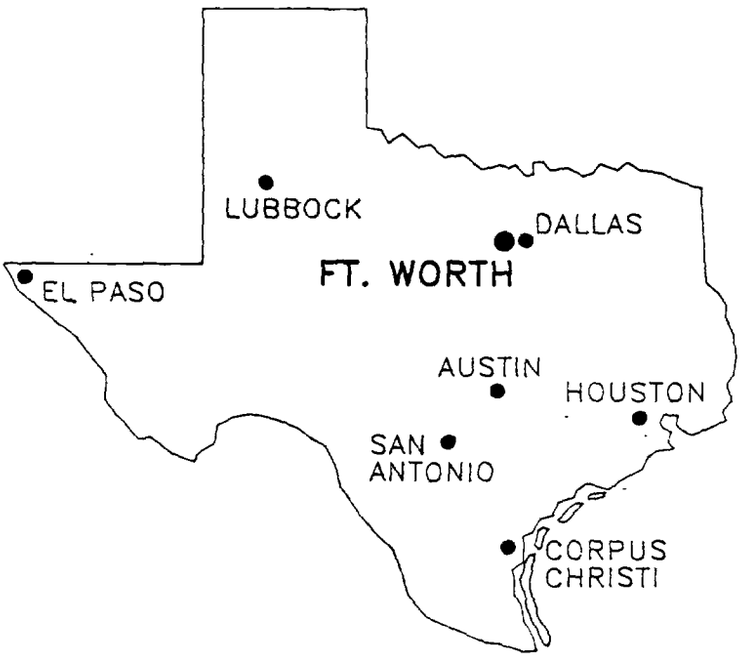


Figure 1 General Location of AFP4

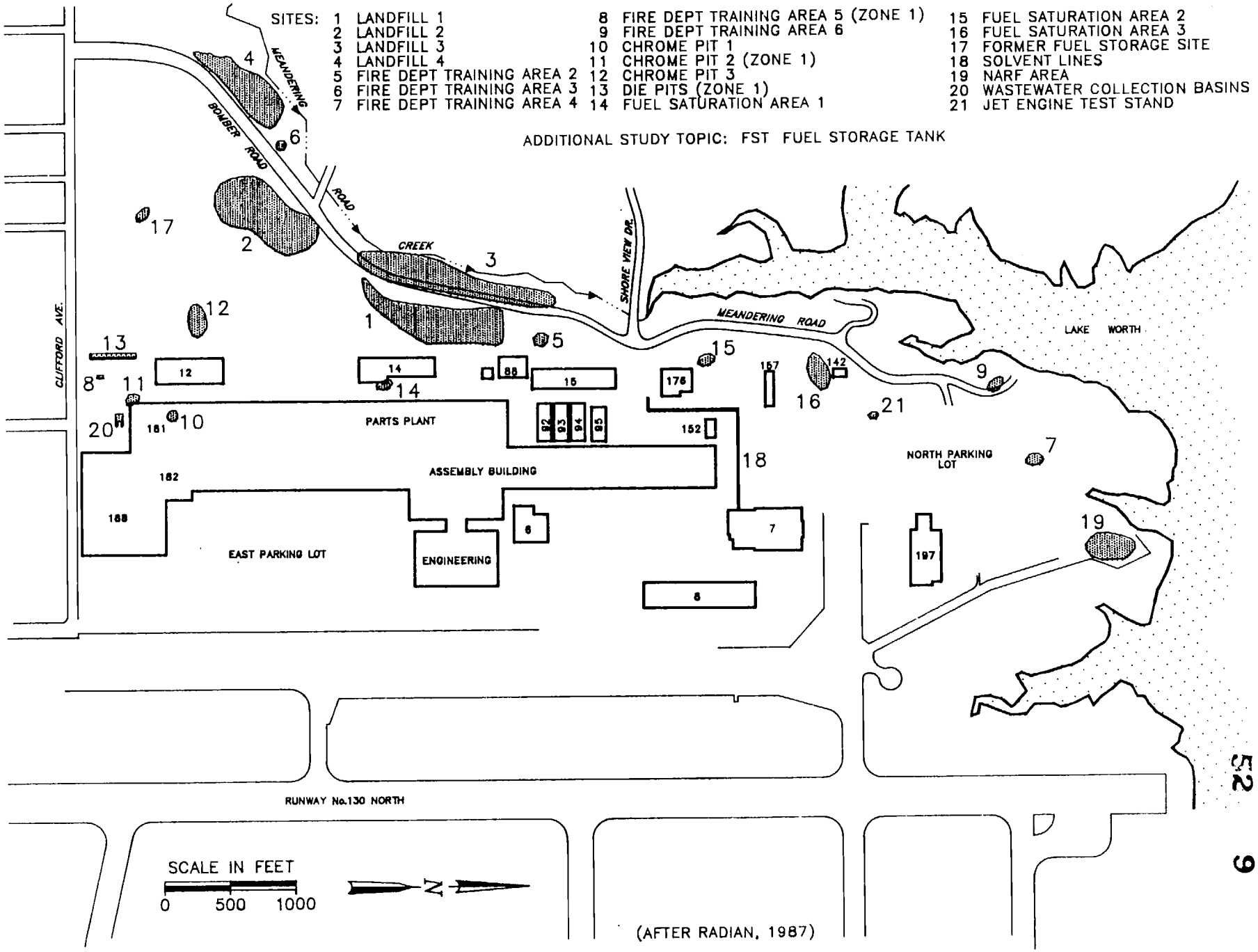


Figure 2. Phase I IRP Sites

- Impacts on humans and the natural environment of each of the remedial action alternatives for each site be assessed.

- Where data indicate that a site does not pose a threat to humans or the natural environment, "No Further Action" decision papers be prepared to document that additional RI/FS investigations aren't required.

This Work Plan incorporates the tasks required by the Remedial Investigation/ Feasibility Study (RI/FS) process which are applicable to AFP 4. These tasks will be conducted to satisfy the requirements of the following statutes:

- The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

- The National Contingency Plan (40 CFR Part 300)

- The National Environmental Policy Act (NEPA).

Individual work tasks are described in this document with respect to the rationale and overall approach to be used in completing the RI/FS process and reaching a Record of Decision (ROD). Ultimately, the objective is to obtain a "No Further Action" (NFA) decision on all former waste and spill sites at AFP 4 and removal of the facility from the federal Superfund National Priorities List (NPL). The criteria for which these NFA decisions are to be made will be based on satisfying any standard requirements, criteria, or limitations promulgated under Federal or State environmental laws that apply to AFP 4. These will include but not be limited to:

- The Safe Drinking Water Act [42 U.S.C. 30 et seq]

- The Toxic Substances Control Act [15 U.S.C. - 2601 et seq]

- The Clean Air Act [42 U.S.C. 7401 et seq]

- The Clean Water Act [33 U.S.C. 1251 et seq]

- The Solid Waste Disposal Act [42 U.S.C. 6901 et seq]

- Endangered Species Act [16 U.S.C. 1531 et seq]

- State laws which are more stringent than the equivalent Federal standard.

A more comprehensive list of applicable or relevant and appropriate requirements (ARARs) is presented in Appendix B, this document.

This plan, hereby designated Volume I: Work Plan, provides the overall plan for conducting the remedial investigation, feasibility study, and environmental assessment for AFP 4. Details of sampling and analysis, quality assurance, and health and safety tasks will be presented in the accompanying volumes:

- Volume II: Sampling and Analysis Plan
- Volume III: Quality Assurance Project Plan
- Volume IV: Health and Safety Plan

2.0 SITE BACKGROUND

2.1 LOCATION

AFP 4 is located in Tarrant County Texas, seven miles northwest of the City of Fort Worth (See Figure 1). AFP 4 occupies 602 acres and is bounded on the north by Lake Worth, on the east by Carswell Air Force Base, and on the south and west by the City of White Settlement.

2.2 SITE HISTORY

AFP 4 became operational in 1942 when Consolidated Aircraft began manufacturing the B-24 bomber for national defense during World War II. In 1953, General Dynamics took over operation of the manufacturing facility. Since 1953, AFP 4 has produced B-36, B-58, and F-111 aircraft, and currently produces F-16 aircraft. In addition to F-16 aircraft, General Dynamics produces spare parts, radar units, and missile components.

Manufacturing operations at AFP 4, have resulted in the generation of various hazardous wastes which include waste oils, fuels, spent solvents, paint residues, and spent process chemicals. Specific wastes at each site will be discussed in more detail in Section 5.0 of this plan. Throughout most of the plants history, waste oil, solvents, and fuels were disposed of at on-site landfills or were burned in fire training exercises. Chemical wastes were initially discharged to the sanitary sewer system which went to the City of Fort Worth treatment system. In the 1970s chemical process wastes were treated on-site at a newly constructed chemical waste treatment system prior to being discharged to the sanitary sewer system. Currently, waste oils and solvents are disposed of by a contractor and burning of these wastes has been discontinued. Chemical wastes continue to be treated on-site prior to discharge to the sanitary sewer system.

2.3 PREVIOUS INVESTIGATIONS

Potential contamination at AFP 4 was first noted by a private citizen in September, 1982. General Dynamics was notified and took immediate action. The source of the observed contamination was thought to be leachate from a landfill. In October, 1982, General Dynamics began construction of French Drain No. 1 to prevent migration of contaminated groundwater toward Meandering Road Creek and divert the flow of surface water from the outfall where the contamination was first noted.

In November, 1982, the USAF Aeronautical Systems Division, through General Dynamics, retained Hargis and Montgomery, Inc. to investigate the potential for groundwater contamination at AFP 4. Hargis and Montgomery drilled and constructed 12 monitor wells from November, 1982 to January, 1983 and submitted a summary report in February, 1983 (Hargis and Montgomery, 1983). From February, 1983 to March, 1985, Hargis and Montgomery and Hargis and Associates, Inc. drilled and constructed an additional 87 monitor wells during the second phase of the AFP 4 hydrogeologic assessment. From November, 1985 to March, 1988 an additional 36 monitor wells were constructed and 33 soil borings were drilled by Hargis and Associates. Results of these investigations are contained within several reports (Hargis and Associates, Inc., 1985a-c, 1987a-b, 1988a-b).

The IRP for AFP 4 was initiated in March 1984 when CH2M Hill conducted a Phase I Records Search (CH2M Hill, 1984). CH2M Hill ranked 20 identified disposal sites (Figure 2) in August, 1984 according to the USAF Hazard Assessment Rating Methodology (HARM).

The U.S. Army Corps of Engineers was retained in June 1985 to further delineate groundwater conditions along the southern base boundary and the East Parking Lot area of AFP 4. The Corps of Engineers drilled 28 soil borings and constructed 6 monitor wells (U.S. Army Corps of Engineers, 1986).

Radian Corporation was retained in September, 1985 to perform Phase II, Stage I, Confirmation/Quantification of the IRP. Radian drilled 11 soil borings and constructed 12 groundwater monitoring wells. Additional work included a confirmation sampling round of all existing monitoring wells. A summary report of field investigations performed during the IRP Phase II, Stage 1 Confirmation/Quantification studies was prepared (Radian, 1987).

In December, 1985, Intellus Corporation was contracted to conduct an IRP Phase IV Remedial Action Plan for ten potential disposal sites and Phase IV A Remedial Action Plan plus Phase IV B Design and Construction for Fuel Saturation Areas Nos. 1 and 3. In support of the tasks, Intellus Corporation drilled 12 soil borings and constructed 24 groundwater monitoring wells (Intellus Corporation, 1986a-b and 1987).

A Technical Review Committee (TRC) for AFP 4 was established in 1983. The TRC consists of representatives from the U.S. Environmental Protection Agency (EPA) Region VI, the Texas Water Commission, the City of Fort Worth, the City of White Settlement, the USAF, Army Corps of Engineers, and General Dynamics. Periodic TRC meetings have been held since 1983 to keep the local authorities and community informed of remedial investigations at AFP 4.

The activities described in this work plan are essentially a continuation of the previous IRP investigations. The information required to determine the extent of contamination, to determine the pathways to the human or natural environment, and to evaluate alternatives for remedial action was assessed based on previous investigations and current conditions at AFP 4. Where data gaps exist, additional data will be collected. In addition, public health assessments and feasibility studies for each remedial action will be completed. Finally an environmental assessment of the impacts of each remedial action alternative will be prepared.

3.0 ENVIRONMENTAL SETTING

3.1 PHYSIOGRAPHY

AFP 4 is located within the Western Cross Timbers Section and the Grand Prairie Section of the Central Lowlands Physiographic Province. Most of AFP 4 is within the Grand Prairie Section which is typically a broad, gently sloping terrace of sedimentary rock mantled by a thin layer of light brown to black loamy soil. The Grand Prairie Section is typically grass covered with isolated stands of upland timber.

The northwest corner of AFP 4 lies within the Western Cross Timbers Section which is characterized by rolling to hilly topography that is dissected into steep hills and deep ravines. This section is typified by sandy soils supporting a heavy growth of post oak and blackjack oak.

Topography at AFP 4 is generally flat except for areas adjacent to Meandering Road Creek. Elevations range from 590 feet along the shore of Lake Worth to approximately 670 feet mean sea level at the southwest corner of AFP 4.

3.2 METEOROLOGY

AFP 4 is located in north-central Texas which is characterized by a sub-humid climate with hot summers and dry winters. Mean annual precipitation is approximately 32 inches with the wettest months being May and September and the driest months being November and January.

3.3 GEOLOGIC SETTING

The geology of the AFP 4 area is characterized by a thin veneer of Quaternary age detrital alluvial deposits and fluvial terrace deposits overlying a sequence of Cretaceous sedimentary formations which in turn overlies a thick sequence of undifferentiated Paleozoic rocks. The Cretaceous sequence forms a broad homocline which dips gently southeastward toward the East Texas structural basin (Nordstrom, 1982). The undifferentiated Paleozoic rocks, which are unconformably overlain by the Cretaceous age rocks, are 6,000 to 7000 feet thick. The following sections briefly describe the geologic units of principle interest in the vicinity of AFP 4.

3.3.1 Surficial Deposits

The United States Department of Agriculture (USDA) Soil Conservation Service (SCS) has identified two soil types at AFP 4. Most of the surficial soils at AFP 4 are clayey soils of the Sanger-Purves-Slidell association. The second soil type, the Aledo-Bolar-Slidell association, occurs only in a thin strip along the northern boundary of AFP 4.

Detrital alluvial deposits and fluvial terrace deposits of Quaternary age crop out along stream valleys as a thin veneer overlying Cretaceous rocks. The deposits are generally unconsolidated and consist of poorly sorted to well-sorted clay, silt, sand, and gravel. Surficial deposits are found over the majority of AFP 4 but isolated discontinuities do exist.

3.3.2 Fredericksburg Group

The Cretaceous Fredericksburg Group in Tarrant County includes the Goodland Limestone and the underlying Walnut Formation. The group is part of the homoclinal sequence and dips uniformly to the southeast at approximately 0.4 degrees or 38 feet per mile.

3.3.2.1 Goodland Limestone

The Goodland Limestone in the area of AFP 4 consists of dense, thinly to massively bedded fossiliferous limestone interbedded with stiff clay and shale. The formation is extensively jointed and the top of the unit is highly weathered in places. The Goodland Formation has been removed by erosion in several areas at AFP 4. The maximum thickness observed at AFP 4 is approximately 47 feet. In other areas the Goodland Limestone ranges from 70 to 130 ft in thickness. The greatest thicknesses at AFP 4 occur beneath the western Radar Range and along Clifford Avenue.

3.3.2.2 Walnut Formation

The Walnut Formation member of the Fredericksburg Group is present beneath most of AFP 4. The Walnut Formation consists of indurated fossiliferous limestone and coquinite with thin interbeds of calcareous shale and clay.

The Walnut Formation crops out along the shoreline of Lake Worth and along Meandering Road Creek on the west side of AFP 4. The maximum measured thickness of the Walnut Formation at AFP 4 is 46 feet on the south side. Lithologic data indicate that the Walnut Formation is very thin and may be absent on the east side of the East Parking Lot. No faults or prominent fractures are known to occur in the Walnut Formation in the vicinity of AFP 4. In areas where the overlying Goodland Limestone has been removed, erosional channels exist in the top of the formation with intervening saddles. Two major erosional channels which are filled with alluvial deposits are located west of Facilities Building No. 14 near Landfills Nos. 1 and 3 and on the east side of AFP 4.

3.3.3 Trinity Group

The Trinity Group of Cretaceous age includes in descending order, the Paluxy Formation, the Glen Rose Formation, and the Twin Mountains Formation (also referred to as the Travis Peak Formation). The Trinity Group underlies the Fredericksburg Group in the homoclinal sequence.

3.3.3.1 Paluxy Formation

The Paluxy Formation is overlain unconformably by the Walnut Formation. The Paluxy Formation crops out over large areas northwest of Fort Worth and forms the bed of Lake Worth. The thickness of the Paluxy Formation at AFP 4 ranges from 133 to 175 feet as noted in monitoring well lithologic logs. In Tarrant County, the thickness ranges from 140 to 190 feet with an average thickness of 160 feet (Leggat, 1957).

The Paluxy Formation consists of two main units referred to as the upper Paluxy and lower Paluxy Formation. The upper Paluxy Formation consists

predominantly of fine-grained sandstone. On the east side of AFP 4, three distinct lithologic units comprise the upper Paluxy Formation. The uppermost unit is a clayey sandstone approximately 9 feet thick (the "upper sand"), followed by a 5 foot thick layer of silty claystone, and a third unit of very fine-grained sandstone approximately 8 feet thick.

The lower Paluxy Formation is thicker and generally coarser-grained than the upper Paluxy Formation. It consists of interbedded sand, clay, and shale. In some locations a clay layer divides the sand in the Lower Paluxy Formation into two distinct units. Where this occurs, the two sand units are referred to as the middle and lower Paluxy Formations.

3.3.3.2 Glen Rose Formation

The Glen Rose Formation member of the Trinity Group does not crop out in the vicinity of AFP 4. The Glen Rose is overlain conformably by the Paluxy Formation. The upper boundary of the Glen Rose Formation is defined as the first occurrence of a limestone unit below the Walnut Formation (Leggat, 1957). The top of the Glen Rose Formation was encountered in drilling at AFP 4 at depths ranging from 213 to 227 feet. Thickness of the formation is reported to be about 250 feet in the area of Lake Worth. The formation consists of limestone with some lenses of sand, clay, sandy clay, and anhydrite.

3.4 HYDROGEOLOGIC SETTING

The hydrogeologic units present in the vicinity of AFP 4 are, in descending order, the upper zone, the Walnut aquitard, the upper Paluxy aquifer (which includes the upper sand), the lower Paluxy Formation (including the middle and lower Paluxy aquifers) and the Twin Mountains aquifer (also referred to as the Travis Peak aquifer).

3.4.1 Upper Zone

The uppermost hydrogeologic unit at AFP 4 is referred to as the upper zone. This unit is an unconfined aquifer contained mainly within the Quaternary alluvium which is generally fine-grained in the upper portion grading into coarser material with depth. The base of the upper zone typically consists of sand and gravel. Hydraulic conductivity also increases with depth in the upper zone. The Goodland Limestone which directly underlies the upper zone sediments is sufficiently weathered to provide good hydraulic communication between the two units; for this reason, the base of the upper zone is defined as the top of the Walnut Formation (base of the Goodland Limestone) and includes the entire saturated zone.

Groundwater in the upper zone occurs as a perched water table, meaning that upper zone groundwater is not in fully-saturated hydraulic connection with underlying aquifers. Recharge to the upper zone is local with the majority coming from rainfall and infiltration from stream channels, drainage ditches, and leakage from water supply lines, sanitary sewers, and storm drains. Discharge from the upper zone occurs at various locations along Meandering Road Creek as seeps along the top of the Walnut Formation. Leakage from the upper zone into the Walnut Formation also accounts for some loss of water from the upper zone. There is no on-site use of the upper zone groundwater. In

other portions of Tarrant County, there is limited use of the upper zone water for irrigation and residential use.

Groundwater flow in the upper zone is influenced by the erosional surface of the underlying Walnut Formation, by vertical and lateral variations in hydraulic properties within the upper zone, and by proximity to areas of recharge and discharge. A more detailed analysis of the groundwater flow characteristics of the upper zone is presented in Section 4.2.3 of this plan, which presents a conceptual site model.

3.4.2 Walnut Aquitard

The Walnut Formation at AFP 4 acts as an aquitard between the upper zone and the Paluxy aquifers. This formation, which consists of limestones and shales having very low permeabilities, ranges in thickness from 0 to 46 feet with an average of 25 feet in the area of AFP 4. The top of the formation is an erosional surface, however, and isolated areas of the Walnut Formation are thin to missing resulting in upper zone sediments being unconformably in contact with the Paluxy Formation.

Groundwater movement in the Walnut Formation is mainly restricted to bedding planes in clay and shale lenses that separate the limestone beds. Drilling of the Walnut Formation during previous investigations has indicated that the limestone units are dry and that the uppermost Paluxy Formation is not fully saturated which supports the classification of the Walnut Formation as an aquitard in the area of AFP 4. Where the Walnut Formation is thin or absent, there is potential for communication between the upper zone and upper Paluxy aquifers. Cross sections that show the variable thicknesses of the Walnut Formation beneath AFP 4 are in Section 4.0 (see Figures 22 and 23). These cross sections were prepared as part of a conceptual site model.

3.4.3 Paluxy Aquifers

The Paluxy aquifer is an important source of potable groundwater in the Fort Worth area, and communities surrounding AFP 4 develop municipal supplies from the Paluxy. As a result of extensive pumping, water levels in the Paluxy have declined over the years. Due to the close proximity of AFP 4 to Lake Worth which is a recharge area for the Paluxy aquifers, water levels have not decreased as much at AFP 4 as in other areas of Tarrant County. Off-site pumping may influence the directions and rates of contaminant transport from AFP 4. This is discussed in more detail in Section 4.2.3 which presents results of site preliminary modeling.

The Paluxy Formation contains several distinct sand units separated by clay and shale layers in the AFP 4 area. Previously, the Paluxy Formation has been classified as four separate aquifers (Hargis and Associates, 1989). These included:

- The "upper sand" unit, a 10-foot thick sandstone unit of limited extent in the upper Paluxy Formation,

- The upper Paluxy aquifer, a 5- to 20-foot thick sandstone in the upper Paluxy Formation that is separated from the "upper sand" by a silty claystone unit,

- The middle Paluxy aquifer, a lower Paluxy Formation sandstone unit as thick as 60 to 70 feet, separated from the upper Paluxy aquifer by a 5 to 20-foot clay and shale layer and separated from the lower Paluxy aquifer by a similar clay and shale unit of undetermined thickness, and

- The lower Paluxy aquifer, also a lower Paluxy Formation sandstone unit that is, in some areas, in direct contact with the middle Paluxy aquifer.

In this work plan the entire Paluxy Formation will be classified as only two separate aquifers--the upper Paluxy aquifer and the lower Paluxy aquifer. The upper Paluxy aquifer will essentially be the upper Paluxy Formation and will include the "upper sand" unit and the unit formerly referred to as the upper Paluxy aquifer. The lower Paluxy aquifer will be the lower Paluxy Formation and will include what has formerly been referred to as the middle and lower Paluxy aquifers. This classification is motivated largely by a desire to be consistent with the established regional terminology which distinguishes between only an upper and lower Paluxy Formation.

3.4.3.1 Upper Paluxy Aquifer

The upper Paluxy aquifer includes one permeable sandstone unit that exists throughout the AFP 4 area. In the southeast area of the facility, a second sandstone unit, the "upper sand" is found above the main sandstone unit of the aquifer.

The "upper sand" unit ranges in thickness from zero to approximately 10 feet and consists of fine-grained sandstone. Cross sections presented in Section 4 (see Figures 21 through 23), show that the outer portions of the upper sand unit are dry whereas the central portion is saturated and exhibits confined hydraulic pressures. Such a condition is unusual, as one would typically expect a much flatter lateral hydraulic gradient in a relatively permeable sandstone unit. Previous studies have not resolved the uncertainties associated with the upper sand unit and its hydraulic characteristics are still unknown.

The main sandstone unit of the upper Paluxy aquifer ranges in thickness from approximately 5 to 20 feet. The unit is partially saturated throughout most of the AFP 4 area, exhibiting unconfined water levels that equal or slightly exceed those in the lower Paluxy aquifer. Groundwater elevations range from 595 amsl (approximate elevation of Lake Worth) on the northwest side of AFP 4 to 560 feet amsl on the southeast side of the facility. The flow direction is generally to the southeast toward the cities of White Settlement and Westworth. The close agreement between water levels in the upper Paluxy and the lower Paluxy suggest that the two aquifers are in good hydraulic connection across the clay and shale layer that separates them (see Section 4, Figures 22 and 23).

Recharge to the upper Paluxy is derived from Lake Worth in the vicinity of AFP 4. Recharge from leakage from the upper zone and outcrops northwest of AFP 4 is also likely. Discharge occurs mainly as withdrawals from municipal water supply wells with some leakage to the lower Paluxy also likely.

3.4.3.2 Lower Paluxy Aquifer

The lower Paluxy aquifer is separated from the upper Paluxy aquifer by a clay and shale layer that appears to be continuous throughout the AFP 4 area (see Section 4, Figures 22 and 23). The thickness of this aquitard varies from less than 5 feet to approximately 15 feet.

In some areas of AFP 4, the lower Paluxy is divided into two separate sandstone units by a clay and shale layer of variable thickness (Hargis and Associates, 1989). In other areas, it appears that the lower Paluxy is comprised of a simple sandstone strata. Previous investigations have not included an exploration of the lower sandstone unit in the lower Paluxy aquifer. Because the clay and shale layer is discontinuous, it is likely that hydraulic characteristics above and below the unit are similar.

Groundwater flow in the lower Paluxy aquifer is generally from the northwest to the southeast, essentially paralleling that in the upper Paluxy. Recharge is also derived from Lake Worth. Leakage from the overlying upper Paluxy aquifer is also a likely source of small amounts of recharge. Discharge occurs as withdrawals from municipal water supply wells.

3.4.4 Glen Rose Aquitard

Below the Paluxy aquifers are fine-grained limestone, shale, marl, and sandstone beds of the Glen Rose Formation. The thickness of the formation reportedly ranges from 250 to 450 feet (Radian, 1987). The relatively impermeable limestone acts as an aquitard restricting groundwater movement between the Paluxy Aquifer and the underlying Twin Mountains Aquifer.

3.4.5 Twin Mountains Aquifer

The Twin Mountains aquifer is a major water supply aquifer for the AFP 4 area. The formation consists of a basal conglomerate consisting chiefly of chert and quartz which grades upward into coarse-to fine-grained sand interbedded with shale. The formation occurs approximately 600 feet below AFP 4.

Recharge to the Twin Mountains aquifer occurs west of AFP 4 where the formation crops out. Flow is in an eastward downdip direction. Transmissivities in the Twin Mountains aquifer range from 1,950 to 29,700 gpd/ft and average 8,450 gpd/ft in Tarrant County (Radian, 1987). Hydraulic conductivities range from 8 to 165 gpd/ft^2 and average 68 gpd/ft^2 in Tarrant County (CH2M Hill, 1984). As with the Paluxy aquifers, the water levels have been steadily reduced over the years as a result of pumping for municipal water supplies.

3.5 SURFACE WATER

Surface water drainage at AFP 4 is mainly by storm drains and culverts which discharge to Lake Worth, the Meandering Road Creek, or a tributary of Farmers Branch of the West Fork Trinity River. Surface water drainage at AFP 4 is shown on Figure 3. Lake worth, which supplies drinking water to the City of Fort Worth, borders AFP 4 on the north. Meandering Road Creek which borders AFP 4 on the west drains into Lake Worth to the north. Meandering Road Creek is an ephemeral stream which receives storm runoff during periods of precipitation. The stream also receives groundwater discharge from the upper zone aquifer as evidenced by several seeps along the bank of the drainage.

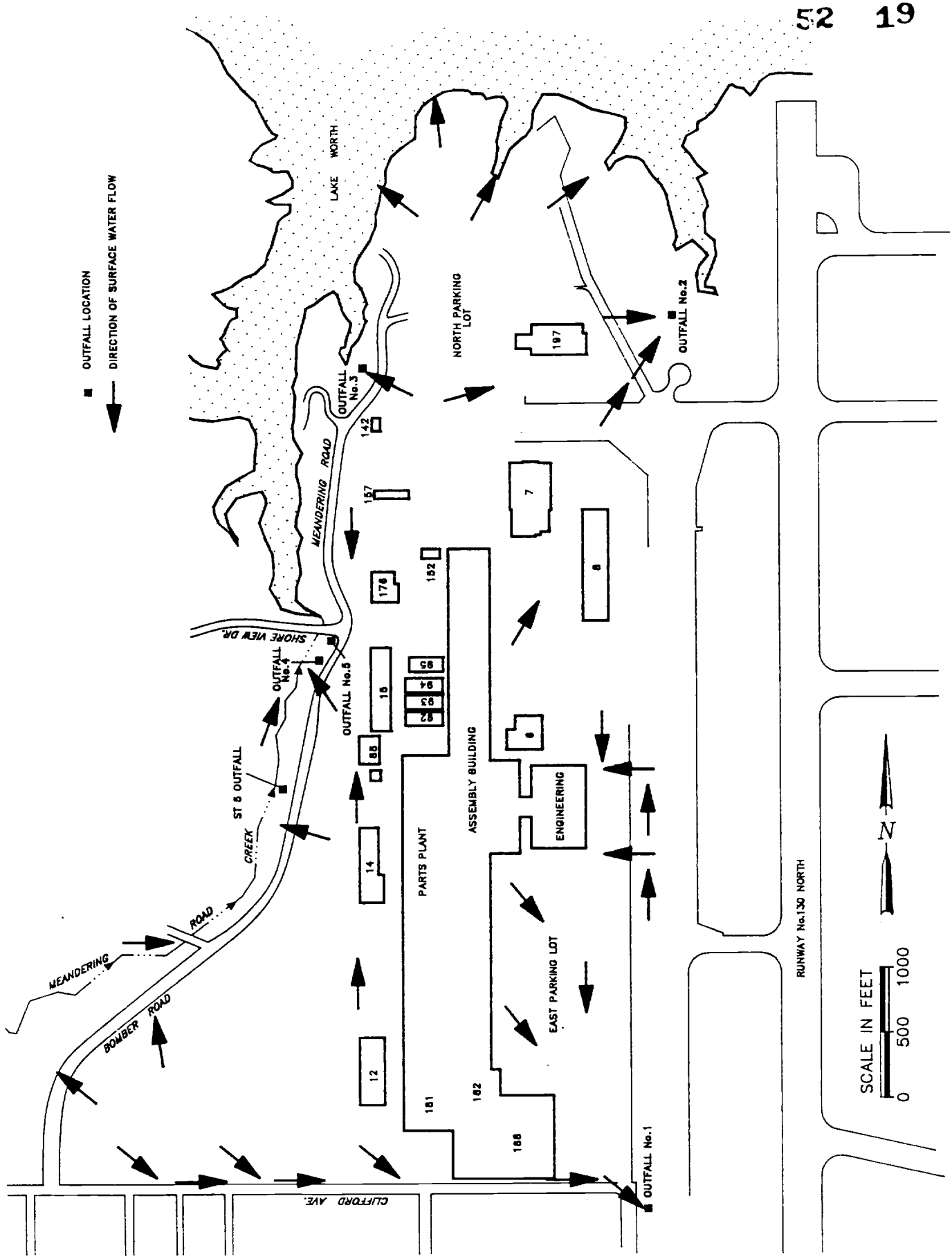


Figure 3. Surface Water Drainage at AFP4

4.0 CONCEPTUAL SITE MODEL

On the basis of all presently available data, the following conceptual site model has been developed to provide a preliminary understanding of the sources of contamination, the migration pathways of contaminants, and potential receptors of contaminants at or near AFP 4. This model is used to assess the adequacy of present information and the need for further investigations to provide data necessary for proper remedial action decisions. Where data gaps exist, the types, quality, and quantity of data to be collected are determined and the uses for the data are described. These additional data needs are described in detail in Section 5.0, Objectives and Rationale, of this plan. Table 1 provides a summary of the types of data previously collected for each potential hazardous waste site at AFP 4.

4.1 SOURCES OF CONTAMINANTS

The following describes the results of previous assessments of potential contaminant sources at AFP 4 that could pose a threat to the human population or the natural environment. Each site where potential contaminants have been identified is briefly described. AFP 4 currently generates an estimated 5,500 to 6,000 tons per year of waste oils, fuels, solvents, paint wastes, and spent process chemicals (CH2M Hill, 1984). Total waste quantities may have been greater during periods of peak aircraft production. For many years (30 +), most of the wastes were disposed of by burial in landfills, by burning, or by discharge into pits or the sanitary sewer system. In the early 1970s a chemical waste treatment plant was installed to treat process chemical solutions, rinse waters, and paint booth wastewater and solvents. Waste paints, and process cyanide solutions were disposed of by a contractor. Waste oils and fuels continued to be disposed of in landfills or burned in fire training exercises. From the late 1970s to the present, the burning of fuels for fire training has been phased out and waste oils and recoverable solvents have been disposed of by a contractor. Currently due to waste minimization efforts, off-site hazardous waste disposal requirements were less than 2500 tons in 1989.

4.1.1 Landfills

4.1.1.1 Landfill No. 1

From 1942 to approximately 1966, several types of hazardous and nonhazardous wastes were disposed of in Landfill No. 1, which is located west of Facilities Building No. 14. This site, which encompasses about 6 acres, is presently the site of the West Parking Lot (Figure 4).

The majority of the waste disposed of at Landfill No. 1 consisted of general refuse, rubble, plaster, lumber, and fill dirt. Potentially hazardous wastes were also disposed of in the landfill. These included drums of unspecified liquid wastes, solvents, thinners, and paint wastes from tank trucks, all of which were dumped in shallow pits. Oils and fuels were also dumped in pits and subsequently burned. Aerial photographs show that at least five separate pits were located within the landfill. Other suspected wastes include mercury and magnesium wastes, chromate sludges, and cyanide.

Table 1. Summary of Previous Investigations

1.1 Groundwater Investigations

Site	Monitoring Wells	Aquifer Tests	Groundwater Samples Analyses Performed	Groundwater Samples Contaminants Identified (Upper Zone/ Paluxy)
Landfill No. 1	12	6	VOCs. semi-VOCs, total fuel hydrocarbons, oil and grease, metals and cyanide	Solvents, fuel, oil and grease, As, Cd, Pb, Cr / Solvents (trace)
Landfill No. 2	5		VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals and cyanide	Fuel, oil and grease, Cr / N/A
Landfill No. 3	10	4	VOCs, semi-VOCs, total fuel hydrocarbons oil and grease, metals and cyanide	Solvents, fuel, oil and grease, Cr/ N/A
Landfill No. 4	3		VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals and cyanide	None detected / N/A
FDTA No. 2	6	3	VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals and cyanide	Solvents, fuel / N/A
FDTA No. 3	1		VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals and cyanide	None detected / N/A
FDTA No. 4	0			
FDTA No. 5	2	2	VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals and cyanide	Solvents, fuel / N/A
FDTA No. 6	0			
Chrome Pit No. 1	1		VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals	Solvents, Cr / N/A
Chrome Pit No. 2	2		VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals	Solvents (trace)/ N/A
Chrome Pit No. 3	9	2	VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals, cyanide	Solvents, fuel, oil and grease, Cr (also As, Cd, Cr, Mg, Se, Cn prior to remedial action) / none detected
Die Yard Chem. Pits	8	1	VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals, cyanide	Solvents, fuel, oil and grease, Cd, Ag, (also Hg, Cn prior to remedial action / N/A
FSA No. 1	6	4	VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals, cyanide	Solvents, fuel / solvents (trace), Pb, fuel
FSA No. 2	2	1	VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals, cyanide	Solvents (trace) / N/A
FSA No. 3	13		VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals, cyanide	Solvents, fuel / N/A
Former Fuel Storage	1		VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals, cyanide	None detected / N/A
Solvent Lines	4		VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals	None detected / N/A
NARF Site	0			
Wastewater Collection Basins	1		VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals, cyanide	Solvents / N/A
Jet Engine Test Stand	4		VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals, cyanide	Fuel / N/A
East Parking Lot/ Flightline	42	2	VOCs, semi-VOCs, total fuel hydrocarbons, oil and grease, metals, cyanide	Solvents, Cr / Solvents

VOCs analyzed by EPA Methods 601/602, 8010/8020, 624, and 8240
Semi-VOCs analyzed by EPA Methods 625 and 8270
Total Fuel Hydrocarbons analyzed by EPA Method 8015
Metals analyzed by EPA Methods 200 series (AA direct aspiration)
Oil and grease analyzed by EPA Method 413.1
Cyanide analyzed by EPA Method 9010

Table 1. Summary of Previous Investigations (Continued)

1.2 Surface Water Investigations

Site	Location	Analyses Performed	Contaminants Identified
Meandering Road Creek	Creek seep	VOCs, semi-VOCs, common ions, metals, total fuel hydrocarbons, oil and grease	Trans-1,2-DCE, TCE, toluene, MEK
	Radar Range seep	VOCs, semi-VOCs, common ions, metals total fuel hydrocarbons, oil and grease	Toluene
	Creek site C-1	VOCs, semi-VOCs, common ions, metals, total fuel hydrocarbons, oil and grease	None detected
	Creek site C-2	VOCs, semi-VOCs, common ions, metals, total fuel hydrocarbons, oil and grease	Trans-1,2-DCE, oil and grease
	Creek site C-3	VOCs, semi-VOCs, common ions, metals, total fuel hydrocarbons, oil and grease	Trans-1,2-DCE, toluene (trace), oil and grease
	Creek site C-4	VOCs, semi-VOCs, common ions, metals, total fuel hydrocarbons, oil and grease	Toluene, oil and grease
	Creek site C-5	VOCs, semi-VOCs, common ions, metals, total fuel hydrocarbons, oil and grease	Toluene, chloroform, bromodichloromethane, trans-1,2-DCE, 1,1,2-TCA, TCE, bromoform, oil and grease
	Outfall No. 4	VOCs, semi-VOCs, common ions, metals, total fuel hydrocarbons, oil and grease	Bromodichloromethane, chloroform
	St. 5 outfall	VOCs, semi-VOCs, common ions, metals, total fuel hydrocarbons, oil and grease	Trans-1,2,-DCE, TCE, MEK, toluene

1.3 Soil Investigations

Site	Soil Borings	Soil Samples Analyses Performed	Contaminants Identified
Landfill No. 1	5	VOCs, semi-VOCs, metals, oil and grease total fuel hydrocarbons, cyanide	Trichloroethylene, toluene, xylene, Di-n-butly phthalate, oil and grease, cadmium, cyanide
Landfill No. 2	2	VOCs, semi-VOCs, metals, oil and grease total fuel hydrocarbons, cyanide	Methylene chloride
Landfill No. 3	2	VOCs, semi-VOCs, metals, oil and grease total fuel hydrocarbons, cyanide	Chlorobenzene, dichloroethylene, tetrachloroethylene toluene and total fuel hydrocarbons
Landfill No. 4	0		
FDTA No. 2	2	VOCs, semi-VOCs, metals, oil and grease total fuel hydrocarbons, cyanide	Total fuel hydrocarbons
FDTA No. 3	0		
FDTA No. 4	0		
FDTA No. 5	2	VOCs, metals, total fuel hydrocarbons, ignitability	None
FDTA No. 6	10	VOCs, semi-VOCs, metals, oil and grease total fuel hydrocarbons, cyanide, PCBs, pesticides, MEK, xylene	Trichloroethane, bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, diethyl phthalate, napthalene and phenanthrene, total fuel hydrocarbons, oil and grease

Table 1. Summary of Previous Investigations (Continued)

1.3 Soil Investigations (continued)

Site	Soil Borings	Analyses Performed	Contaminants Identified
Chrome Pit No. 1	0		
Chrome Pit No. 2	2	VOCs, semi-VOCs, metals, oil and grease, total fuel hydrocarbons, cyanide	None
Chrome Pit No. 3	14	VOCs, semi-VOCs, metals, pesticides (3), herbicides (3),	Cyanide, diethyl phthalate, trichloroethylene, (all detected prior to excavation of pit; no contaminants detected after excavation)
Die Yard Chem. Pits	4	VOCs, semi-VOCs, metals, total fuel hydrocarbons, cyanide	Cyanide, methylene chloride, toluene, xylene, chlorobenzene, 1,2 dichlorobenzene, 1,3 dichlorobenzene, di-n-butly phthalate, trichloroethylene (additional in pit excavation - bis(2-ethylhexyl) phthalate, phenol)
FSA No. 1	1	metals, total fuel hydrocarbons, ignitability	Total fuel hydrocarbons
FSA No. 2	5	VOCs, metals, total fuel hydrocarbons, oil and grease, MEK, xylene	Total fuel hydrocarbons
FSA No. 3	0		
Former fuel storage	1	VOCs, semi-VOCs, metals, oil and grease, total fuel hydrocarbons, cyanide	Oil and grease, di-n-butyl phthalate, ethyl phthalate
Solvent Lines	1	Metals, oil and grease, MEK, xylene	None
NARF Site	4	Radionuclides (alpha, beta, and gamma)	None
Wastewater Collection Basins	0		
Jet Engine Test Stand	5	Metals, total fuel hydrocarbons, oil and grease	Total fuel hydrocarbons, oil and grease
East Parking Lot/	2	VOCs, metals	None
Flightline area	85 (test holes)	None	None

VOCs analyzed by EPA Methods 601/602, 8010/8020, 624 and 8240
semi-VOCs analyzed by EPA Methods 625 and 8270
Total Fuel Hydrocarbons by modified EPA Method 8015
Metals analyzed by EPA Methods 7000 series
Oil and grease analyzed by EPA Method 413.1
Cyanide analyzed by EPA Method 9010

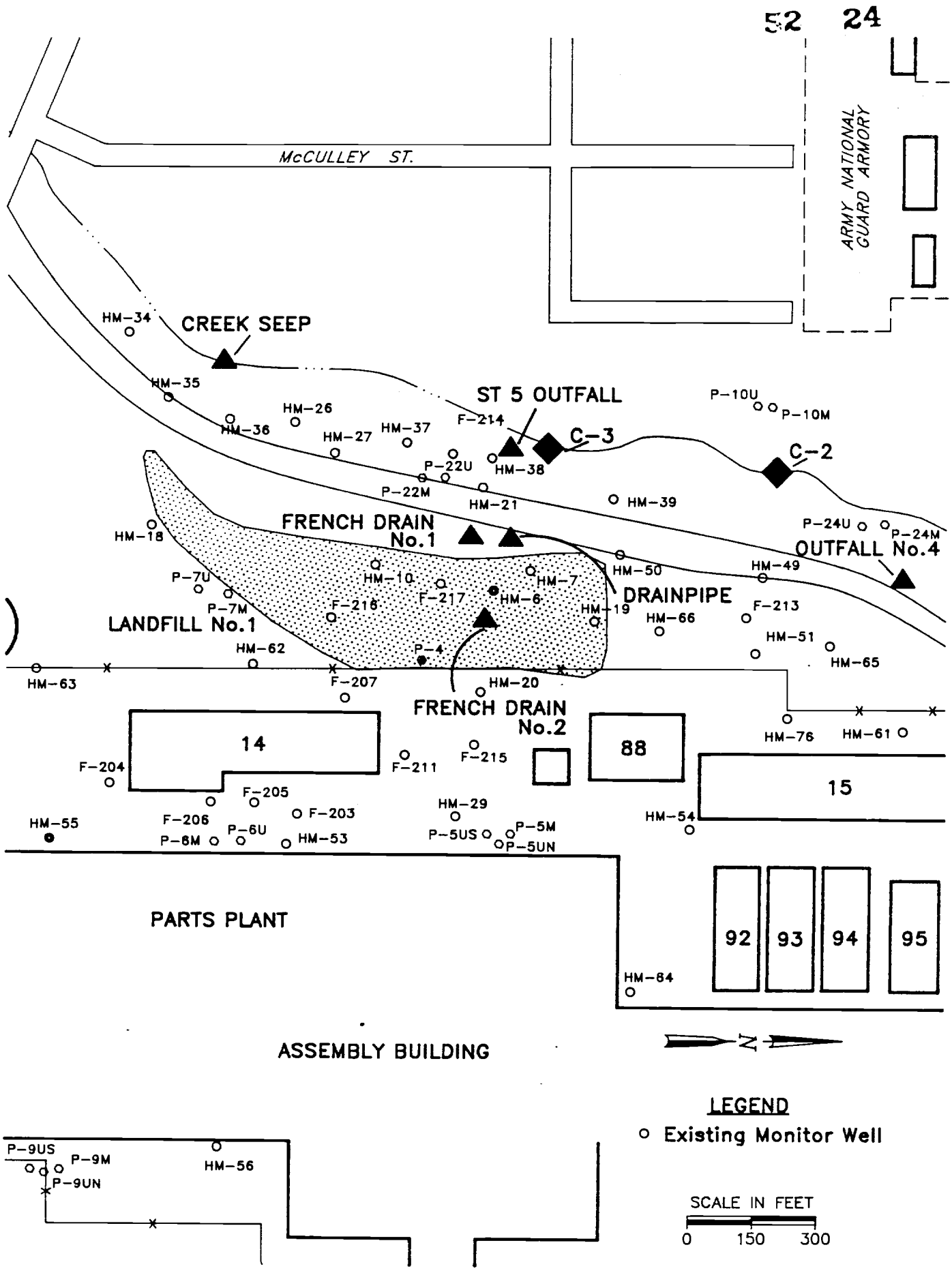


Figure 4. Location Map for Landfill No. 1

The landfill was closed in 1966 and the area was graded and paved for vehicle parking. Prior to the grading and paving, two 6-inch perforated pipes were laid on bedrock just east of Meandering Road. These were intended to channel leachate from the landfill to a storm water outfall. When contaminants were identified in water samples collected from a storm drain in 1982, the original perforated pipes were rerouted to a collection basin and French Drain No. 1 was constructed.

In 1983, a portion of the landfill was excavated and the material removed to an approved hazardous waste disposal facility as an interim remedial action. Within the excavation, a french drain was constructed to intercept contaminated groundwater. The excavation was then backfilled and the site repaved. Currently, groundwater is collected from French Drain No. 2 and placed in a cooling tower where the effluent is combined with the waste stream that is discharged to the Fort Worth sanitary sewer. The cooling tower is a National Pollution Discharge Elimination System (NPDES) permitted system and is analyzed monthly for VOCs in the waste stream.

On the basis of data from previous studies, the following contaminants with concentrations that exceed federal Maximum Contamination Limits (MCLs) have been reported to occur at Landfill No. 1:

Arsenic
Cadmium
Chromium
Lead
Acenaphthene
Benzene
Ethylbenzene
Fluoranthene
Tetrachloroethylene
Toluene
1,1,1-Trichloroethane
Trichloroethylene (TCE)
Vinyl Chloride

As evidenced by the above list of contaminants, the Landfill still contains oil and grease, waste solvents and process chemical wastes. The interim remedial actions have eliminated only a portion of the potential source area for these contaminants. A large portion of the Landfill still needs to be characterized for types and relative concentrations of buried contaminants.

4.1.1.2 Landfill No. 2

Landfill No. 2 includes approximately eight acres located west of Facilities Building No. 13 (Figure 5) in the northern portion of the Radar Range. The site was operational from the early 1940s to the early 1960s. The landfill was used for the disposal of construction rubble, plasters, lumber, and tires. There were no reports of hazardous materials being deposited in Landfill 2.

Results of previous investigations, which include soil borings and groundwater sampling, indicate that some of the shallow soils contain elevated concentrations of VOCs but no contaminants have affected the groundwater quality at or near the landfill. This site was previously recommended as a

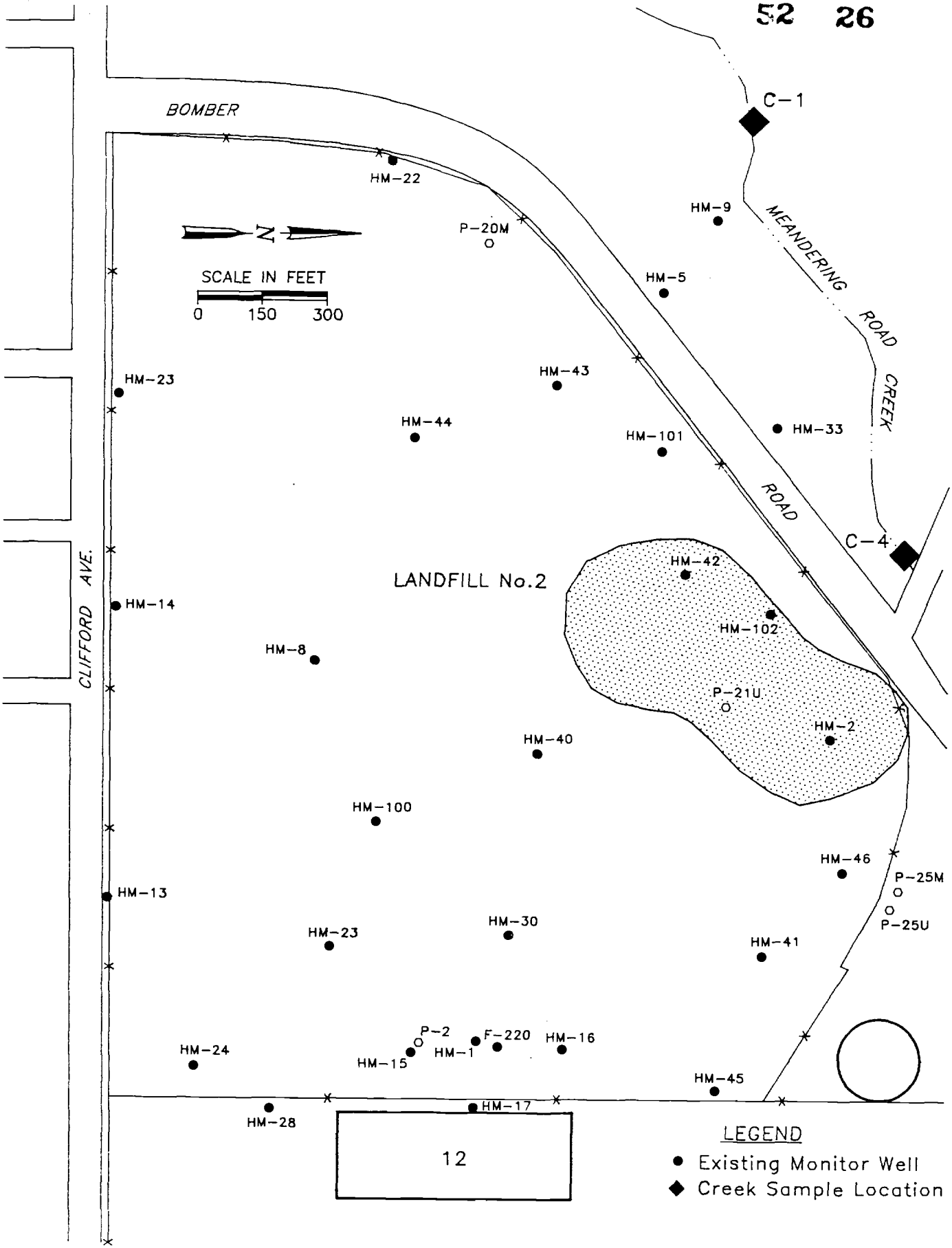


Figure 5. Location map for Landfill 2.

site which meets the criteria for the "No Further Action" remedial action alternative. Recent studies by Hargis and Associates (1989) indicate that the "No Further Action" remedial action alternative is appropriate.

4.1.1.3 Landfill No. 3

Landfill No. 3 encompasses approximately three acres west of Landfill No. 1 and adjacent to the Meandering Road Creek (Figure 6). The landfill was used from 1942 to 1945 for the disposal of a variety of wastes including hazardous liquid wastes consisting of mixed oils and solvents. Burning of some of these wastes was performed in small pits within the landfill. From 1945 to 1966, the landfill was inactive. Fill dirt and rubble was used to fill and grade Landfill No. 3 from 1966 to 1967.

Results of soil sampling from soil borings and groundwater sampling from monitoring wells show that the soils contain anomalous concentrations of VOCs and petroleum hydrocarbons and the groundwater is contaminated with cyanide, metals, VOCs, semi-VOCs, fuel hydrocarbons, and oil and grease. Two monitoring wells in the landfill contain a large amount of fuel-related floating product and solvent-related free product. The following is a list of contaminants observed which exceed federal MCLs:

arsenic
chromium
lead
Vinyl chloride
methylene chloride
trans-1,2-dichloroethylene
trichloroethylene
tetrachloroethylene
toluene
1,4-dichlorobenzene
1,2-dichlorobenzene
acenaphthene
naphthalene
fluorene
phenanthrene

Due to the presence of a significant amount of floating product observed in two wells at the landfill, a localized source of fuel-related and solvent-related contaminants is indicated within the landfill. The major contaminants appear to be confined to a relatively small area within the landfill.

4.1.1.4 Landfill 4

Landfill No. 4 is located near the southwest boundary of the AFP 4 facility (Figure 7). This landfill occupies approximately two acres of land west of Meandering Road. Landfill 4 utilized a low area adjacent to Meandering Road Creek for the disposal of construction rubble from 1956 to the early 1980s. Evidence (Radian, 1987) suggests that other types of wastes may have been disposed of from 1966 until approximately 1973. These wastes are thought to have included small quantities of hazardous wastes such as solvents, oils, fuels, and thinners.

VOCs and other organic compounds were reported during interviews (CH2M Hill, 1984) but were not confirmed in subsequent field investigations. On the basis of IRP Phase II investigations, a "No Further Action" remedial action alternative was recommended.

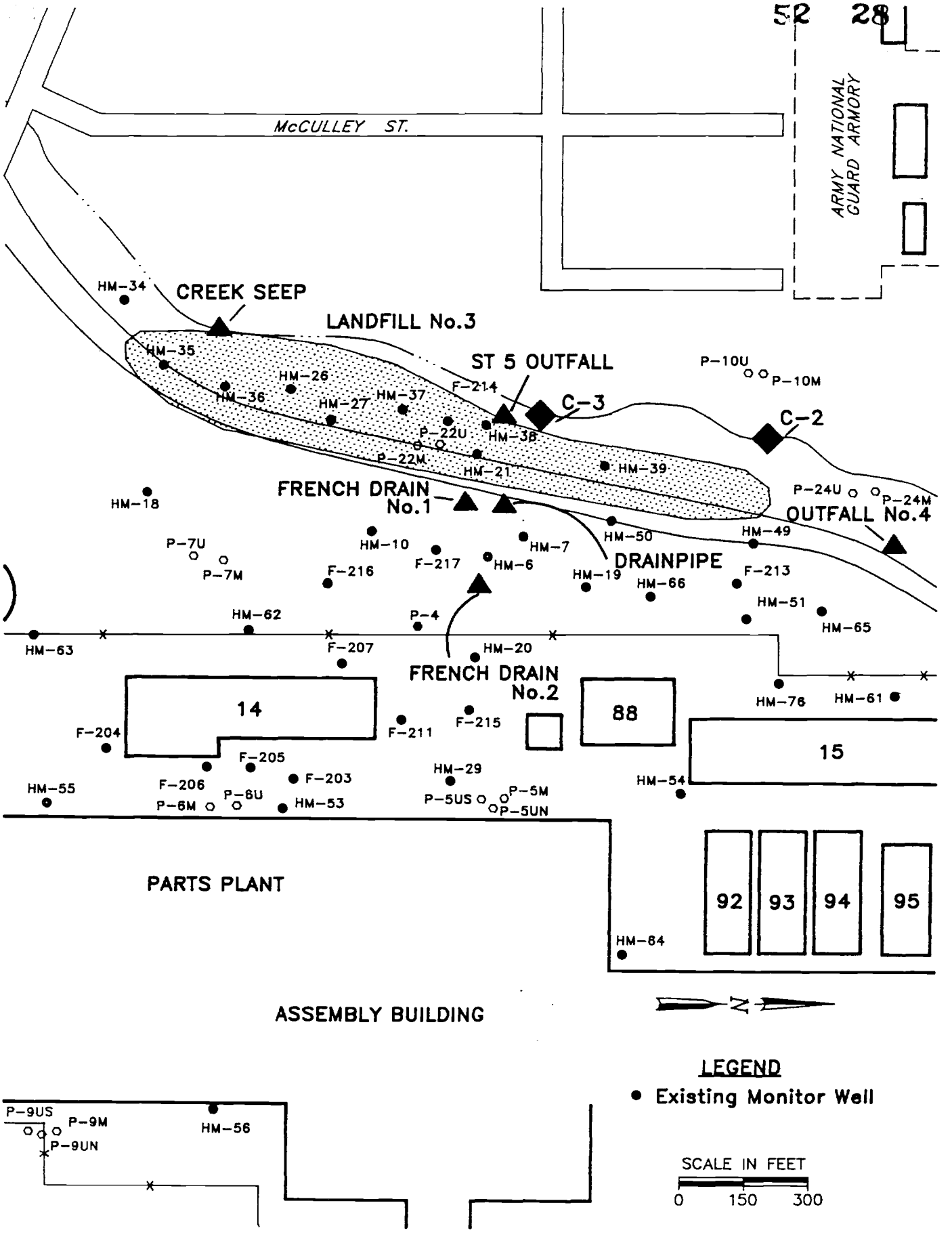


Figure 6. Location map for Landfill No. 3.

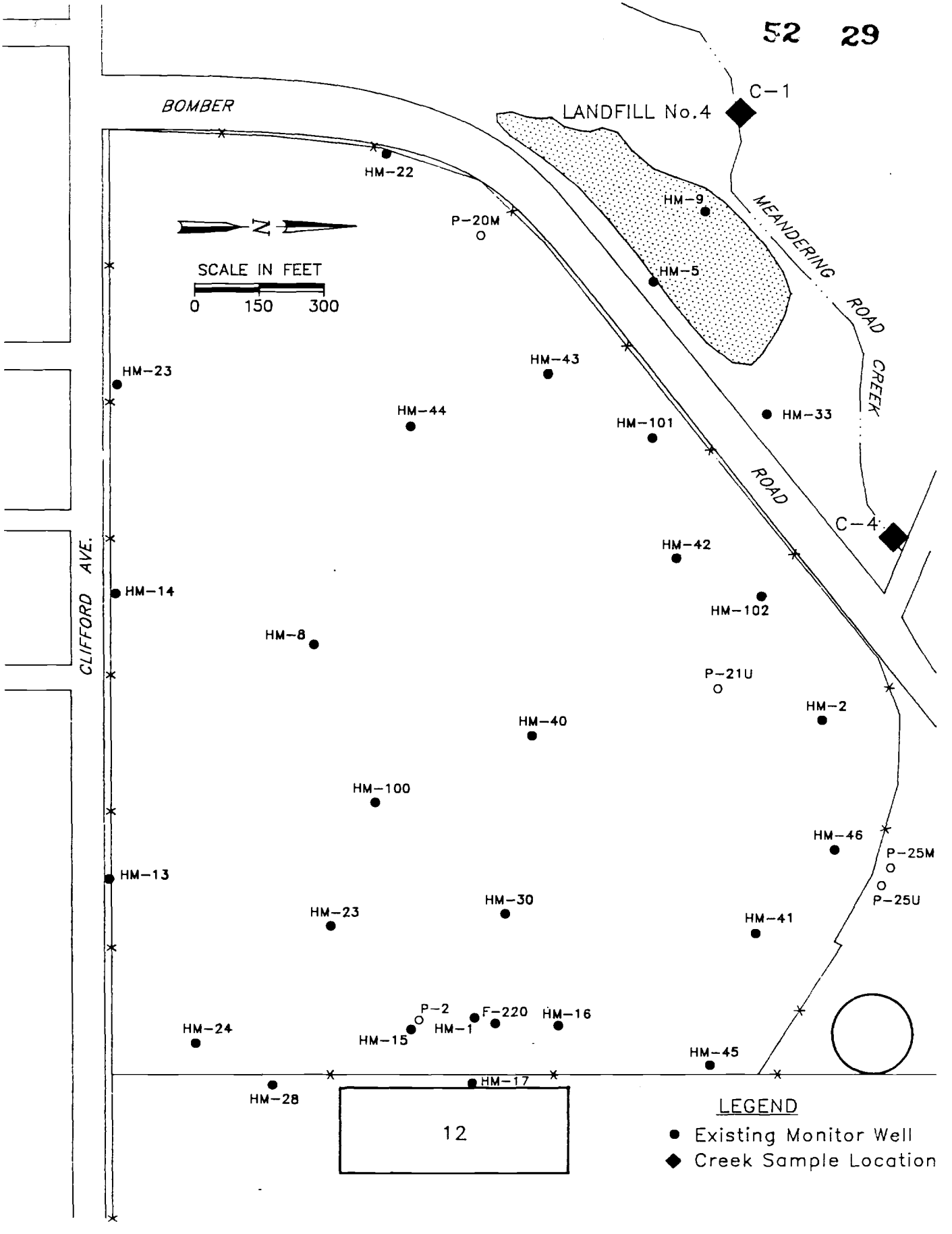


Figure 7. Location map for Landfill No. 4

4.1.2 Fire Department Training Areas (FDTAs)

4.1.2.1 FDTA No. 2

FDTA No. 2 is a 50-foot diameter earthen ring located north of Landfill No. 1 (Figure 8). This location was used for fire training exercises from 1955 to 1956. Exercises were held twice a year with approximately 250 gallons of waste oils and fuels used for each exercise. It was suspected that disposal of oils and fuels and uncontrolled burns may have been more frequent (CH2M Hill, 1984). This site is located under the pavement in the west employee parking lot.

Both soil and groundwater analyses indicate that fuel-related contamination is present at FDTA No. 2. Groundwater collected from the center of FDTA No. 2 was found to contain contaminants which indicate that solvent-related free product is present. The contaminants at FDTA No. 4 that exceed federal standards are as follows:

Trichloroethylene
Dichloroethylene
Toluene

4.1.2.2 FDTA No. 3

The FDTA No. 3 was reportedly located northeast of Landfill No. 4 (Figure 9) but the exact location could not be determined since it was not visible on historical aerial photographs (Radian, 1987). Like the other FDTA areas, approximately 250 gallons waste fuels and oils were reportedly used per exercise during the mid-1960s.

One monitoring well is located in the center of the reported location of the fire training area. Analytical results indicate that no contaminants are present in groundwater near the FDTA and based on the results of the IRP Phase II investigation, a "No Further Action" remedial action alternative was recommended (Radian, 1987).

4.1.2.3 FDTA No. 4

The exact location of FDTA No. 4 could not be determined since it was not visible on historical aerial photographs. The location is reportedly in the northern portion of AFP 4 at a location known locally as "Tater Hill" (See Figure 2). Routine training exercises were reportedly conducted at FDTA No. 4 during the late 1960's. Each training exercise used approximately 250 gallons of waste oils and fuels.

A soil gas survey was performed in the area thought to contain FDTA No. 4. No positive results for hydrocarbons were noted during the survey. Interviews with fire department personnel with 20 to 30 years experience at AFP 4 resulted in doubts as to whether the FDTA No. 4 location ever existed. Based on the results of the IRP Phase II investigation, the site was recommended for a "No Further Action" remedial action alternative.

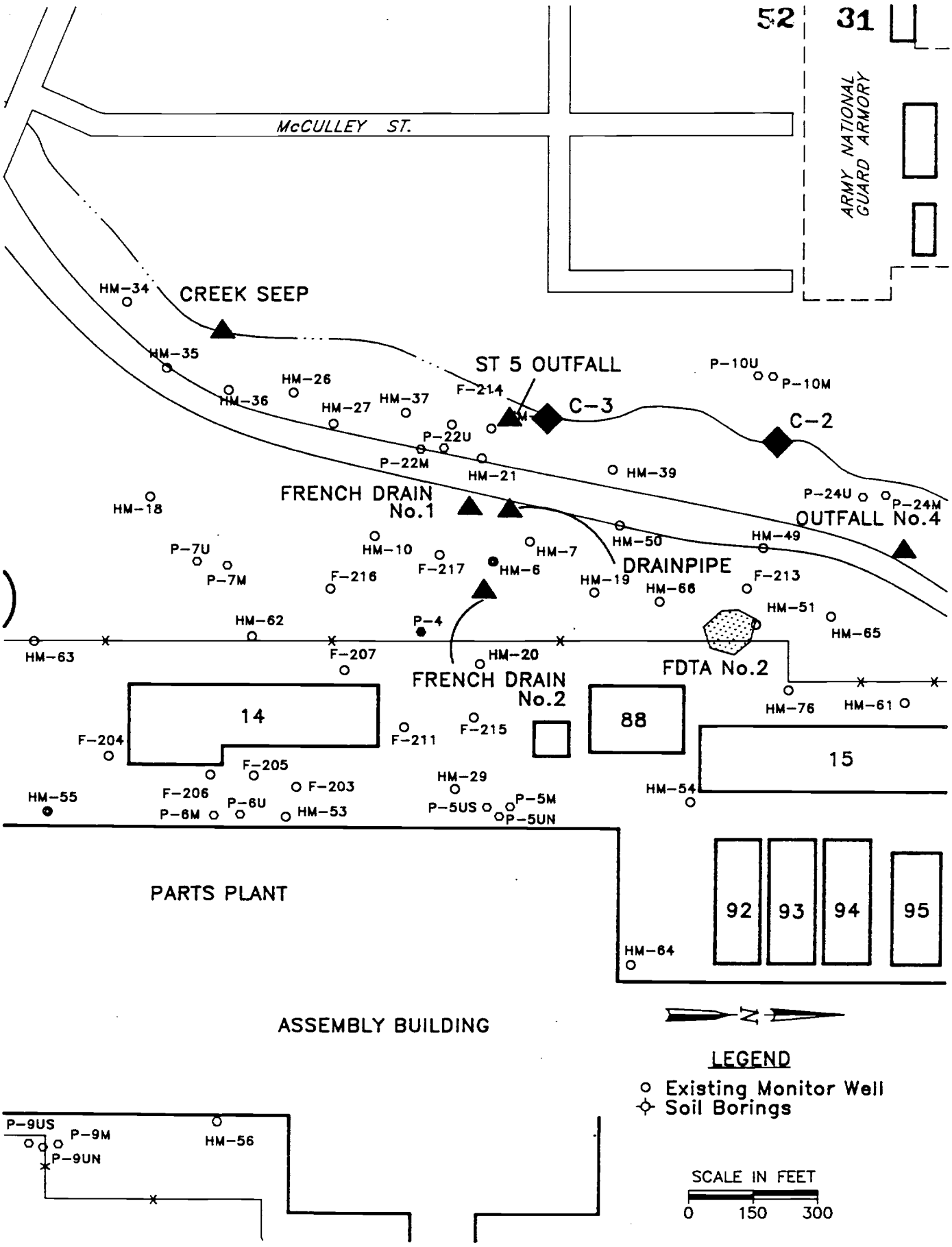


Figure 8. Location map for FDTA No. 2

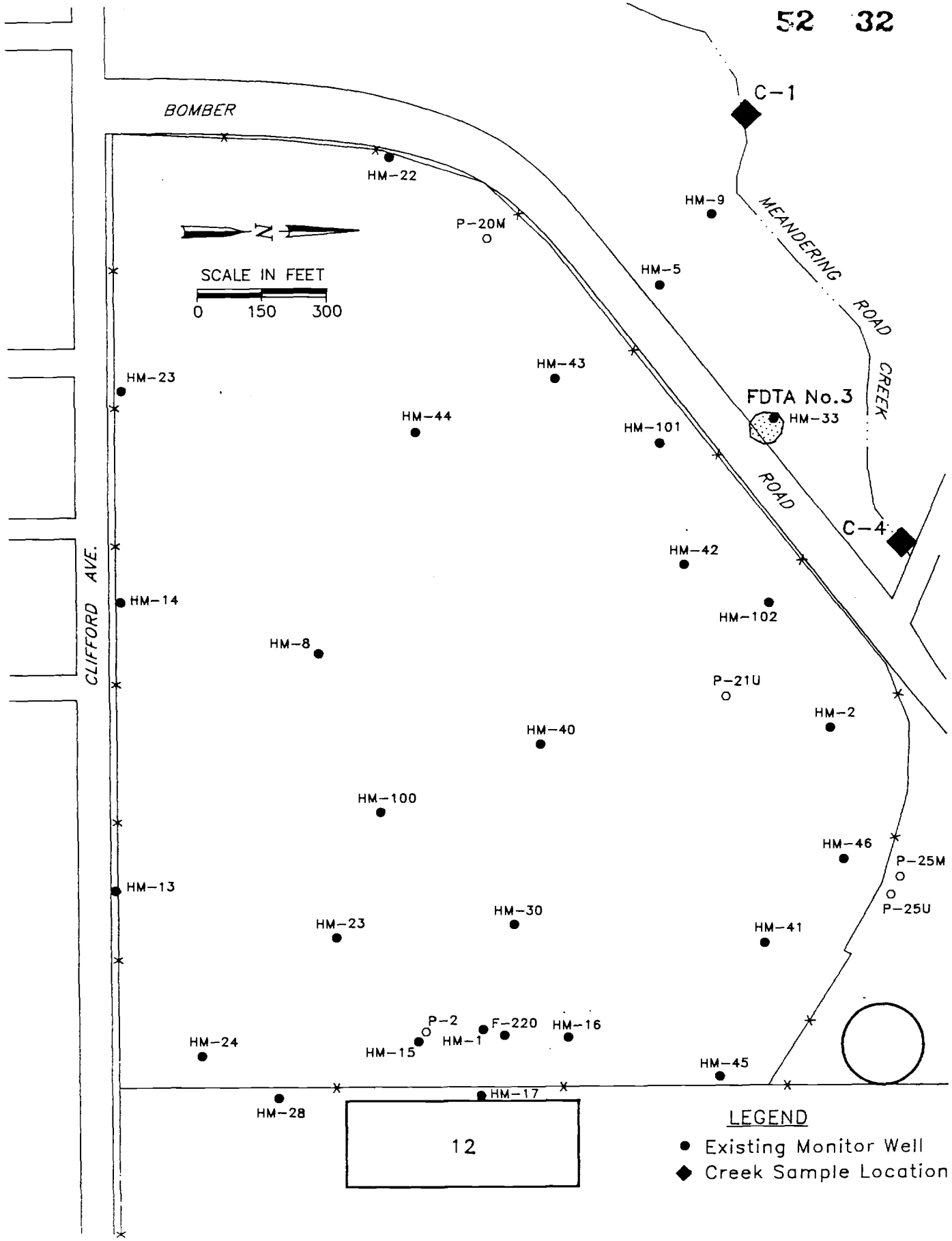


Figure 9. Location map for FDTA No. 3

4.1.2.4 FDTA No. 5

FDTA No. 5 is located in the die yard area south of Facilities Building No. 12 (Figure 10). This site consisted of a shallow pit measuring approximately 10 feet by 20 feet. Waste fuels, oils, and unspecified chemicals were deposited in this pit for fire extinguisher training exercises during the mid-1960s.

Analytical results from soil samples collected from two soil borings during a previous investigation indicated that the shallow soils do not contain significant concentrations of contaminants. Groundwater samples, however, contained VOCs, semi-VOCs, and fuel hydrocarbons. Fuel-related product was observed in one monitoring well in the vicinity of FDTA No. 5. Arsenic was also present in concentrations above drinking water standards from monitoring wells at FDTA No. 5.

4.1.2.5 FDTA No. 6

FDTA No. 6 is located on the northwestern side of AFP 4, adjacent to Meandering Road (Figure 11). This site was the primary fire department training area from the late 1950s to 1980. FDTA No. 6 consisted of a 50-foot diameter gravel-lined ring that was approximately 2 feet deep and surrounded by an earthen berm (Hargis & Montgomery, 1983). Before 1970, training exercises were conducted twice a year and after 1970, exercises were conducted at monthly intervals (Radian, 1987). Approximately 250 gallons of waste fuels and oils were reportedly used for each exercise. The IRP Phase I report (CH2M Hill, 1984) also indicated that unknown quantities of fuels and oils were likely deposited in FDTA No. 6 between exercises.

Analytical results of previous investigations indicate that the soils around the FDTA are contaminated with VOCs, semi-VOCs, fuel hydrocarbons, and oil and grease. Although no groundwater samples have been collected in the immediate vicinity of FDTA No. 6, it is suspected that no upper zone groundwater exists in the area of the FDTA. The following is a list of contaminants identified at FDTA No. 6 :

Fuel-related hydrocarbons
oil and grease
trichloroethane
bis(2-ethylhexyl)phthalate
di-n-butyl phthalate
diethyl phthalate
naphthalene
phenanthrene

4.1.3 Process Waste Disposal Sites

4.1.3.1 Chrome Pit No. 1

The actual location of Chrome Pit No. 1 could not be accurately determined from previous investigations. The pit is located somewhere under the southern end of the Parts Plant. Miscellaneous liquid and solid chemical wastes, in addition to chrome wastes were thought to have been disposed of in Chrome Pit No. 1 in the early 1940s.

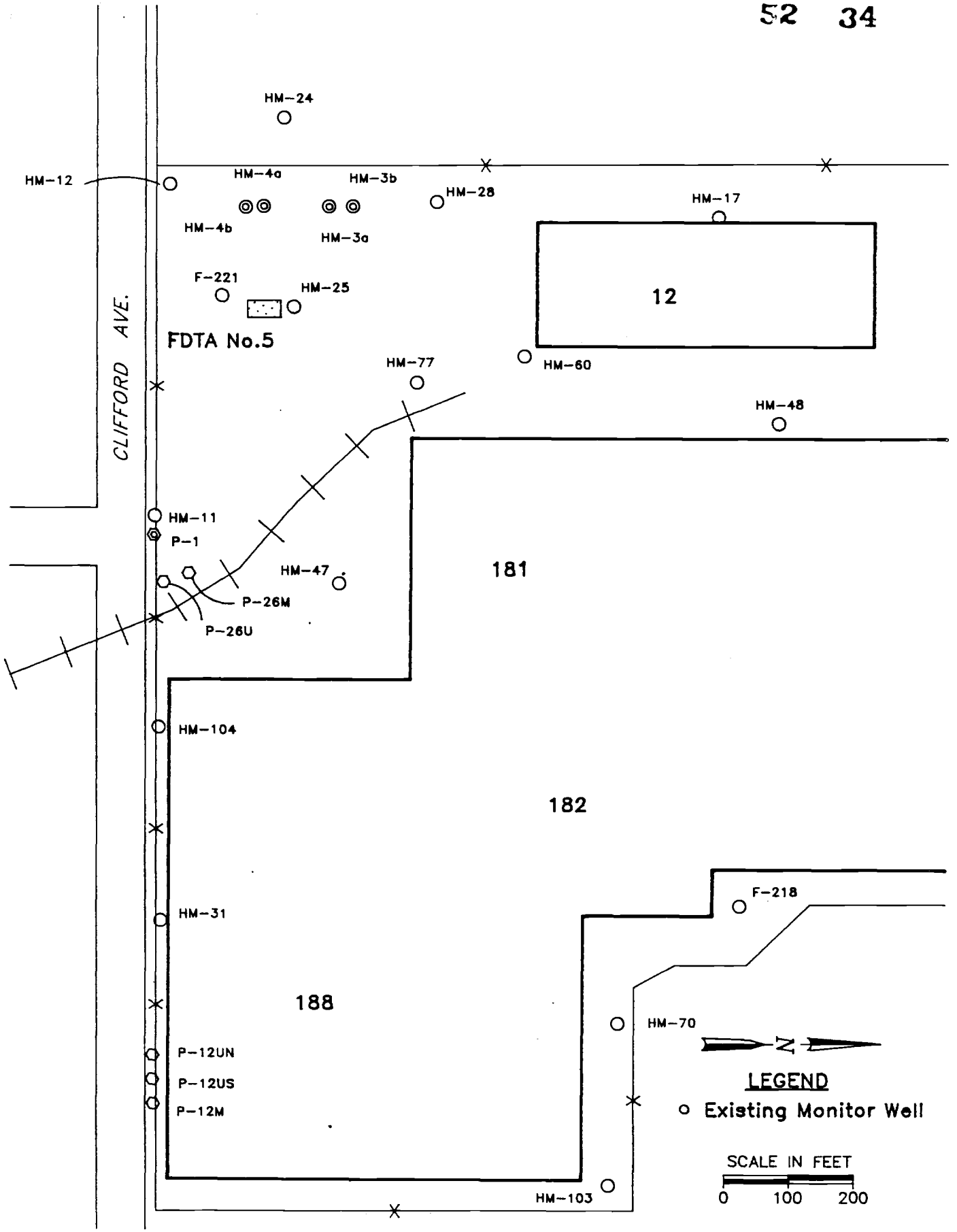


Figure 10. Location map for FDTA No. 5

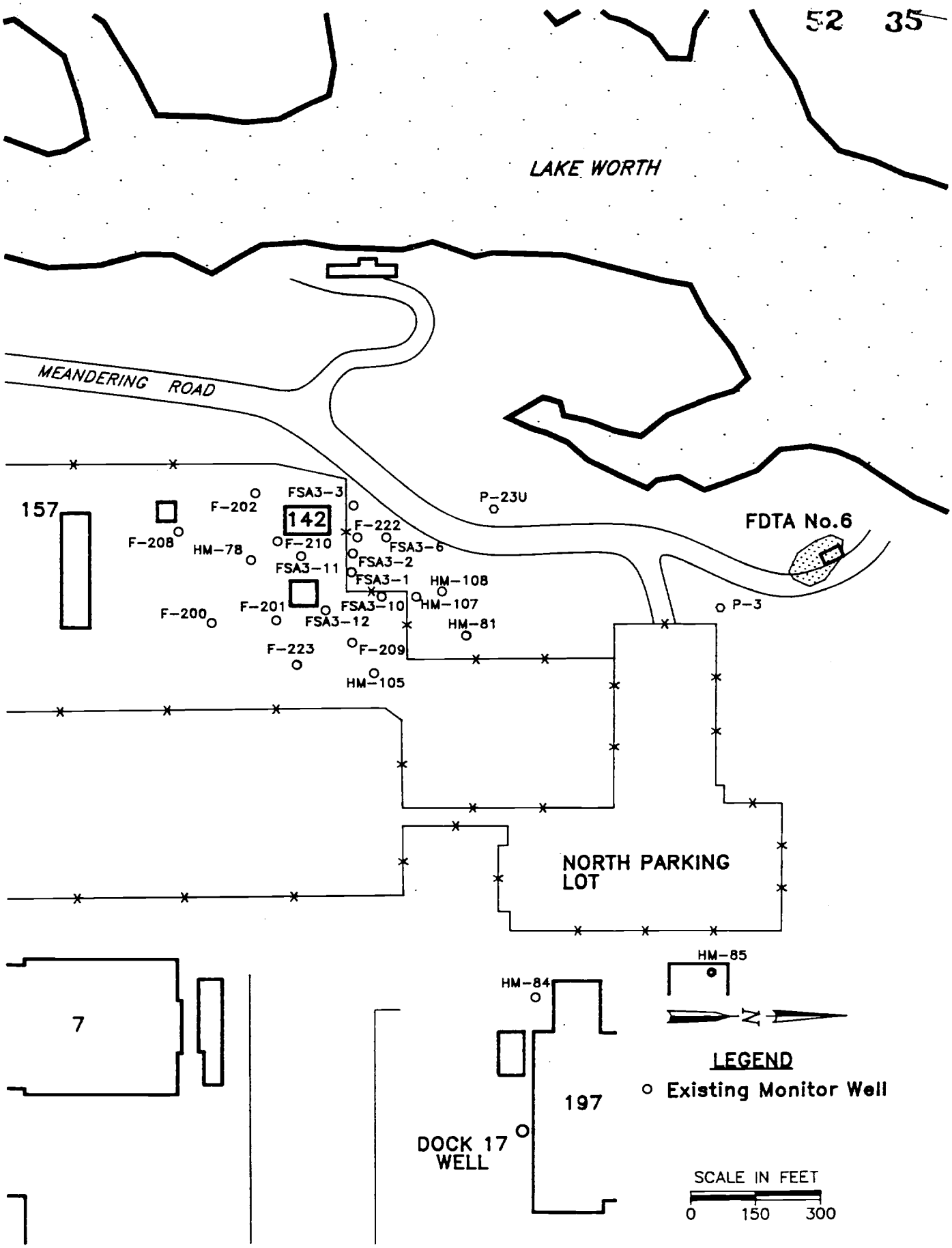


Figure 11. Location map for FDTA No. 6

One monitoring well is present near what would be the western side of the Chrome Pit. Although groundwater from this well contains elevated concentrations of trichloroethylene, the well is upgradient from the site. Therefore, no data have been collected to confirm the presence or absence of contaminants related to Chrome Pit No. 1. Analytical results from other Chrome Pits at AFP 4 may be used to give an indication of the potential contaminants at Chrome Pit No. 1.

4.1.3.2 Chrome Pit No. 2

Chrome Pit No. 2 is reportedly located near the southwest corner of the Parts Plant (See Figure 2), although the exact location could not be determined from interviews and review of aerial photographs (CH2M Hill, 1984). According to the Phase I study report, miscellaneous liquid and solid wastes, in addition to chromate solutions, were likely disposed of in Chrome Pit No. 2 during the mid-1940s.

Soil samples and groundwater samples collected in the vicinity of the reported location of the chrome pit showed that the soils did not contain contaminants whereas the groundwater contained elevated concentrations of metals and VOCs. The only contaminant in groundwater near Chrome Pit No. 2 which exceeded federal standards was trichloroethylene (TCE).

4.1.3.3 Chrome Pit No. 3

Chrome Pit No. 3 is located on the Radar Range west of Facilities Building No. 12 (Figure 12). The pit measured 66 feet by 165 feet by 15 feet deep. This pit was used for the disposal of chromate, barium-chromate sludge, dilute metal solutions, and drums of unidentified liquids from 1957 to 1973.

From December, 1983 through January, 1984, approximately 8,900 cubic yards of contaminated soil was excavated and removed from the chrome pit as an interim remedial action. Analytical results of samples collected during the excavation indicate that the greatest concentrations of contaminants were removed. However, some contaminants may remain in the soils and groundwater adjacent to the excavated portion of the pit.

Analytical results from soil and groundwater samples collected in or near the pit indicate that the following contaminants were present in concentrations exceeding federal standards:

- Diethyl phthalate
- Trichloroethylene
- Bis(2-ethylhexyl)phthalate
- Cyanide
- Chromium

4.1.3.4 Die Yard Chemical Pits

The die yard chemical pits are located east of the Radar Range and south of Facilities Building No. 12 (Figure 13). Three pits, measuring approximately 20 feet by 90 feet, were used from 1956 to 1962 for the disposal of chromate sludges, metal solutions, and other chemical wastes. In 1962, the site was graded and the entire die yard was paved. Based on the Phase I investigation

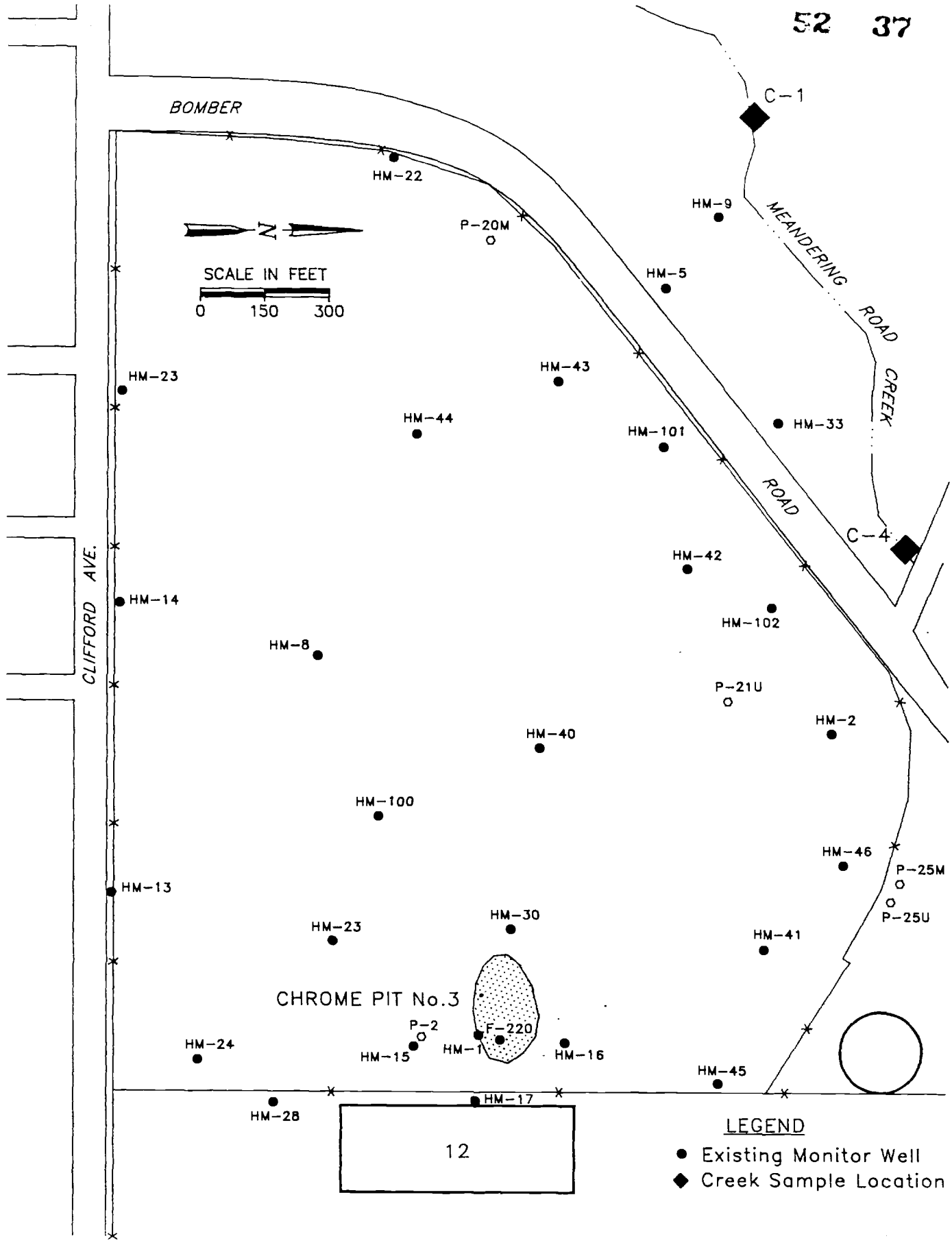


Figure 12. Location map for Chrome Pit No. 3

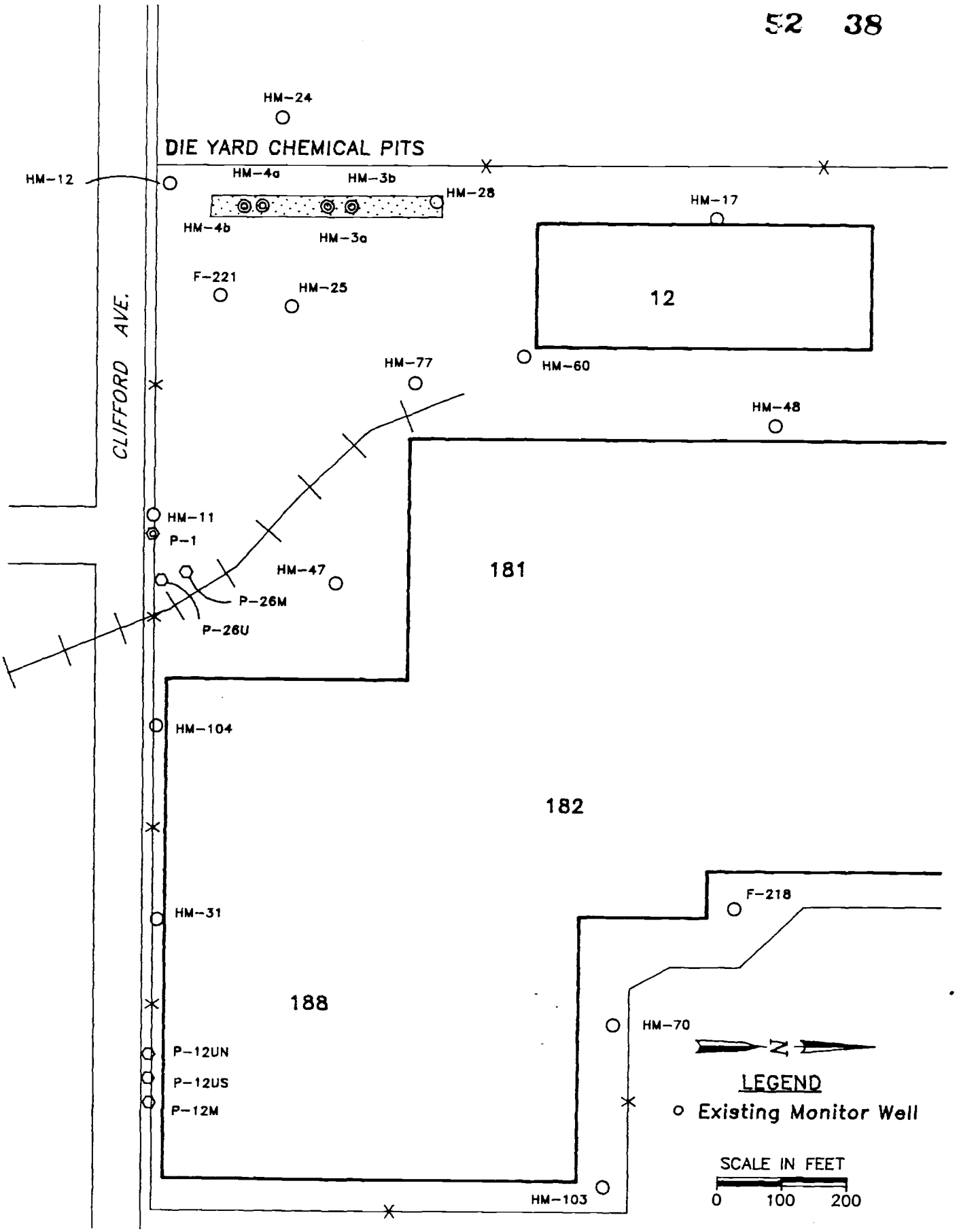


Figure 13. Location map for the Die Yard Pits

by CH2M Hill (1984), it is suspected that contaminated soils from the pits may have been spread around the die yard during the leveling and grading activities. The site of the original pits was excavated and 1,100 cubic yards of contaminated soil were removed and transported to an approved hazardous waste landfill for disposal as an interim remedial action. Although the majority of the contaminants were thought to have been removed, sampling of surrounding soils was not performed at the time of the interim remedial action.

On the basis of previous investigations, the following contaminants exceeding federal standards were present in the Die Yard chemical pits:

- Trichloroethylene
- Methylene chloride
- Toluene

4.1.4 Fuel Spill Areas

4.1.4.1 Fuel Saturation Area No. 1

The Fuel Saturation Area No. 1 (FSA No. 1) is located just west of the parts plant and east of Facilities Building No. 14 (Figure 14). The ground at this location reportedly became saturated by fuels from leaking fuel lines from the mid-1970s to the early 1980s. The saturated area is immediately north of underground fuel tanks and a fuel pumping station.

Analytical results from soil samples collected from one soil boring at the site indicate that the soils are contaminated with fuel-related hydrocarbons. Groundwater collected from monitoring wells in the FSA No. 1 area also contained anomalous concentrations of VOCs, semi-VOCs, fuel-related hydrocarbons, and metals. Four of the monitoring wells have fuel-related floating product. General Dynamics is currently preparing designs for a groundwater treatment system to recover the floating product.

Contaminants identified at the FSA No. 1 site which exceed federal standards are as follows:

- Benzene
- Ethylbenzene
- Toluene
- Trichloroethylene
- Chromium

4.1.4.2 Fuel Saturation Area No. 2

Fuel Saturation Area No. 2 (FSA No. 2) is located northwest of Facilities Building No. 176 (Figure 15) in the northwestern portion of AFP 4. The site was reportedly saturated by fuels leaking from buried fuel pipelines in the 1970s and early 1980s.

Five soil borings at FSA No. 2 were drilled and sampled. Only one shallow soil sample contained anomalous concentrations of VOCs and fuel hydrocarbons. Samples from one of two monitoring wells in the FSA No. 2 also contained trace amounts of fuel hydrocarbons.

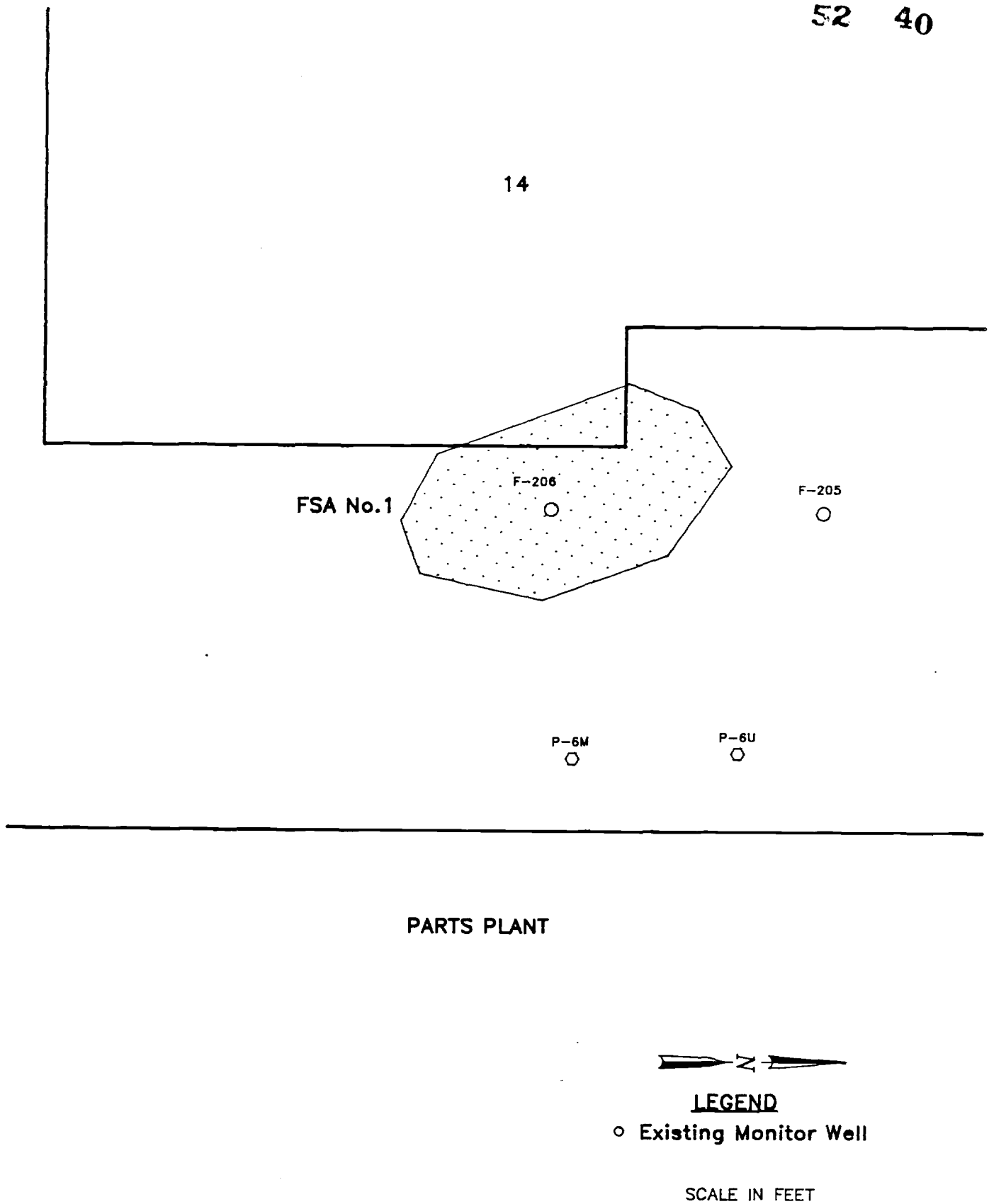


Figure 14. Location map for FSA No. 1

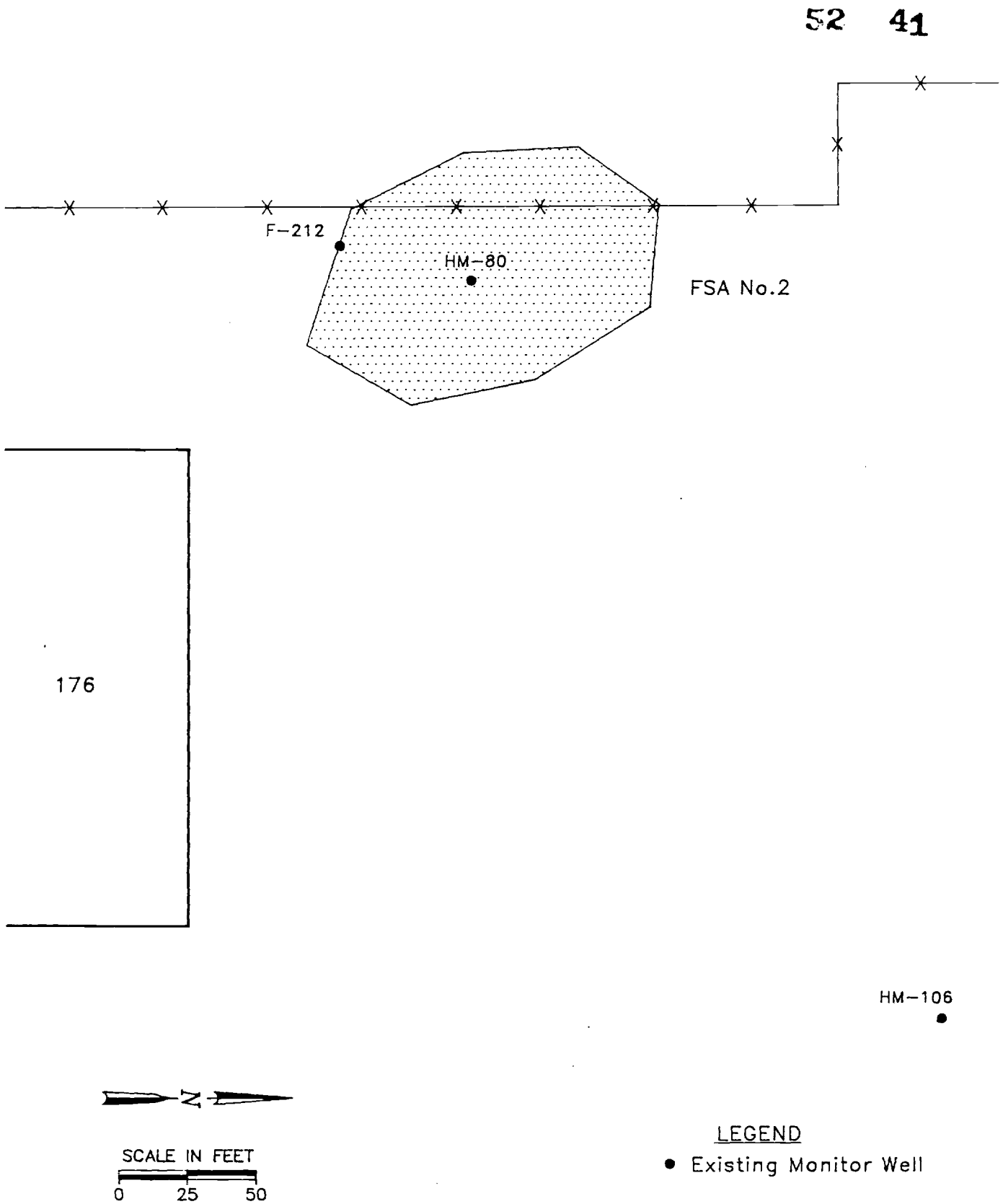


Figure 15. Location map for FSA No. 2

No contaminants identified in the shallow soils at the FSA No. 2 exceed current federal standards.

4.1.4.3 Fuel Saturation Area No. 3

Fuel Saturation Area No. 3 is located immediately east of Meandering Road between Facilities Building Nos. 157 and 142 (Figure 16). As with the other FSA areas, the soils at this site were contaminated by fuels that leaked from buried fuel pipelines during the 1970s and early 1980s.

Groundwater samples have been collected from 13 monitoring wells in the vicinity of FSA No. 3. Fuel-related floating product was observed in seven of the thirteen wells. Analytical results of the groundwater samples show that the groundwater at FSA No. 3 contains anomalous concentrations of VOCs, semi-VOCs, and fuel hydrocarbons.

General Dynamics is currently designing a system to recover the floating product as part of an interim remedial action plan for FSA No. 3. Contaminants related to FSA No. 3 which exceed federal standards are:

- benzene
- ethylbenzene
- toluene
- chlorobenzene
- trichloroethylene
- naphthalene

4.1.4.4 Former Fuel Storage Site

A 100,000 gallon above-ground JP-4 storage tank was located near the center of the Radar Range (see Figure 2) from the early 1940s to 1962. The tank was removed from the site and relocated in 1962. Leakage of fuel was suspected to have occurred.

Sampling of soils and groundwater at the site in 1982 indicated that both media were contaminated by fuels and other organic compounds. Subsequent sampling during IRP Phase II investigations indicated that no significant contamination is present at the site and a recommendation for a "No Further Action" remedial action alternative was made.

4.1.4.5 Solvent Lines

The buried solvent lines used to carry xylene, methyl ethyl ketone, and kerosene in the early 1940s (see Figure 2). The lines were reportedly drained, capped, and abandoned in place in 1944 due to leaks experienced in the lines. The actual sites of the leaks are not known (CH2M Hill, 1984). One downgradient monitoring well was installed in the upper zone and soil samples were collected from that boring. No significant contaminants were identified in the soils collected. Groundwater was also collected from five other monitoring wells in the vicinity of the solvent lines. Only one well located on the southern end of the solvent lines contained trace amounts of VOCs. Based on the results of previous investigations, this site was recommended for a "No Further Action" remedial action alternative selection.

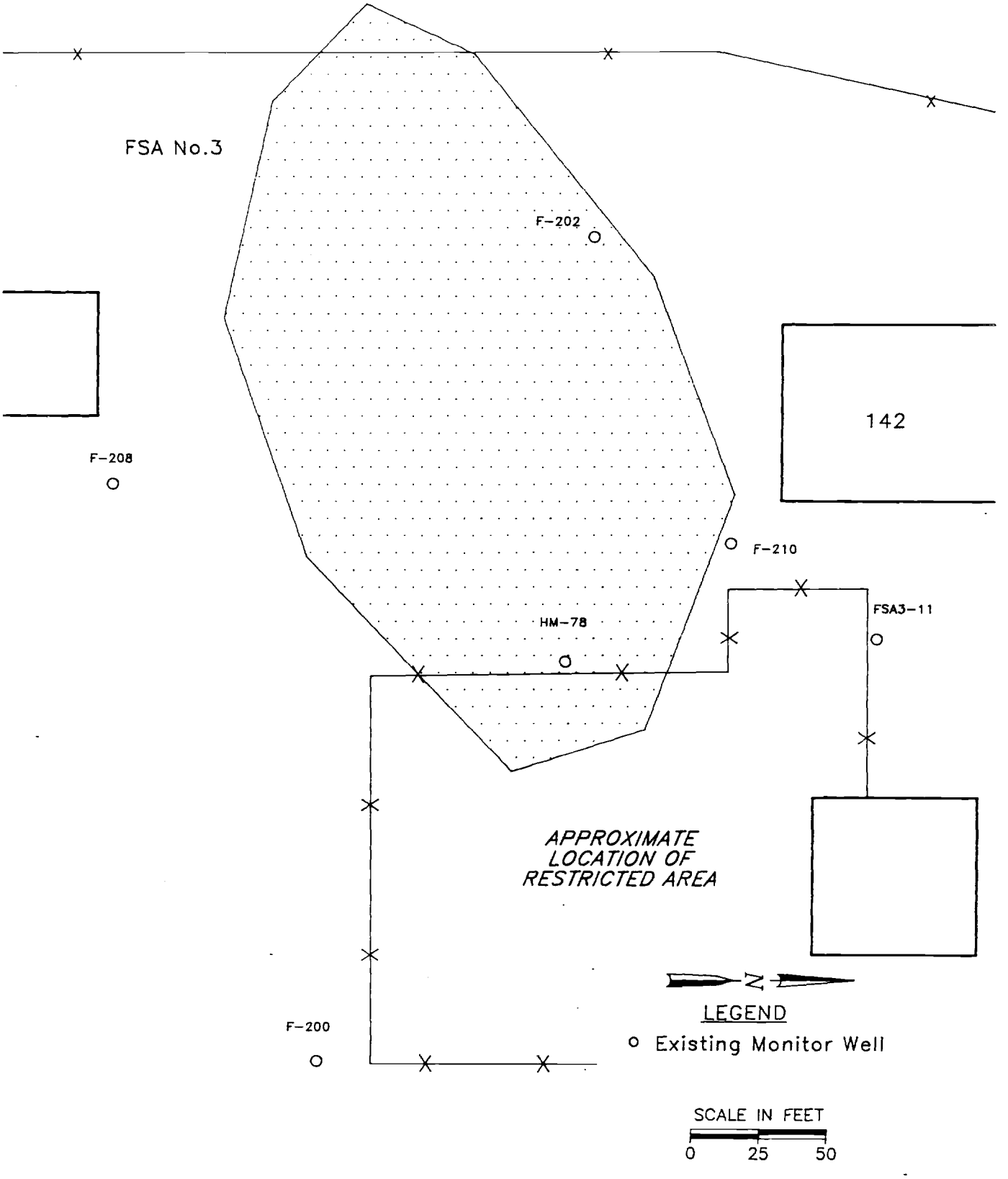


Figure 16. Location map for FSA No. 3

4.1.4.6 Jet Engine Test Stand

The jet engine test stand site (Figure 17) is located northeast of Facilities Building No. 142 and east of Meandering Road. The site was identified by Radian (1987) during the IRP Phase II investigations as being north of a fuels test area and a known area of fuel contamination. Facilities Building No. 21 has a sump constructed in 1975 which collects water for cooling, noise suppression, and building cleanup, after which it is then pumped into an industrial waste line. Just south of Building 21 two underground tanks used for fuel storage were removed from the area. Both the sump and the tanks were suspected sources of contaminants.

Soil samples collected from five borings in the vicinity of the jet engine test stand contained anomalous concentrations of fuel hydrocarbons and oil and grease. Groundwater samples collected from four monitoring wells in the vicinity of the jet engine test stand indicated that two of the wells contained fuel-related hydrocarbons.

Contaminants identified in samples from the jet engine test stand site that exceed federal standards are:

- Oil and grease
- Total fuel hydrocarbons

4.1.4.7 Underground Storage Tanks (removed)

As part of the IRP Program, fourteen USTs were removed from the ground at AFP 4 before December 22, 1988 which was the effective date of federal Subtitle I regulations. Twelve of the tanks contained petroleum and two contained hazardous substances (Hargis and Associates,1989). Following removal of the tanks, soil samples collected from the tank excavation pits indicated that six of the tank locations were contaminated. The location of these tanks is shown on Figure 18. No further remedial action was performed after removal of the tanks.

The six tanks (Tank Nos. 19, 20, 24A, 24B, 25A, and 30) contained Methyl ethyl ketone, xylene, gasoline, gasoline, JP-4 and JP-4 respectively. Analytical results from soils in the excavation for each tank indicated that the contaminants generally corresponded to the materials stored in the tanks. However, some of the compounds detected were not listed as being stored in the corresponding tanks.

Contaminants found in soils associated with each underground storage tank are as follows:

- Tank 19 -- 2-butanone
- Tank 20 -- 2-butanone, ethylbenzene, xylene
- Tank 24A -- 1,1,1-trichloroethane, trans-1,2-dichloroethylene, ethylbenzene, methylene chloride, tetrachloroethylene, toluene, trichloroethylene, and xylene
- Tank 24B -- 1,1,1-trichloroethane, tetrachloroethylene, methylene chloride, and toluene
- Tank 25A -- benzene, toluene, ethylbenzene, xylene
- Tank 30 -- benzene, toluene, ethylbenzene, xylene

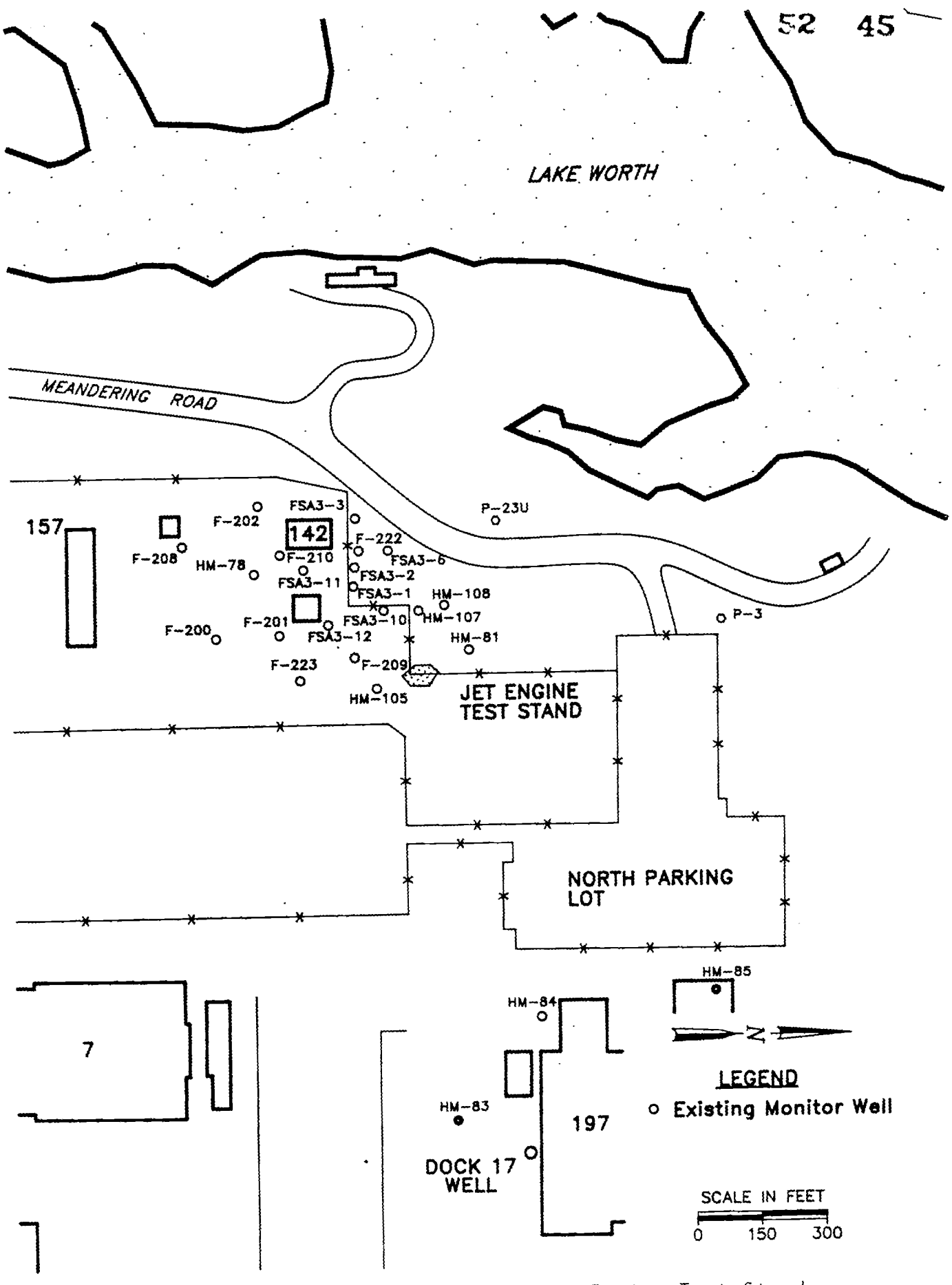


Figure 17. Location map for the Jet Engine Test Stand.

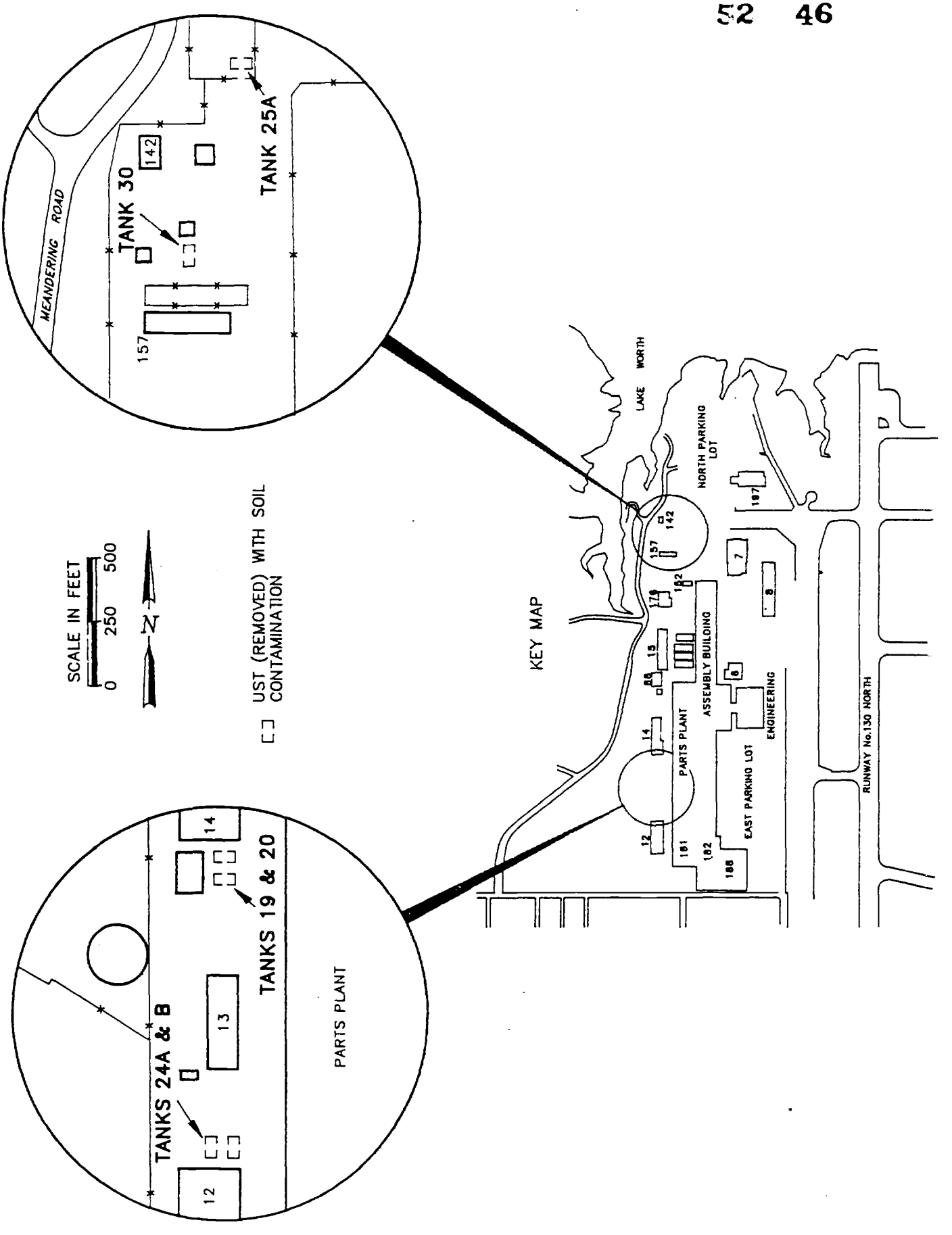


Figure 18. Location map of UST's (removed)

4.1.5 Other Areas

4.1.5.1 Nuclear Aerospace Research Facility (NARF)

The NARF site is located at the north end of AFP 4 (see Figure 2). Several experimental atomic reactors were located in this area between 1953 and 1974. The site was decommissioned in 1974. Over 2 million pounds of miscellaneous parts and 15 million pounds of rubble were removed from the NARF site. Post-closure sampling indicated no remaining waste (CH2M Hill, 1984; Radian, 1987). Analytical results of soil samples collected from borings indicate that no radionuclides are present above background levels at the site. Based on the results of the IRP Phase II investigation, a "No Further Action" remedial action alternative was recommended for this site (Radian, 1987).

4.1.5.2 Waste Water Collection Basins

The waste water collection basins are located south of the Process Building (Facilities Building 181). The site (Figure 19) consists of two concrete-lined waste basins, each with an approximate capacity of 85,000 gallons. The basins, which are still in use, are designed to collect and settle suspended solids from plant wastewater. These basins have been used since 1966. IRP Phase I investigations determined that several spills of vapor degreaser from the Process Building (primarily TCE) have flowed to the basins via floor drains. Other chemical spills may have entered the basins via the floor drains. The integrity of the concrete that lines the basins has not been evaluated. Cracks in the basin wall that might allow leaks are suspected.

Groundwater samples were collected from one monitoring well southeast of the basins. Analytical results from these samples indicate that the groundwater is contaminated with VOCs and heavy metals. It is uncertain whether the VOCs in the groundwater at this location can be attributed to the wastewater basins. A sanitary sewer line runs on an east-west line through the site and a storm drain, which runs northwest-southeast is located approximately 75 feet south of the basins. Other upgradient sources, such as Chrome Pit No. 2 may be the source of heavy metals found in groundwater samples. Several organic compounds were present in samples from the downgradient well. These include:

- trans-1,2-dichloroethylene
- trichloroethylene
- chlorobenzene

A possible source of the trichloroethylene (TCE) in the well is vapor degreaser spilled from tanks in the Process Building.

4.1.5.3 Assembly Building/Parts Plant Perimeter

A review of processes within the main manufacturing building in relationship to the methods of containment of spills within the building has resulted in a need to perform a building perimeter survey to help identify and isolate sources or potential sources of contaminants which may affect environmental pathways. Numerous concrete-lined trenches, sumps, and elevator shafts may provide pathways for contaminants if cracked. Several process lines and tanks may have leaked or spilled over the years resulting in contamination through the trenches or sumps. Contaminant plumes identified downgradient of the main

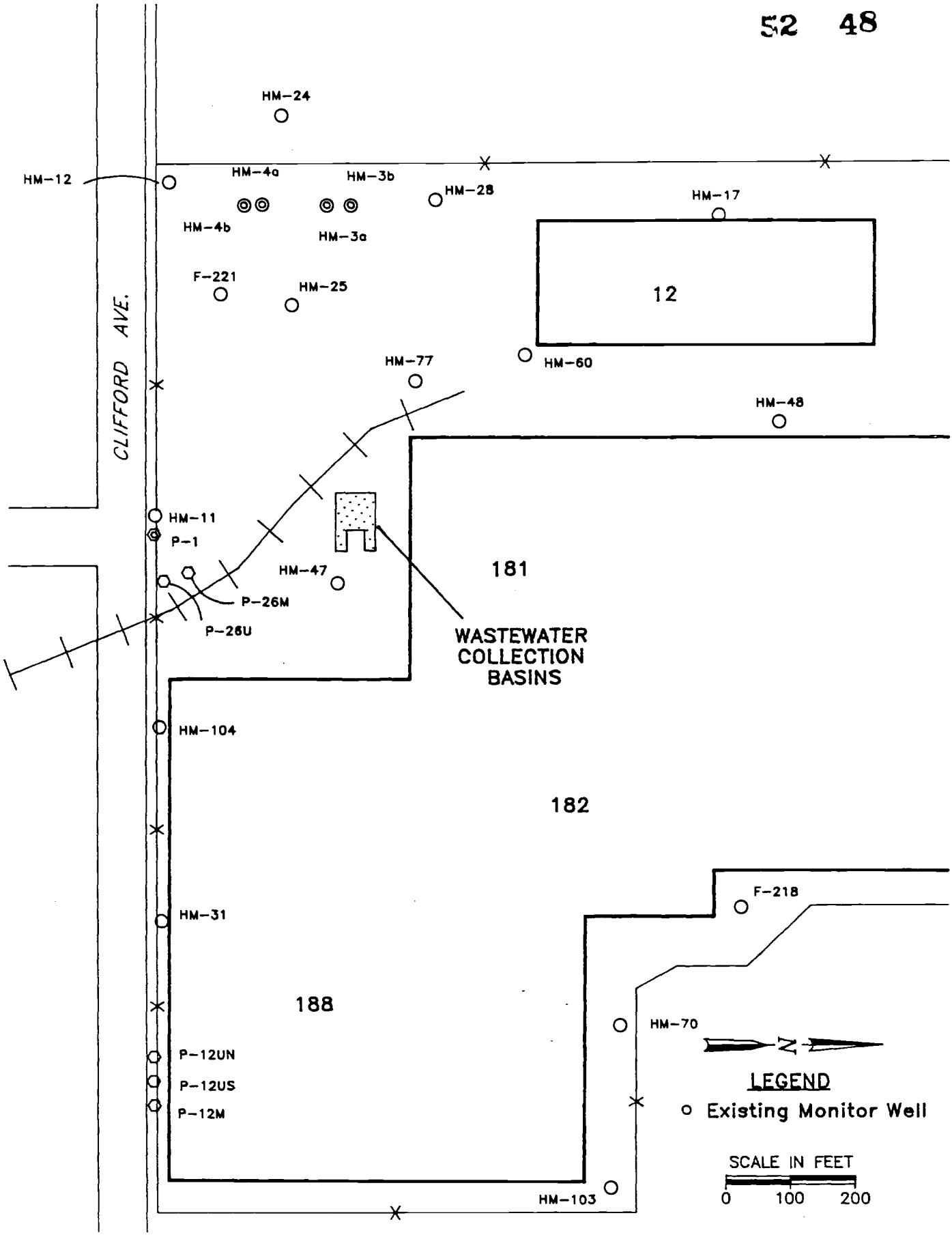


Figure 19. Location map for the Wastewater Collection Basins

manufacturing facilities are significant in extent (see 4.1.5.4 East Parking Lot). The source of the contaminants has not been determined.

4.1.5.4 East Parking Lot

The East Parking Lot and flight line area (Figure 20) are located east of the Assembly Building/Parts Plant. Monitoring wells installed in the East Parking Lot area were found to contain high concentrations of dichloroethylene during IRP Phase II Stage 1 investigations. Hargis and Associates (1985), the Corps of Engineers (1986), and Intellus (1986) further investigated the area by drilling and installing monitoring wells in the contaminated upper zone, aquifer testing, and groundwater sampling. A total of 22 upper zone monitoring wells have been installed to characterize the contamination plume in this area.

The source of DCE, TCE, and chromium contaminants in the East Parking Lot area has not been determined. Possible sources will be determined in the future based on the results of the previously mentioned building perimeter studies.

The groundwater underlying the area by the cafeteria near the northern end of the Parts Plant is contaminated with PCE. This area is reportedly west of the groundwater divide that is described as bisecting the Parts Plant and Assembly Building. Groundwater in this area is said to flow to the west whereas the groundwater in the East Parking Lot flows to the east. Again, the source of the PCE contamination has not been determined but is suspected to originate from the northern end of the Parts Plant.

4.1.6 Summary of Contaminant Sources

A variety of contaminant sources exist at AFP 4. Due to the fact that the plant has been in continuous operation since 1942, significant quantities of contaminants may have been released to the environment due to past disposal practices, fire training activities, continuous leaks in buried fuel lines, process lines and tanks or from spills. The sites identified in this section appear to be the major contributors to the contaminants already observed in contaminant pathways. Further investigations may identify more sources of contaminants. Phaseout of all existing underground storage tanks, which is scheduled to occur in the early 1990s will likely result in the identification of additional areas where contaminants have been released.

Since there are numerous sources of contaminants, it should be noted that many areas of AFP 4 will potentially contain a mixture of contaminants from several source areas. This will be especially important in evaluating remedial action alternatives.

4.2 EVALUATION OF CONTAMINANT PATHWAYS

This section provides an initial evaluation of the contaminant migration pathways at AFP 4. Based on knowledge of the contaminants identified in Section 4.1, general conclusions can be made regarding the potential fate of the contaminants as they migrate along the pathways. A more detailed evaluation of contaminant fate and transport as related to potential receptors will be conducted as part of a baseline risk assessment to be performed as one of the RI/FS work tasks (Section 6.0, this plan).

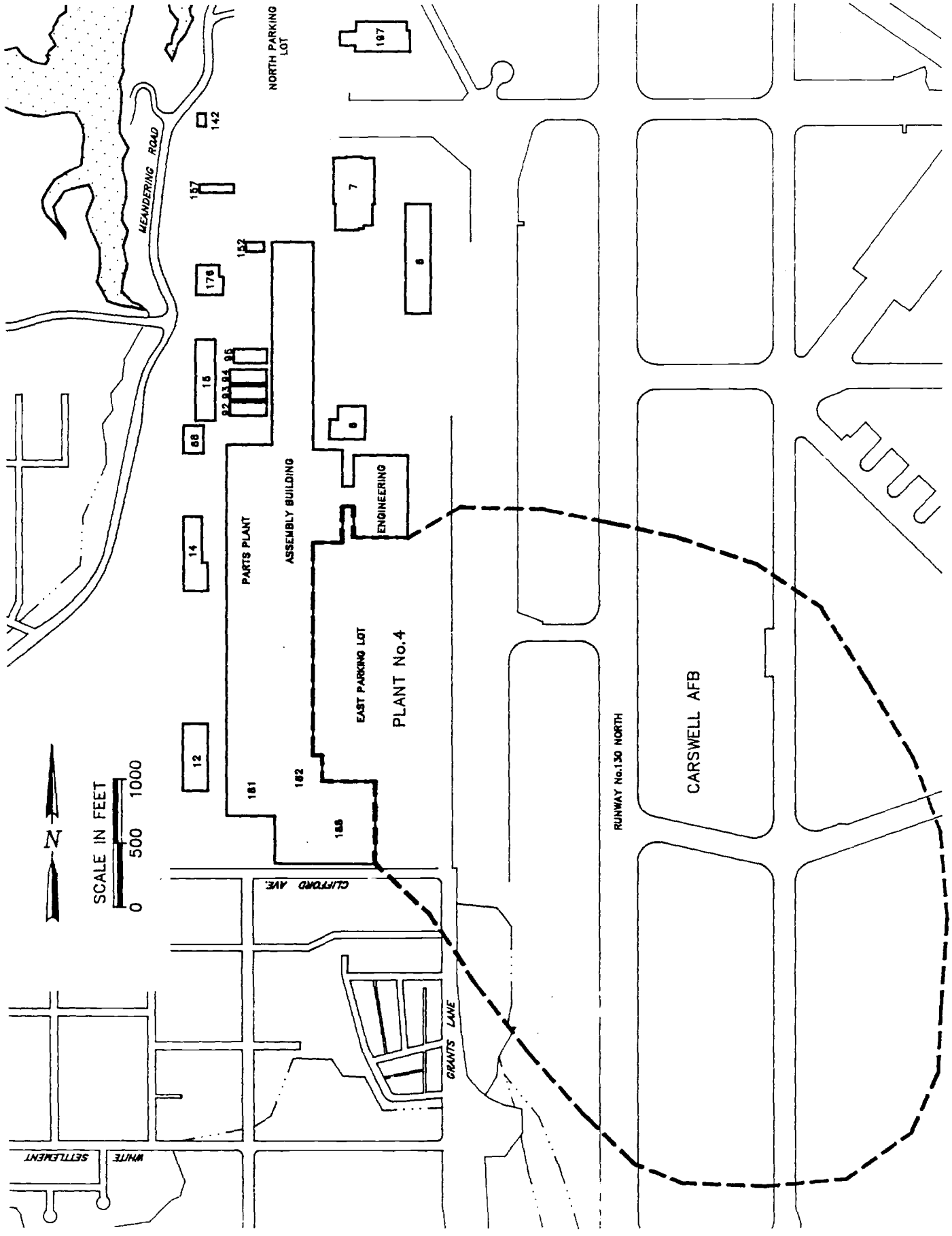


Figure 20. Location of the East Parking Lot/Flightline Area

4.2.1 Air

4.2.1.1 Volatilization

As shown in Section 4.1, several areas at AFP 4 contain volatile organic compounds either in soils or in the groundwater (both dissolved and floating product). Some areas such as Landfills 1 and 3, the Fuel Saturation Areas 1 and 3, Fire Department Training Area 2, and Chrome Pit 3 contain both soil and groundwater VOC contamination. Significant migration to the surface of VOCs in the vapor phase could occur in areas where soils are exposed. Much of AFP 4 however, is paved with asphalt or covered with buildings, which reduces the potential for vapor-phase VOC migration in air. Exceptions are Landfill No. 3 and Chrome Pit No. 3 which are in unpaved areas. No previous investigations have adequately addressed the potential for release of VOCs to the air pathway.

Another source of VOCs to the air pathway at AFP 4 is the cooling tower which is used to air strip groundwater pumped from French Drain No. 2 located in Landfill No. 1. This practice is not performed on a continuous basis but only on an as-needed basis. The cooling tower is currently exempt from agency air emission control.

Daily emissions of VOCs occur at AFP 4 as a result of aircraft traffic from Carswell AFB and General Dynamics. Routine handling and use of solvents inside and outside buildings also contributes to emissions of VOCs. Depending on climatic conditions, the background levels of emissions may be fairly high at AFP 4.

4.2.1.2 Solid phase transport

In unpaved areas of AFP 4, surface contaminants could be transported as wind-blown particulates. Again, because much of AFP 4 is paved, covered by buildings, or covered by vegetation (mainly grasses), the potential for significant wind-blown transport of contaminants is normally small. During periods of excavation or construction, adequate measures should be taken to minimize dust. Chrome Pit No. 3 is an example of an area where dust control would be necessary to reduce the potential for transport of particulate contaminants in air.

4.2.2 Surface Water

Surface water drainage at AFP 4 is discussed in Section 3.5 (see Figure 3 for a map). The majority of surface water runoff at AFP 4 is handled by storm drain systems which discharge to Lake Worth, Meandering Road Creek, or a tributary of Farmers Branch. In addition to surface runoff, upper zone groundwater discharges into Meandering Road Creek and Lake Worth. Some of the earliest evidence of environmental contamination at AFP 4 was observed at a stormwater outfall which discharges downgradient of Landfill No. 1 where leachate was observed entering Meandering Road Creek. Although analytical data for surface water samples collected from Meandering Road Creek have not indicated significant concentrations of contaminants, past disposal practices along the drainage and past spills may have caused contamination of the sediments within the drainage. Previous investigations have not adequately addressed the potential for contaminated sediments.

Lake Worth, which borders AFP 4 is used for both recreation and domestic water supply. In addition to receiving potentially contaminated water through creeks and upper zone discharge, Lake Worth is also a source of recharge to the Paluxy Aquifer, which is used for industrial and domestic water supply. Contaminants in surface waters therefore have the potential to degrade both surface and subsurface water supplies.

Several of the outfall discharge points at AFP 4 are NPDES permitted and are routinely monitored for oil and grease and total organic carbon. Other storm drains are not permitted or routinely monitored.

Hargis and Associates established five creek stations and creek seep stations which have been monitored monthly for VOCs and oil and grease. Analyses show that a variety of contaminants are present in Meandering Road Creek. The most commonly detected contaminants are toluene, TCE, and oil and grease.

4.2.3 Groundwater

The hydrogeologic units at AFP 4 are graphically shown on cross sections developed from previous monitor well drilling and soil borings (Figures 21-23). Discussions of each unit are presented in the following sections.

4.2.3.1 Upper Zone

Because the majority of the contaminant sources identified in Section 4.1 are present in the subsurface, the pathway with the greatest potential to be affected is groundwater transport in the upper zone aquifer. It is an unconfined aquifer with a large saturated zone which allows for constant contact between contaminated soils and groundwater. Recharge to the upper zone at AFP 4 is thought to be mainly from precipitation and leakage from water supply lines, sanitary sewers, and storm drains. This provides a mechanism for additional contamination of the upper zone. Numerous areas of upper zone groundwater contamination have been identified from previous investigations.

Figure 24 is a water table contour map which shows the general flow directions of the upper zone at AFP 4. A groundwater divide occurs within the area of the Assembly Building/Parts Plant. Groundwater to the west of the divide flows west toward Meandering Road Creek and Lake Worth whereas groundwater east of the divide flows eastward to Carswell AFB. The discharge area for the eastward flowing upper zone groundwater has not been determined. Within the immediate vicinity of AFP 4, there are no known water supply wells that obtain water from the upper zone.

Contaminants detected in the upper zone groundwater system include dissolved species and immiscible liquids that form distinct phases. These liquids include both light and dense non-aqueous phase liquids (LNAPLs and DNAPLs). LNAPLs are typically fuel-related liquids found floating on the water table surface. DNAPLs are typically chlorinated solvents found in "pools" at the bottom of the aquifer. Observations of LNAPL and DNAPL plumes made via monitoring wells indicate that these separate phases may not necessarily migrate with the natural groundwater flow. These plumes may in fact be relatively stationary. Migration of DNAPL plumes is also likely to be controlled by the topography of the aquifer bottom. DNAPLs tend to flow via gravity drainage down-dip along the top of the first impermeable unit encountered.

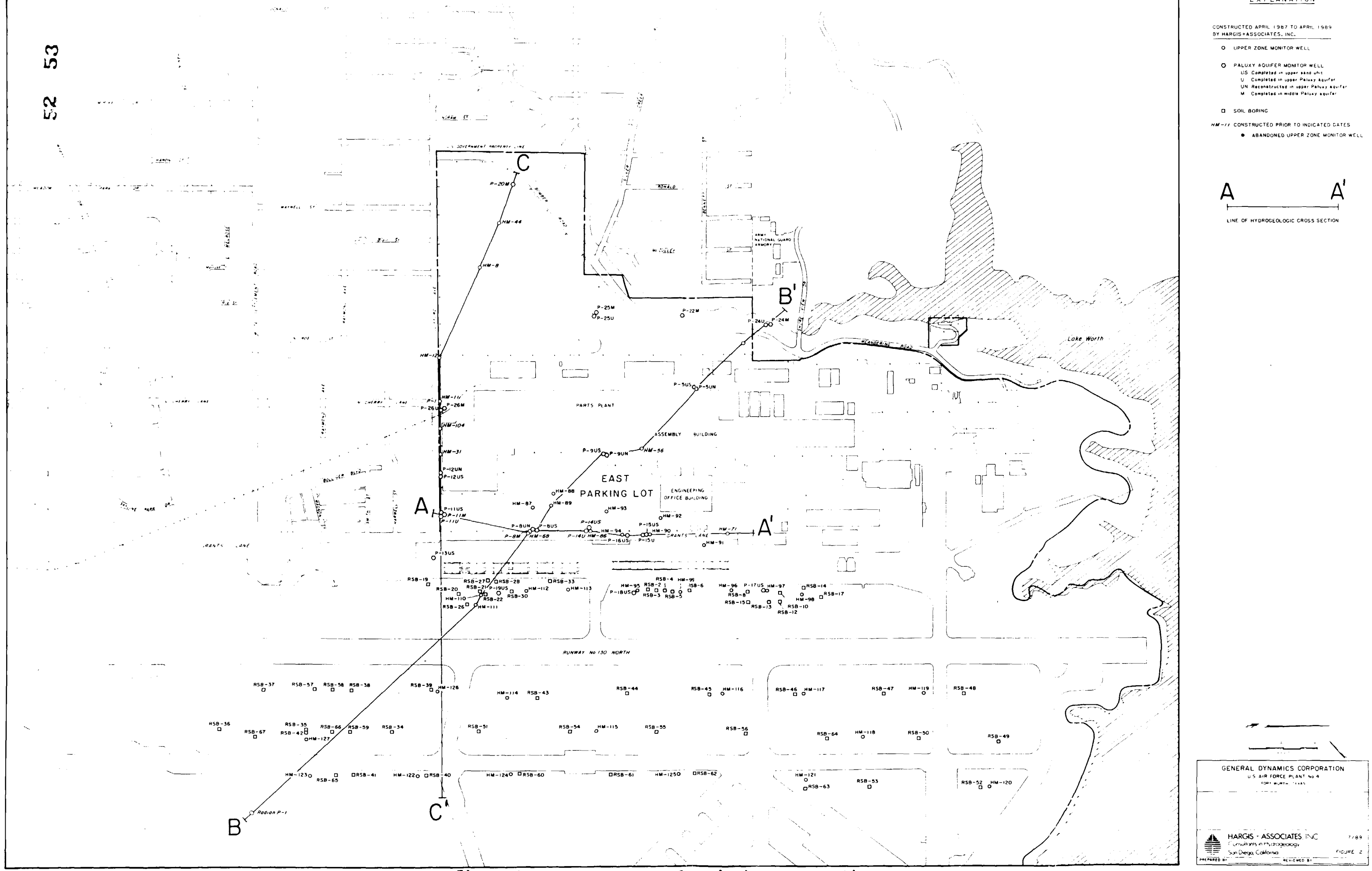
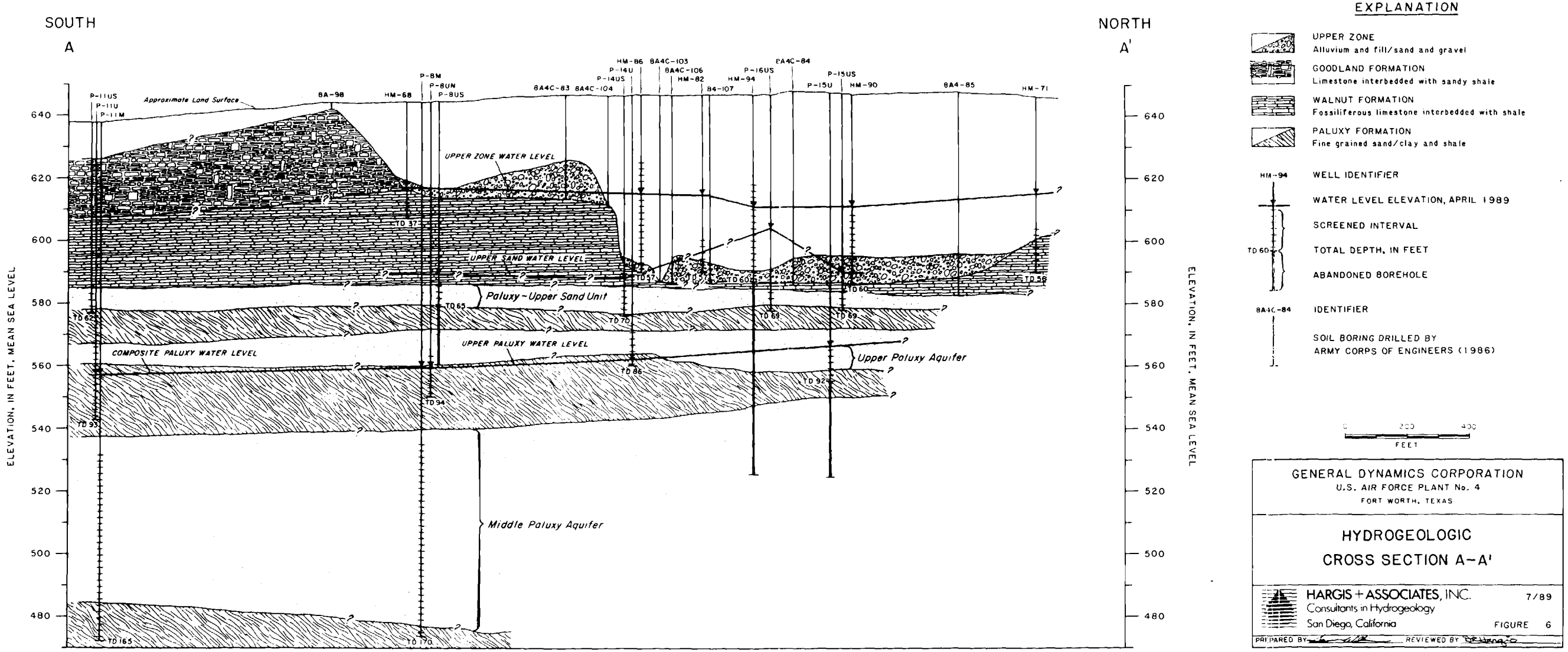


Figure 21. Location map of geologic cross sections



EXPLANATION

- UPPER ZONE — Alluvium and fill/sand and gravel
- GOODLAND FORMATION — Limestone interbedded with sandy shale
- WALNUT FORMATION — Fossiliferous limestone interbedded with shale
- PALUXY FORMATION — Fine grained sand/clay and shale
- HM-94 — WELL IDENTIFIER
- WATER LEVEL ELEVATION, APRIL 1989
- SCREENED INTERVAL
- TD 60 — TOTAL DEPTH, IN FEET
- ABANDONED BOREHOLE
- 8A4C-84 — IDENTIFIER
- SOIL BORING DRILLED BY ARMY CORPS OF ENGINEERS (1986)

0 200 400
FEET

GENERAL DYNAMICS CORPORATION
U.S. AIR FORCE PLANT No. 4
FORT WORTH, TEXAS

HYDROGEOLOGIC
CROSS SECTION A-A'

HARGIS + ASSOCIATES, INC.
Consultants in Hydrogeology
San Diego, California

7/89

FIGURE 6

PREPARED BY _____ REVIEWED BY _____

Figure 22. North-South cross section, East Parking Lot area.

52 55

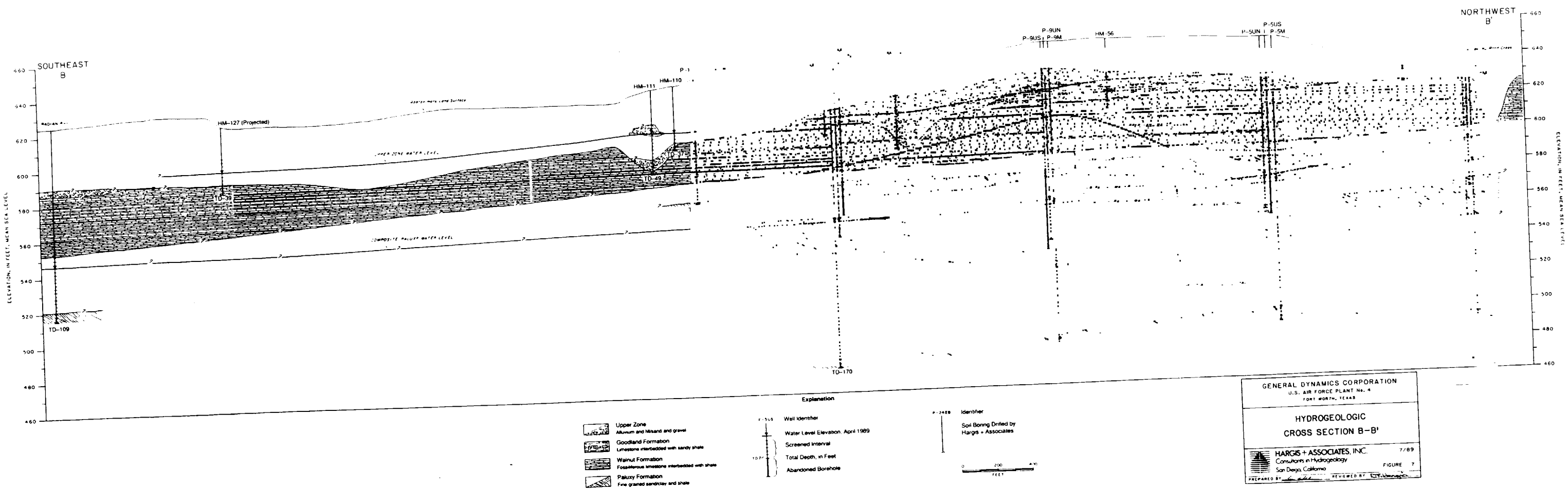


Figure 23. Northeast-Southwest cross section. Meandering Road Creek to Flightline area.

52 56

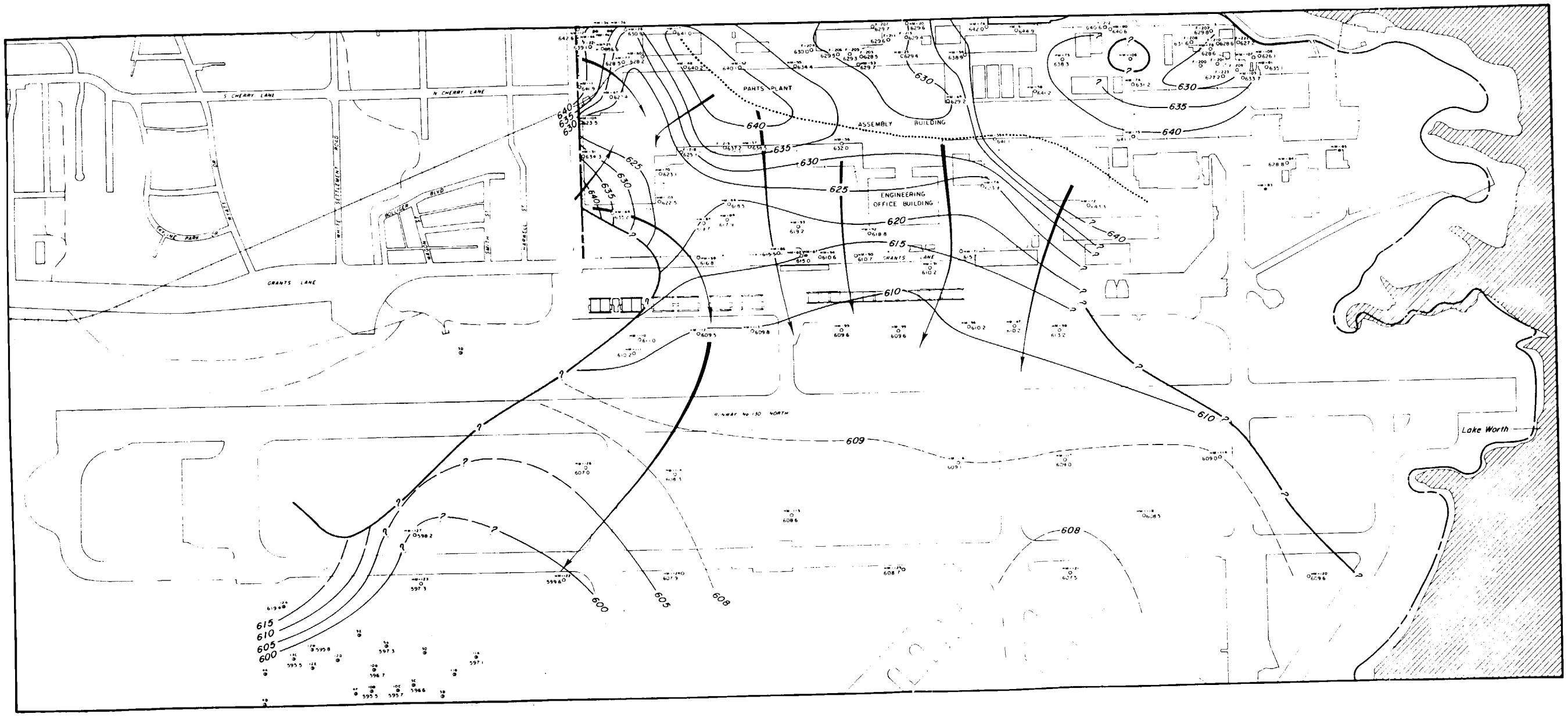


Figure 24. Water level contour map of the Upper Zone

Hydraulic heads in the upper zone exceed those of virtually all underlying saturated units in the Paluxy aquifer. This indicates a potential for downward migration of contaminants, although movement is likely to be slow because of the underlying Walnut Formation aquitard. There are areas, however, where the Walnut Formation is thin or absent at AFP 4. In these areas, there is a potential for significant vertical migration of upper zone contaminants to the Upper Paluxy aquifer.

4.2.3.2 Paluxy Aquifer

The city of White Settlement derives a large fraction of its municipal water supply through pumping from the Paluxy aquifer system. Heavy pumping from the Paluxy aquifer has caused a significant decline in hydraulic head in the aquifer east of Fort Worth (CH2M Hill, 1984). Significant decline in the hydraulic head in the Paluxy system has not occurred in the vicinity of AFP 4 due to its close proximity to recharge areas such as Lake Worth and Paluxy Formation outcrops in northwestern Tarrant County and Parker County.

Locally, groundwater withdrawals from the Paluxy aquifer appear to have influenced the direction and rate of groundwater flow. Figure 25 presents a contour map of hydraulic head elevations in the Paluxy aquifer. Elevations for points within the boundaries of AFP 4 are based upon water levels measured in Paluxy monitoring wells. Elevations outside the plant boundaries are based upon data from the Bureau of Economic Geology at the University of Texas (CH2M Hill, 1984) and numerical solutions of the Theis non-equilibrium radial well flow equation (Walton, 1987). The solution is based upon the assumption that the Paluxy is a leaky confined, homogeneous, and isotropic aquifer of uniform thickness and infinite lateral extent. The effects of multiple well pumping and intersecting radii of influence are evaluated based upon the principle of linear superposition (Freeze and Cherry, 1979).

Within the plant boundaries the direction of groundwater flow in the Paluxy is generally southeast, towards the city of Westworth and the city of White Settlement (Figure 25). The locations of municipal supply wells in the vicinity of AFP 4 (personal communication with Mike Estrosci, City of White Settlement; and maps on file at the Texas Water Development Board, Austin, Texas) are also shown on Figure 25. There are no wells within the limits of the City of Westworth.

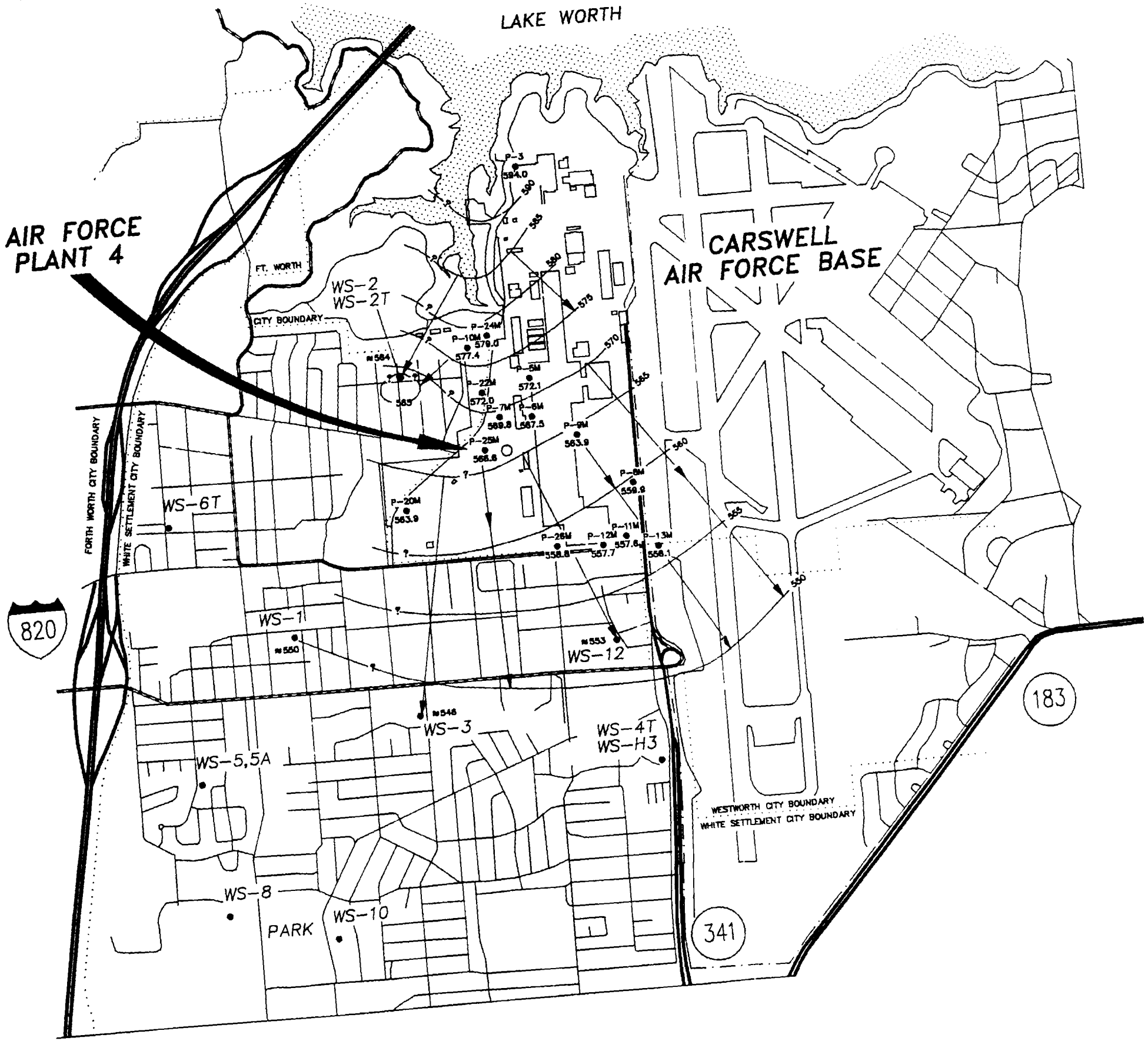
Drawdown cones are evident surrounding the White Settlement water supply wells. Production rates provided by the City of White Settlement (Mike Estrosci, personal communication, 1989) for these wells are as follows:

- WS-1, WS-2, WS-3, WS-H3, WS-A5, WS-8 (Park), WS-12 produce from the Paluxy Formation at average daily pumping rates of 73,000, 56,000, 75,000, 64,900, 82,600, 68,900, and 62,000 gallons.

- WS-2T (Travis Peak), WS-4T, WS-6T, and WS-10 pump from the Twin Mountains Formation at average daily pumping rates of 106,300, 219,000, 119,600, and 14,900 gallons.

- WS-5 pumps from the Trinity Group at an average daily pumping rate of 80,000 gallons.

52 58



N

SCALE IN FEET
0 1000 2000

560 WATER LEVEL CONTOUR IN FEET ABOVE SEA LEVEL

P-24M MIDDLE PALUXY MONITOR WELL

WS-6T WHITE SETTLEMENT WATER SUPPLY WELL

548 WATER-LEVEL ELEVATION IN WELL

FIGURE 25
CONTOUR MAP OF WATER LEVELS IN THE PALUXY AQUIFER WELLS

VALUES FOR WHITE SETTLEMENT WELLS ARE ESTIMATES BASED UPON PREDICTED DRAWDOWN CALCULATIONS. QUESTION MARKS INDICATE UNCERTAINTY IN LOCATION OF CONTOUR LINES, ARROWS INDICATE APPROXIMATE FLOW DIRECTIONS.

Given that flow directions for a homogeneous, isotropic aquifer are orthogonal to equipotential lines, it is clear that the White Settlement wells nearest the plant influence groundwater movement in the Paluxy. Although the information presented in Figure 25 does not represent a rigorous model of the flow system, wells WS-1, WS-2, WS-3, WS-H3 and WS-12 appear to have the potential to receive water that was at one time beneath AFP 4. Rigorous numerical modeling of the flow system will be conducted to reduce the uncertainty associated with this conceptual model.

Low concentrations of several organic compounds have been identified in Paluxy wells at AFP 4. None of the compounds exceeded federal standards. The presence of these compounds in the Paluxy aquifer indicates that there may be some vertical leakage of groundwater from the overlying upper zone. It was suggested by Hargis and Associates (1986) that some Paluxy recharge may occur from Meandering Road Creek which may be a source of contaminants entering the Paluxy System. Seeps along the stream banks indicate that contaminants are likely discharged into the creek from the upper zone or from storm drains. Low levels of contaminants present in Lake Worth could also enter the Paluxy aquifer system via Lake Worth recharge.

4.2.4 Summary of Contaminant Pathways

All major pathways at AFP 4 appear to have the potential for significant contamination which could pose a hazard to human health or the environment. On the basis of the widespread potential sources of contaminants (See Section 4.1), methods of source control will be required prior to the cleanup of contaminated pathways. Since groundwater from the upper zone is not used for domestic purposes at or near AFP 4, the major concern is the potential for contamination of other pathways through discharge or vertical leakage. The effectiveness of current control measures such as French Drains No. 1 and No. 2 need to be evaluated. Additional control measures such as long-term groundwater treatment and source removal will also be evaluated. As long as contaminated upper zone groundwater and waters from wastewater and storm sewer systems at AFP 4 discharge into surface drainages, the surface water pathway will also remain a potential hazard to human health and the environment. The air pathway could pose a hazard in unpaved areas of AFP 4 which contain high concentrations of VOCs. Construction and excavation in these areas could increase the potential for significant air pathway contamination.

4.3 ASSESSMENT OF POTENTIAL RECEPTORS

On the basis of information presented in Sections 4.1 and 4.2, an evaluation was made concerning potential receptors of contaminants present in the major environmental pathways. The results of the IRP Phase I individual site scorings using the Hazard Assessment Rating Methodology (HARM) model (CH2M Hill,1984) were also used to evaluate receptors for each site. More detailed assessments of risk to the human population and the natural environment will be conducted as part of the baseline risk assessment subtask of the RI/FS. The following sections are presented by environmental pathway.

4.3.1 Air

The contaminants of major concern for the air pathway are VOCs. The primary route of exposure is inhalation. VOC contaminants at AFP 4 (outside of the

main Assembly Building/Parts Plant) are mainly contained in the shallow subsurface soils or in the groundwater. Most of the surface at AFP 4 is covered by asphalt, concrete, buildings, etc. that inhibit VOCs from reaching the normal breathing zone of AFP 4 personnel. Exceptions would be in areas along Meandering Road Creek, such as Landfill 3 where there is no barrier between subsurface contaminants and the surface. Since access is restricted in the Landfill 3 area, the amount of exposure to any individual would be minimal. At AFP 4 the personnel with the maximum risk for exposure to VOCs are sampling personnel who routinely sample monitoring wells that penetrate the contaminated zones. Adequate protection is provided for these workers.

Off-site receptors downwind of AFP 4 likely receive some VOCs emissions from routine aircraft activities by both Carswell AFB and General Dynamics. Additional emissions from contaminants in surface soil would be minimal. At seeps, volatilization occurs as the groundwater reaches the surface. Human contact with the seeps along Meandering Road Creek, however, is likely to be minimal due to the relatively steep slopes and heavy vegetation. The only wildlife possibly affected would be cottontail rabbits, gray squirrels, opossums, or birds in the wooded area adjacent to the seeps.

The potential for airborne particulate contamination is also small due to the extensive cover at AFP 4. The receptors most likely to be affected by particulate contamination would be construction workers during excavations in contaminated areas. With the proper dust control measures, worker exposure could be minimized.

4.3.2 Surface Water

On the basis of available information, the greatest concern in terms of the surface water pathway is the possible contamination of Lake Worth. Lake Worth is used for contact recreation (water-skiing, swimming), non-contact recreation (fishing, boating), and domestic water supply for the City of Fort Worth. The greatest number of human receptors likely to be affected by surface water contamination would be those who receive drinking water from Lake Worth.

Over 50 species of fish are reported to be in the area reservoirs -- this includes a variety of game fish. Potential human receptors of contaminants would be fishermen and their families who ingest potentially contaminated fish, especially bottom dwellers. Although there would be few potential receptors in Meandering Road Creek, the creek appears to be a possible significant source of contaminants that would discharge directly into Lake Worth. The tributary to Farmers Branch Creek is another possible exposure route for contaminants although the potential receptors could not be adequately defined at this time.

The risks to potential receptors from contact with Meandering Road Creek or seeps along its banks are low because of the relatively steep slopes and heavy vegetation. Although the seeps are likely to contain higher concentrations of contaminants than the creek, water from the seeps evaporates, infiltrates, or mixes with Meandering Road Creek, which results in a minimal risk to receptors.

4.3.3 Groundwater

The groundwater with the greatest amount of contamination at AFP 4 is the upper zone. No domestic use of the upper zone groundwater is known to occur in the vicinity of AFP 4. The potential receptors would be those discussed for surface water since the upper zone groundwater discharges to the creeks or Lake Worth.

Groundwater from the Paluxy aquifer has the most potential for affecting human receptors since the City of White Settlement uses the Paluxy Aquifer for domestic water supplies. Although contamination of the aquifer as a result of activities at AFP 4 appears to be minor, continued monitoring of the aquifer is necessary to ensure that no health hazards are present in groundwater leaving AFP 4.

4.3.4 Summary of Potential Receptors

The following receptors appear to be at some risk as a result of past practices at AFP 4:

- Natural habitat along Meandering Road Creek due to groundwater seeps, storm sewer drains, and natural runoff from contaminated sites adjacent to the creek
- The population of Fort Worth who obtain drinking water from Lake Worth due to potential contamination of the lake from upper zone discharge and discharge of Meandering Road Creek into the lake
- The population of the City of White Settlement who receive drinking water from the Paluxy Aquifer due to potential leakage of contaminants from the upper zone to the Paluxy.
- Sampling personnel and construction workers who conduct work in contaminated areas due to the potential presence of VOCs in the air pathway.

5.0 OBJECTIVES AND RATIONALE

5.1 PRELIMINARY ASSESSMENT/SITE INSPECTION (PA/SI)

The purpose of the PA/SI is to obtain sufficient information to determine if a particular site where hazardous substances were/are handled has released contaminants into the environment. At AFP 4, numerous investigations have been conducted to evaluate areas of known or suspected contamination. Previous investigations have failed, however, to identify and assess the source areas for some of the contaminants present in environmental pathways at AFP 4. The PA/SI is normally conducted prior to the generation of an RI/FS Work Plan. Due to the complex nature of the contamination at AFP 4, additional PA/SI activities will be performed concurrently with RI/FS activities and, in some cases, concurrently with remedial action activities.

5.1.1 Assembly Building/Parts Plant

Extensive contamination (mainly TCE) of the upper zone east of the Assembly Building/Parts Plant has been identified through monitoring well installation and sampling. The source of this contamination, however, has not been determined. To define whether the contamination is originating upgradient of the buildings or whether the contamination is coming from sources within the buildings, field screening activities are warranted around the perimeter of the buildings.

5.1.2 Underground Storage Tanks (USTs)

Previous investigations did not adequately address existing underground storage tanks as sources of fuel-related contamination observed in the upper zone groundwater. General Dynamics is presently in the process of UST removals as part of a plan to phase-out all USTs and replacement with above-ground tanks. Several of the tanks removed have evidence of past leakage or spills.

The purpose of the PA/SI activities at the sites of removed USTs is to evaluate whether contaminants have been released to the environment and to determine if additional investigations are warranted during RI/FS activities. Limited sampling results indicate that contaminants were present in the excavations of several tanks but no attempt was made to characterize the extent of contamination prior to backfilling, grading, and paving because this activity was intended to be accomplished during subsequent RI/FS activity. These sites may have contributed significant amounts of contaminants over the years to the soils and groundwater surrounding the tank.

5.2 REMEDIAL INVESTIGATION (RI) STUDIES

For those areas previously identified as having released contaminants into the environment, an evaluation was made as to whether sufficient information presently exists to allow remedial action decisions to be made. For those sites where sufficient information exists, no RI investigations will be proposed and the site(s) will immediately go to the Feasibility Study (FS) phase of the RI/FS. This includes those sites identified as requiring "No Further Action". For those sites where data gaps exist, additional information will be gathered through RI studies. The following sections

identify the sites requiring further investigation, present the rationale used in their selection, and discuss the types of information to be obtained. Details of the data quality objectives and sampling and analysis requirements are presented in Volume III, the Quality Assurance Project Plan and Volume II, the Sampling and Analysis Plan that accompany this work plan.

5.2.1 Landfill No. 1

Although interim remedial action has been performed at Landfill No.1 in the area of the former oil pits, additional characterization is needed to define the lateral extent of contamination in soils at Landfill No. 1. The vertical extent of contamination is controlled by the top of the Walnut Formation which is an aquitard. Additional hydrologic data are required to characterize the hydraulic parameters of the upper zone at Landfill 1 to allow contaminant transport modeling. The effectiveness of the french drains, which were installed on the top of the Walnut Formation to intercept contaminant leachate from the landfill prior to entering Meandering Road Creek, will be evaluated based on previous water quality data as part of the FS process. There is some evidence that contaminated groundwater is reaching Meandering Road Creek from seeps. Additional information is needed from sediments across the channel of Meandering Road Creek to identify the possible extent of contaminants along the creek adjacent to the Landfill No. 1 area.

5.2.2 Landfill No. 3

Groundwater in Landfill No. 3 is known to contain anomalous concentrations of VOCs, semi-VOCs, fuel-related organic compounds, metals and free floating fuel product in concentrations exceeding MCLs. The extent of contamination has been roughly defined as a result of previous investigations. Additional soil borings are needed to better define the lateral extent of contamination both in the soils and upper zone groundwater. Aquifer tests are needed to provide information necessary to perform contaminant transport modeling. Because contaminant transport in the upper zone at Landfill No. 3 results in discharge to Meandering Road Creek, stream channel sampling is needed to evaluate the extent of contamination from the point of discharge (seeps) to the current streambed. Interim remedial action may be necessary for free product removal prior to completion of RI/FS activities due to the potential for contaminant release to the environment.

5.2.3 Landfill No. 4

Results of previous investigations indicate that no contaminants exceeding MCLs are present in groundwater in the area of Landfill No. 4. No further investigations appeared to be warranted and a "No Further Action" remedial action alternative was suggested. Soil samples, however, were not collected from this site. On the basis of aerial photographs of the landfill when it was still in use, it appears that materials other than construction rubble were deposited in the landfill which is located on the floodplain of Meandering Road Creek.

To determine if contaminants are leaching from the landfill, soil samples from shallow borings are needed along the floodplain adjacent to the landfill. If contaminants are detected, then further investigations may be required to characterize the extent of contamination. If no contamination is present, a "No Further Action" decision document will be prepared for the site.

5.2.4 FDTA No. 2

Soil and groundwater at the FDTA No. 2 site contain anomalous concentrations of VOCs and fuel hydrocarbons. To determine the lateral and vertical extent of contamination at the site, additional soil borings are needed. Additional hydrologic data are also required to determine the upper zone hydraulic parameters at the site. This information will be used for contaminant transport modeling. Additional water quality data will be required from existing monitoring wells.

5.2.5 FDTA No. 3

FDTA No. 3 is said to be located northeast of Landfill 4 between Meandering Road and Meandering Road Creek. The only data available for this site are groundwater analyses from a monitoring well located in the reported center of FDTA No. 3. Theses analyses indicate that the groundwater is not contaminated at this site. No soils data exist for this site, however, because waste oils and fuels were dumped on the surface at this location, it is likely that soil contamination is still present at FDTA No. 3. A soil gas survey will be conducted across the area followed by sampling of soil borings selected on the basis of the soil gas survey results. These data will be used to determine if contaminants are present and if they are present, to what extent. Since FDTA No. 3 is located on the floodplain of Meandering Road Creek, there is a potential for contaminant transport in the surface water pathway.

5.2.6 FDTA No. 5

FDTA No. 5 is a shallow pit measuring approximately 10 feet by 20 feet located in the Die Yard area south of Facilities Building 12. Groundwater samples from monitoring wells in the area of FDTA No. 5 contain VOCs, semi-VOCs, and petroleum hydrocarbons. Fuel-related floating product was also observed in one of the wells. Soil samples collected at FDTA No. 5 were reportedly not contaminated by VOCs, semi-VOCs, petroleum hydrocarbons, or metals. Additional monitoring wells are needed both upgradient and downgradient to help determine if FDTA No. 5 is the source of contaminants in the upper zone groundwater in this area. Aquifer testing will be performed on all new wells at the site to characterize upper zone hydrologic parameters. Additional soil samples will be collected from soil borings around the perimeter of the former pit to determine the extent of contamination at FDTA No. 5.

5.2.7 FDTA No. 6

Interim remedial action was performed at FDTA No. 6 in 1982 and 1983 when oil and fuel contaminated soils were removed and hauled to an approved hazardous waste landfill. Because FDTA No. 6 was the primary fire training area for approximately 30 years, a significant amount of fuel-related contamination was placed in the 50-foot diameter gravel-lined ring. Although some remediation has taken place, the data are insufficient to determine the lateral and vertical extent of remaining contaminants. On the basis of a review of information concerning the interim remedial action, soil borings will be established around the perimeter of the excavated area to determine the extent of remaining contaminants. A single boring is required near the center of the excavated area to determine whether contaminated soil remains at depth below

the excavation. No upper zone groundwater is believed to exist at this site. If groundwater is encountered in soil borings at the site, those boring(s) will be completed as monitoring wells.

5.2.8 Chrome Pit No. 3

Interim remedial action was conducted at Chrome Pit No. 3 in 1983 and 1984. The pit was excavated and backfilled with clean soil. Insufficient soil samples were collected to determine if all of the contamination exceeding MCLs was removed. Future plans for the Chrome Pit No. 3 area include the building of a new chemical process building over the former pit. Additional sampling will likely be performed prior to the start of RI/FS activities outlined in this plan. UNC Geotech will collect sufficient data to determine whether additional remedial action is required or whether a "No Further Action" decision document can be written.

5.2.9 Die Yard Chemical Pits

Remedial action was performed at the Die Yard Chemical Pits in 1983 and 1984. Soil was excavated from the site and clean backfill was used to fill the excavation. Samples collected from the sides and bottom of the excavation indicated that VOCs, semi-VOCs, and petroleum hydrocarbons were still present in the soils adjacent to the excavation. Additional soil samples are needed from soil borings around the perimeter of the excavation to evaluate the extent of soil contamination exceeding MCLs. Two additional monitoring wells are required -- one upgradient and the other immediately downgradient of the former pits -- to evaluate the effect of the die yard pits on groundwater quality. Aquifer tests will be performed on these wells to help define the hydraulic parameters of the upper zone at the site.

5.2.10 Fuel Saturation Area No. 1

FSA No. 1, which is located north of underground fuel tanks and a pumping station, is the site of soil saturated by fuel from leaking buried fuel lines during the 1970's and 1980's. Soil and groundwater samples contain high concentrations of fuel hydrocarbons. Three monitoring wells contain fuel-related floating product. Due to the large amounts of floating product in the monitoring wells, interim remedial action is needed to remove free-floating product prior to long-term remediation. This remedial action should begin prior to completion of RI/FS activities at AFP 4. UNC Geotech will assist in the design of a pumping system for the removal of free product.

The extent of soil contamination, extent of groundwater contamination, and extent of floating product have not been determined. Soil borings in the upgradient direction from previous borings that are contaminated are needed to better define the extent of soil contamination and the potential source area for the contamination. Additional groundwater monitoring wells are required in the downgradient direction from existing wells containing contamination to help define the lateral extent of groundwater contamination. Any wells found to contain floating product will be added to the system designed for product removal from the site.

5.2.11 Fuel Saturation Area No. 2

Previous investigations have shown that soils in the FSA No. 2 site area are contaminated with VOCs and fuel hydrocarbons. The lateral and vertical extent of contamination, however is not yet defined. Additional soil borings are required to determine the extent of contamination. Placement of the borings will be based on results of previous drilling at the site. If results show that contaminants extend to the water table, select soil borings will be completed as monitoring wells to determine the affect of the site on groundwater quality. Aquifer testing is also needed in this area to better define the hydraulic parameters of the upper zone. This information will be used in contaminant transport modeling.

5.2.12 Fuel Saturation Area No. 3

Previous investigations have determined that groundwater in the vicinity of FSA No. 3 is contaminated with VOCs, semi-VOCs, and fuel hydrocarbons. Floating fuel product was observed in seven monitoring wells at the site. Due to the presence of floating product, interim remedial action, consisting of free product removal prior to the completion of the RI/FS, is warranted.

Additional hydrologic data are required to complete the RI/FS. Hydraulic parameters of the upper zone at FSA No. 3 are needed to conduct contaminant transport modeling. This will require additional aquifer testing of both new and existing wells. To define the extent of contamination, additional monitoring wells are needed to the west and to the east of FSA No. 3 the east. Water quality data are required from all existing and new monitoring wells at FSA No. 3.

Soil sample data are required around the perimeter of FSA No. 3 to define the lateral and vertical extent of contamination. Borings will be drilled and sampled from the surface to the top of the water table.

5.2.13 Former Fuel Storage Area

Previous investigations have indicated that soils are contaminated with semi-VOCs and oil and grease. In addition, an anomalous concentration of nickel was present in a monitoring well south of the former fuel storage area. Both additional soil sampling and groundwater sampling are needed to determine the extent of contamination at this site. The site was previously recommended for "No Further Action". Borings will be concentrated in the area of monitoring well HM-8 where soil contamination was first detected. Groundwater from monitoring well HM-14 will be collected and analyzed for nickel to confirm previous results.

5.2.14 Jet Engine Test Stand

Soils and groundwater at the jet engine test stand site contain fuel hydrocarbons and oil and grease. Although the site was previously identified as requiring "No Further Action", the data indicate that significant concentrations of contaminants may be present at the site. Additional soil borings and soil samples are needed to determine the extent of contamination. Additional groundwater quality data are needed from existing temporary wells located downgradient of the site. Aquifer testing will be conducted to

determine the hydraulic parameters of the upper zone at the jet engine test stand to be used in contaminant transport modeling. An additional monitoring well will be installed upgradient of the jet engine test stand to determine if the source of the fuel contamination is from the test stand site or from another site such as FSA No. 3.

5.2.15 Waste Water Collection Basins

Floor drains from the Process building empty into the wastewater collection basins. A very large potential exists for chemical and solvent spills to enter the basins. The integrity of the concrete basins has not been adequately addressed. Leaks in the basins could contribute significant contaminants to the soils and the upper zone groundwater adjacent to the basins. Soil samples will be collected from soil borings located immediately downgradient of the basins to determine if leakage from the basins has contaminated the upper zone groundwater. The soil borings will be completed as monitoring wells and groundwater quality data will also be collected. Aquifer tests will be performed on the new wells to determine hydraulic parameters to be used in groundwater and contaminant transport modeling. The results of the water quality sampling will be compared with water quality data upgradient of the basins to determine if the basins are the most likely source of the contaminants in the groundwater.

5.2.16 East Parking Lot/Flight Line TCE Plume

The Assembly Building/Parts Plant investigations are, in part, designed to identify potential source areas for the TCE contamination found in the upper zone from the East Parking Lot extending to the flight line area of Carswell AFB. Identification of the source area is necessary for source control. Previous investigations have evaluated the TCE groundwater plume but the downgradient extent of the plume has not been defined. Studies conducted by Radian Corp. on Carswell AFB have identified the presence of the plume but also have not defined the maximum extent. Additional downgradient monitoring wells are needed to define the maximum extent of the TCE contaminant plume.

Additionally, aquifer tests are needed for both existing and new monitoring wells in the East Parking Lot/Flight Line area to characterize the upper zone hydraulic parameters to allow groundwater flow and contaminant transport modeling.

Detailed lithologic logs of the new monitor well borings are needed to determine the nature of the upper zone lithology and bedrock topography, both of which affect the flow of groundwater and the transport of contaminants.

5.2.17 Site-Wide Investigations

5.2.17.1 Lake Worth

Lake Worth is providing recharge to the Paluxy aquifer in the area of AFP 4. To determine the water quality of the surface water recharging the Paluxy aquifer, surface water samples are needed from the lake to provide background data on the quality of the water available for recharge.

To determine if contaminants have entered Lake Worth from previous activities at AFP 4, near-shore lake bottom sediment samples are needed. These sediments will be taken to a depth of 2 feet below the lake bottom surface to help detect contamination that may have occurred in the past due to storm drain discharge, spills, or waste disposal.

5.2.17.2 Air Quality Monitoring

Both upwind and downwind air quality monitoring data are needed to help determine air quality prior to entering AFP 4 and air quality leaving AFP 4 to determine if significant contaminants (mainly VOCs) are being placed in the air environmental pathway at AFP 4. These data are necessary for assessing environmental risk.

5.2.17.3 Continuous Groundwater Elevation Monitoring

At two distinct locations at the plant, "continuous" data loggers and electronic pressure transducers will be installed in upper zone and Paluxy aquifer monitoring wells. Data collected will be used to evaluate (1) the hydraulic communication between the two aquifer systems, (2) the hydraulic response of the aquifers to external stresses such as lake fluctuations, precipitation, pumping, and barometric pressure fluctuations, and (3) hydraulic properties (such as barometric efficiency and hydraulic conductivity - from spectral analysis of response to solid earth tides).

5.2.17.4 Paluxy Aquifer System Characterization

Because the Paluxy Aquifer System is an important water supply in the Fort Worth area, its hydraulic and water quality/contaminant transport characteristics will be thoroughly investigated.

Aquifer testing will be conducted to provide hydraulic parameters for use in groundwater flow and contaminant transport modeling and remediation evaluation. In addition, these tests will be used to evaluate the hydraulic properties of the important aquitards that are part of the Paluxy system. Subsurface boring and logging will be conducted, and monitoring wells will be constructed in areas where current information is insufficient. Core analyses will be conducted to provide parameters for use in groundwater flow and contaminant transport modeling.

Groundwater samples will be analyzed to provide water quality data on the Paluxy aquifer. These data will be used to model contaminant transport in the Paluxy, evaluate remedial actions, and assess the impact on water quality from AFP 4 activities, Lake Worth recharge, and infiltration from the upper zone.

5.2.17.5 Archaeological Survey

Although nearly all land associated with AFP 4 has been disturbed, there may be small isolated areas along the shore of Lake Worth that warrant an archeological survey. The local historical societies will be contacted to determine if any historical sites were known to exist at AFP 4 prior to construction of the manufacturing facility. Areas determined to have potential for archeological finds will be surveyed by an experienced archeologist and findings will be presented in a letter report.

5.2.17.6 Ecological Survey

The majority of AFP 4 is covered by asphalt, concrete, buildings, or grasses which do not provide an environment for significant vegetative growth or wildlife. Three areas adjacent to AFP 4 do contain vegetation, wildlife, and aquatic life that may be affected by activities at AFP 4. These include Meandering Road Creek, Farmers Branch of the West Fork Trinity River, and Lake Worth. An ecological survey will be conducted for these three areas to determine if any threatened or endangered species are present, determine if there is evidence of stressed vegetation, and determine if there is evidence of contaminants within the food chain. Bottom dwelling aquatic life in Meandering Road Creek and Lake Worth (i.e., crayfish) will be collected and analyzed for select contaminants (i.e., heavy metals) to determine if contaminants from AFP 4 have affected aquatic life. These will include both upgradient and downgradient specimens. If warranted, burrowing animals such as rabbits will be collected and analyzed for select contaminants especially in areas where upper zone groundwater is known to discharge from AFP 4. Results will be used in the baseline risk assessment portion of the RI/FS.

5.2.17.7 Meandering Road Creek

Previous investigations have not adequately addressed the potential for contamination of the surface water pathway from sources originating from AFP 4. To adequately determine the distribution of contaminants within Meandering Road Creek, additional creek sampling stations will be established for the collection of surface water and stream sediments. The additional stations will include upstream locations to determine contamination of Meandering Road Creek from other sources.

To determine potential source areas for contaminant migration to Meandering Road Creek, additional seeps will be identified and sampled along the stream drainage. A detailed study of contaminant fate and transport after discharge from the seeps will be conducted in the area of Landfill No. 3. This study will evaluate contaminant distribution from the point of discharge (seep) to the current streambed.

5.2.17.8 Background Sampling

Two locations will be identified off-site for the collection of soil and soil gas samples to establish background concentrations for specific analytes. These background concentrations will be used for comparison with concentrations found in soils and soil gas at AFP 4. The locations will be chosen on the basis of having the same or similar lithology as AFP 4 and on the basis of being in a non-contaminated area (away from industrial activity).

5.2.17.9 Leachability Testing

Leachability tests (TCLP) of contaminated soils are necessary to determine the extent to which these soils are contaminating groundwater. Selected soil samples from each different type of hazardous waste site at AFP 4 (e.g., PSAs, FDTAs, landfills, chrome pits) will be analyzed for TCLP.

5.2.17.10 Common Ions

Approximately 20 percent of the groundwater samples collected for the RI/FS at AFP4 will be analyzed for common ions for use in geochemical characterization and modeling of the aquifer systems present at AFP4. These data may be useful in determining sources of groundwater recharge and groundwater flow paths. They may also be useful when evaluating remedial action alternatives and the possible effect of common ion constituents on the technology being evaluated.

6.0 PA/SI AND RI/FS WORK TASKS

6.1 SUBTASK 1.1 PROJECT PLANNING

Work to be completed during the Project Planning subtask includes the preparation of the following plans:

- Work Plan, Volume I -- The work plan provides the overall plan for conducting both PA/SI and RI/FS activities at AFP 4. The plan presents the scoping process and outlines future tasks. Previous studies are reviewed for background information and data that will be required to complete the subtasks described later in this document. A conceptual site model is presented for the purpose of determining objectives, rationale, and technical approach. Included is a schedule for the completion of the individual tasks and subtasks.

- Sampling and Analysis Plan, Volume II -- The Sampling and Analysis Plan (SAP) provides a detailed description of the field and laboratory methods to be used for the PA/SI and RI/FS. The plan presents the data quality objectives, investigation design, and rationale. Individual sampling locations are identified on individual site maps. Included are summaries of the number and types of samples and measurements required, sample identification numbers, analytical parameters, and QA/QC sample and measurement requirements. Included are descriptions of data management, logistics, and schedule.

- Quality Assurance Project Plan, Volume III -- The Quality Assurance Project Plan (QAPP) describes the methods and procedures that will be used to verify the precision, accuracy, and completeness of the data generated during the PA/SI and RI/FS at AFP 4. How the plan meets the 14 elements specified in the EPA Guidance for conducting remedial investigations and feasibility studies under CERCLA (EPA, 1988) is addressed.

- Health and Safety Plan, Volume IV -- The Health and Safety Plan describes the health and safety requirements for UNC Geotech and contractor personnel while conducting work at AFP 4. The plan incorporates, as necessary, health and safety requirements specified by General Dynamics which includes emergency procedures and notifications. The plan is consistent with Occupational Safety and Health Administration (OSHA) requirements and guidelines.

6.2 SUBTASK 1.2 COMMUNITY RELATIONS

A community relations plan was previously developed by the USAF for AFP 4 during the IRP investigations. The Air Force also had the responsibility for implementing the plan. A draft community relations plan is attached as Appendix A to this plan. It is a modified version of the previous plan. As part of the community relations plan, a Technical Review Committee (TRC) will be established. UNC Geotech will participate in the TRC meetings and will provide support to the Air Force in implementing the plan as needed.

6.3 SUBTASK 1.3 NO FURTHER ACTION DOCUMENTATION

On the basis of existing data, the following sites will be recommended for "No Further Action" (NFA) and a decision document will be prepared with all supporting documentation for the decision. NFA Decision Documents will be prepared for the following sites:

- Landfill No. 2
- FDTA No. 4 (Site 7)
- Solvent Lines (Site 18)
- NARF site (Site 19)

Additionally, if previous results are confirmed by RI studies proposed in this plan, NFA decision documents will be prepared for the following sites:

- Landfill No. 4
- FDTA No. 3
- Former Fuel Storage Area

6.4 SUBTASK 1.4 FIELD INVESTIGATIONS

Field investigation activities proposed for PA/SI and RI/FS sites at AFP 4 are listed below and are summarized in Table 2. Detailed descriptions of activity locations and techniques to be used are presented in the Sampling and Analysis Plan (Volume II).

6.4.1 Assembly Building/Parts Plant

- Soil gas survey at a depth of four feet spaced every 200 feet around entire building perimeter (approximately 75 locations). In areas of positive results for VOCs, additional soil gas samples will be collected to better define the lateral extent of contamination.

- On the basis of the soil gas survey, perimeter locations which had elevated VOCs will be investigated by soil borings and soil samples from the surface to the top of the water table. Estimated number of borings is 25 with an estimated 100 soil samples from the borings. Samples will be analyzed for VOCs, semi-VOCs, total petroleum hydrocarbons, and metals.

- On the basis of the soil gas and soil sample results, specific sites will be targeted as potential source areas within the Assembly/Parts Plant building. Select borings will be made within the building at locations that will yield the desired information but will not have a significant impact on production activities. An estimated 10 borings will be required. Specific locations will be determined after the other surveys are completed. The borings within the building may be completed as groundwater monitoring wells to provide groundwater flow data and groundwater quality data beneath the facility. These wells will be flush mounted.

- To determine extent of off-site migration near the southeast corner of the Assembly Building/Parts Plant facility, from two to four additional upper zone monitoring wells will be completed and sampled

Table 2. Summary of Field Investigation Activities at AFP 4.

Site	Field Investigation Activity												
	Soil Gas	Soil Borings	Soil Samples	Core Analysis	New Wells	Groundwater Samples Existing Wells/New Wells		Aquifer Tests	Water-level Measurements	Surface-water Samples	Sediment Samples	Air Samples	Biota Samples
Assembly Bldg/ Parts Plant	x	x	x		M[a]	x	x	x	x				
Underground Storage Tanks		x	x		C[a]	x	x	x	x				
Landfill 1		x	x	x		x		x					
Landfill 3		x	x	x	C	x	x	x	x	x	x		
Landfill 4		x	x										
FDTA No. 2		x	x		C		x	x	x				
FDTA No. 5		x	x		C	x	x	x	x				
FDTA No. 6		x	x		C		x	x	x				
Chrome Pit No. 3		x	x		C	x	x	x	x				
Die Yard Pits		x	x		M	x	x	x	x				
FSA No. 1	x	x	x		C		x	x	x				
FSA No. 2	x	x			C		x	x	x				
FSA No.3	x	x	x	x	C		x	x	x				
Former Fuel Storage Area		x	x			x							
Jet Engine Test Stand		x	x		C	x	x	x	x				
Wastewater Collection Basins		x	x		M		x	x	x				

Table 2 (continued) Summary of field investigation activities at AFP 4.

Site	Field Investigation Activity											
	Soil Gas	Soil Borings	Soil Samples	Core Analysis	New Wells	Groundwater Samples: Existing Wells/New Wells		Aquifer Tests	Water-level Measurements	Surface-water Samples	Sediment Samples	Air Samples	Biota Samples
East Parking Lot/ Flightline				x	C		x	x	x				
Lake Worth										x	x		
Meandering Road Crk										x	x		
Paluxy Formation Characterization (not site-specific)		x		x	M	x	x	x	x				
Air Monitoring (site-wide)												x	
Ecological Sampling (site-wide)													x
Background Locations	x	x	x										

[a]M = Multiple-level monitoring well; C = Conventional nested monitoring wells in separate boreholes.

in an area southeast of Clifford Avenue. Groundwater samples will be analyzed for VOCs, semi-VOCs, metals, total petroleum hydrocarbons, and oil and grease.

6.4.2 Underground Storage Tanks (removed)

- Soil borings will be placed around the perimeter of each of six former underground storage tank locations which, based on previous soil sample results, still contained contaminants in the soil after excavation and backfilling. A total of four borings will initially be required, one adjacent to each side of the former excavation to determine the lateral and vertical extent of contamination. If contamination above MCLs is present in any of the borings, (an) additional boring(s) will be made 50 feet outward from the previous boring until contamination no longer is present in concentrations exceeding MCLs. Borings will extend from the surface to the top of the water table. A maximum of 48 borings are estimated for the six locations. Samples will be collected from 5-foot intervals and analyzed for VOCs, semi-VOCs, and total petroleum hydrocarbons. Ten percent of the samples will be analyzed for metals.

- If contamination in the soils is found to extend to the water table at any of the former tank locations, one downgradient monitoring well will be installed to monitor upper zone groundwater quality. If no upgradient wells currently exist in the vicinity of a particular site, then an additional well may be required to establish the effect of the site on groundwater quality. If upgradient wells already exist, analytical results will be compared with the results from the downgradient well. A maximum of six downgradient wells will be installed and sampled, one for each removed tank. Groundwater samples will be analyzed for VOCs, semi-VOCs, and total petroleum hydrocarbons.

- If no contamination above MCLs is found from the soil sampling, a "No Further Action" decision paper will be prepared and submitted for regulatory review and concurrence. If contamination is found to be present, the data will be evaluated to determine if additional RI investigations are required.

6.4.3 Landfill No. 1

- A grid will be established across an area of approximately 1000 x 500 feet which encompasses the entire Landfill 1 (West Parking Lot) site. The locations will be marked with paint on the asphalt surface, using a grid spacing of 100 feet. At 50 percent of the grid points, a soil boring will be drilled and composite soil samples will be collected from 5 foot intervals from the surface to the water table. This will result in approximately 25 borings and 75 soil samples which will be analyzed for VOCs, semi-VOCs, oil and grease, and metals. These borings and soil sample analyses will be used to help define the lateral and vertical extent of contamination at Landfill 1.

- From the results of the initial sampling, an evaluation will be made as to whether additional data are required to better define areas of contamination. The remaining grid points previously established will be used as necessary to fill in data gaps.

- Slug-withdrawal tests will be performed on existing monitoring wells that were properly completed and not previously tested. Aquifer tests may also be repeated on monitoring wells HM-10, F-216, and F-217 if the results of previous tests appear inconsistent. The combined results will be used to characterize the hydraulic parameters of the upper zone at Landfill 1.

- Contaminant transport modeling will be performed using new and existing hydrologic data and water quality data to determine if the present french drain system is adequate to intercept contaminants migrating from the Landfill towards Meandering Road Creek.

6.4.4 Landfill No. 3

- A grid will be established on 100 foot centers across Landfill 3. Soil borings will be drilled and sampled at grid points to help define the lateral and vertical extent of contamination. The borings will be drilled from the surface to the top of the Walnut Formation and composite soil samples will be collected for each two foot interval to the top of the water table. The soil samples will be analyzed for VOCs, semi-VOCs, oil and grease, and metals.

- Selected soil borings (4-6) will be used as temporary monitoring wells for water level measurements and two rounds of groundwater sampling. The data from the temporary wells will be used to provide water quality and hydrologic data to be used in contaminant transport modeling. The samples will be analyzed for VOCs, semi-VOCs, total petroleum hydrocarbons, and metals.

- Slug-withdrawal tests will be performed on existing wells at Landfill 3 that were properly completed and not previously tested to determine hydraulic parameters of the upper zone. These data will be combined with water level and groundwater quality data for contaminant transport modeling.

- Groundwater from seeps downgradient of the landfill along Meandering Road Creek will be sampled to estimate the amount and relative concentrations of contaminants discharging from the upper zone into the Meandering Road Creek drainage. The seeps will be analyzed for VOCs, semi-VOCs, total petroleum hydrocarbons, and metals.

- Free product, where present, will be sampled using a teflon bailer and the sample will be analyzed to identify the type(s) of product present and, if possible, the relative age of the product.

- Channel soil and sediment will be sampled perpendicular to the Meandering Road Creek drainage to determine contaminant distribution from the point of upper zone discharge to the present stream channel. Approximately 10 samples spaced 10 feet apart will be collected from the surface to a depth of two feet starting immediately below the groundwater seeps extending to the creek in an area west of monitoring well F-214. These samples will be analyzed for VOCs, semi-VOCs, oil and grease, and metals.

6.4.5 Landfill No. 4

- Five soil borings along the base of the landfill in the Meandering Road Creek floodplain will be drilled to a depth of 10 feet and samples will be collected from 2-4, 4-6, 6-8, and 8-10 feet below the surface. The samples will be analyzed for VOCs, semi-VOCs, oil and grease, and metals.

- If no contaminants are present above background levels, a "No Further Action" decision document will be prepared and submitted to regulators for review and concurrence.

6.4.6 FDTA No. 2

- Four soil borings will be drilled 25 ft to the north, south, east and west of monitoring well HM-51, which is located near the approximate center of FDTA No. 2 to determine the extent of contamination. Composite soil samples will be collected from the surface to top of the water table at two foot intervals (0-2, 2-4, 4-6). Grab samples for VOCs will taken immediately from each core prior to compositing. The samples will be analyzed for VOCs, semi-VOCs, and total petroleum hydrocarbons.

- The soil borings will be deepened to the top of the Walnut Formation following soil sampling and groundwater samples will be bailed from the borings and analyzed for VOCs, semi-VOCs, and total petroleum hydrocarbons.

- If contaminants are present in soils from the borings, up to four additional borings will be drilled outward from the contaminated borings to better define the lateral extent of contamination. Soil samples would be collected as previously described.

6.4.7 FDTA No. 5

- Four soil borings are needed to help define the lateral extent of soil contamination related to FDTA No. 5. The soil borings will be located 50 feet north, south, east and west of monitoring well HM-25 which is located near the reported center of the training area. Composite soil samples will be collected from 5 foot intervals from the surface to the water table estimated to be approximately 30 feet. The composite samples will be analyzed for semi-VOCs, oil and grease, and metals. The composite samples will be analyzed for semi-VOCs, oil and grease, and metals. Samples for VOCs will be grab samples collected immediately after removal and prior to compositing.

- The west and east soil borings will be drilled below the water table and will completed as monitoring wells. Groundwater samples will be taken after completion and for one additional monthly round. The samples will be analyzed for VOCs, semi-VOCs, metals, total petroleum hydrocarbons, and oil and grease. The western well will be used to determine if upgradient sources are contributing to contamination found in the existing well HM-25. The eastern well will be used to assess the contribution of FDTA No. 5 to downgradient groundwater contamination.

- Water-level measurements and slug tests will be performed on the new monitoring wells to aid in the determination of flow directions and hydraulic parameters of the upper zone at FDTA No. 5.

6.4.8 FDTA No. 6

- Four to six soil borings will be drilled around the perimeter of the excavated portion of FDTA No. 6. A fifth boring will be placed in the approximate center of the excavation. The perimeter borings will be drilled to the base of the upper zone and samples will be collected in 2-foot intervals (0-2, 2-4, 4-6 ft). The boring within the excavation will be drilled to the base of the upper zone and a sample will be collected from the 4-6 ft interval. All samples will be analyzed for VOCs, semi-VOCs, oil and grease and metals.

- If water is encountered in any of the soil borings, a groundwater sample will be bailed from the hole and analyzed for VOCs, semi-VOCs, and total petroleum hydrocarbons.

6.4.9 Chrome Pit No. 3

- One upgradient and one downgradient monitoring well will be installed to assess the contribution of contaminants to the upper zone by the Chrome Pit No. 3 versus potential upgradient sources. Samples will be collected following completion and again after one month. Groundwater samples will also be collected from existing wells. All samples will be analyzed for VOCs, semi-VOCs, metals, and cyanide.

- Water-level measurements and slug tests will be performed on new monitoring wells in the vicinity of Chrome Pit No. 3. Slug tests will also be performed on any existing wells in the area that were properly completed and not previously tested to determine flow directions and hydraulic parameters for groundwater and contaminant transport modeling.

6.4.10 Die Yard Chemical Pits

- Eight soil borings will be drilled around the periphery of the excavated area of the former die yard chemical pits to determine both lateral and vertical extent of contamination In addition, two borings will be drilled in the central portion of the excavated area to determine if contaminants are present below the excavated portion of the die yard pits area. For the perimeter borings, samples will be collected at 5 ft intervals. Samples for VOCs will be grab samples from each interval. The remaining samples will be composites of each 5 ft interval. The samples from the borings within the excavated area will be collected only from the 15-20 and 20-25 ft intervals. All samples will be analyzed for metals, cyanide, VOCs and semi-VOCs.

- One of the two soil borings on the east side of the die yard pits area will be completed as an upper zone monitoring well to evaluate the groundwater quality immediately downgradient of the former pits. A groundwater sample will be collected after completion and then again after one month along with samples from existing well HM-24

which is upgradient of the site. The samples will be analyzed for VOCs, semi-VOCs, metals and cyanide.

- Aquifer tests will be performed on the new well to determine the hydraulic parameters of the upper zone in the Die Yard area.

6.4.11 FSA No. 1

- Installation of a free product recovery system will be conducted by the operating contractor (General Dynamics, Inc.) and free product will be removed and disposed of while other RI activities are being conducted.

- A soil gas survey, based on a grid spacing of 10 feet will be conducted over the FSA No. 1 area to better define the extent of contamination (will show both soil and groundwater contamination).

- On the basis of the results of the soil gas survey, up to 10 soil borings will be drilled at grid points near the suspected outer extent of contamination. Samples will be collected from 5 ft intervals beginning with the 5-10 ft interval extending to the water table. The samples will be analyzed for VOCs, semi-VOCs, total petroleum hydrocarbons and metals.

- Five of the ten borings will be completed as upper zone groundwater monitoring wells. The location of these wells will generally correspond to the maximum limits of the zone of contamination. Groundwater samples will be collected after completion and then monthly for two more sampling rounds. The samples will be analyzed for VOCs, semi VOCs, total petroleum hydrocarbons, and total metals.

- If floating product is observed in any of the new monitoring wells, the wells will be added to the product recovery system for free product removal.

- Aquifer tests will be performed on all new monitoring wells. Results will be compared and combined with aquifer test data from existing wells at FSA No. 1. These data will be used to define the hydraulic parameters of the upper zone in the area of FSA No. 1. Water-level measurements will be taken monthly for three months on the new wells to help determine groundwater flow directions.

6.4.12 FSA No. 2

- A soil gas survey will be conducted as a screening tool, based on a grid with a 20 ft spacing, to help delineate the extent of fuel contamination in soils surrounding FSA No. 2.

- On the basis of the approximate extent of contamination outlined by the soil gas survey, five soil boring locations will be selected to better define the lateral and vertical extent of contamination. Soil samples will be collected from the surface to the top of the water table (estimated 15 feet) in three-foot intervals (0-3, 3-6, 6-9, etc.). Samples for VOCs will be grab samples from each interval. The remaining samples will be composites of each three-foot interval.

The composite samples will be analyzed for semi-VOCs and total petroleum hydrocarbons.

- One upgradient and one downgradient monitoring well will be installed to better define the source and extent of groundwater contamination at FSA No. 2. A sample will be collected from each well after completion and again after one month and analyzed for VOCs, semi-VOCs, total petroleum hydrocarbons, and metals.

6.4.13 FSA No. 3

- Installation of a free product recovery system by General Dynamics, Inc. and initiation of product recovery prior to completing other RI activities.

- A soil gas survey, based on a grid spacing of 20 feet, will conducted as a screening tool across the FSA No. 3 area to help delineate the lateral extent of soil contamination.

- Based on the soil gas survey, from 5 to 10 soil borings will be drilled at grid points located on the outer margin of the zone of contamination. Soil samples will be collected at three-foot intervals from the surface to the top of the water table and analyzed for VOCs and semi-VOCs, and total petroleum hydrocarbons.

- Two additional monitoring wells will be installed to the east and two will be installed to the west of FSA No. 3. Where possible, a soil previously drilled will be completed as a monitoring well. Groundwater samples will be collected after completion and again after one month. If floating product is observed in the new monitoring wells, the wells will be added to the product recovery system.

- Aquifer tests will be performed on new monitoring wells and the results will be compared to and combined with existing aquifer test data to determine the hydraulic parameters of the upper zone at FSA No. 3. Water-level measurements will be taken prior to each round of sampling for groundwater flow data. The results will be used for groundwater and contaminant transport modeling.

6.4.14 Former Fuel Storage Area

- Four soil borings will be drilled 25 feet north, south, east, and west of existing monitoring well HM-8 to determine the lateral and vertical extent of contamination previously identified at that location. Soil samples will be collected from 5-foot intervals. Samples for VOCs will be grab samples from each interval. The remaining sample will be from composites of each 5-foot interval. The samples will be analyzed for semi-VOCs, total petroleum hydrocarbons, and oil and grease.

- An additional groundwater sample will be collected from monitoring well HM-14 and analyzed for nickel to confirm results of previous sampling.

6.4.15 Jet Engine Test Stand

- Four soil borings will be drilled around the perimeter of the jet engine test stand to better define the lateral and vertical extent of contamination. The borings will be drilled to the top of the water table and soil samples will be collected from 5-foot intervals. Samples for VOC analysis will be grab samples from each interval. Remaining samples will be composites of each interval. The samples will be analyzed for VOCs, semi-VOCs, total petroleum hydrocarbons, and oil and grease.

- One of the soil borings will be completed as a monitoring well. Groundwater samples will be collected from the new well and four existing "temporary" monitoring wells located downgradient of the jet engine test stand which were installed as part of a previous FSA No. 3 investigation. The samples will be analyzed for VOCs, semi-VOCs, TPH, and metals. The results will be compared with soil sample results to determine if contamination at the jet engine test stand may have the same source as that observed at FSA No. 3.

- Aquifer tests will be performed on the new well and existing wells that were properly completed.

6.4.16 Wastewater Collection Basins

- One soil boring immediately downgradient (east) of the chemical process building's wastewater collection basins and 25 feet north of monitoring well HM-47 will be drilled to the top of the water table. Soil samples will be collected from 5-foot intervals from the surface to approximately 30 feet. Samples will be analyzed for VOCs, semi-VOCs, and metals. The sampling will help determine if leakage has occurred from the basins to the adjacent soils.

- The soil boring will be deepened following soil sampling and completed as an upper zone monitoring well. Groundwater will be collected after completion and development and then again after one month. The samples will be analyzed for VOCs, semi-VOCs, and metals. The results will compared with results of groundwater samples from upgradient monitoring wells and well HM-47 to determine if the wastewater collection pits are a source for upper zone groundwater contamination.

- Aquifer tests will be performed on the new monitoring well and well HM-47 to determine the hydraulic parameters of the upper zone in the area of the collection pits. Water-level measurements will also be taken prior to each sampling to determine groundwater flow directions at the site.

6.4.17 East Parking Lot/Flight Line TCE Plume

- Obtain results of IRP investigations performed by/for Carswell AFB and enter information such as boring and monitoring well locations, analytical results, water-level measurements, aquifer tests, etc. into the AFP 4 data base for the purpose of groundwater modeling.

- With Carswell AFB review and approval, drill additional groundwater monitoring wells downgradient from the eastern most Carswell well containing TCE in the flight line area. Sampling would be performed and the samples analyzed for VOCs, chromium, and total petroleum hydrocarbons for two rounds of monthly sampling.

6.4.18 Site-Wide Investigations

6.4.18.1 Lake Worth

- Surface water samples collected every 400 ft along the shoreline of Lake Worth adjacent to AFP 4. Samples will be analyzed for VOCs, semi-VOCs, oil and grease, total petroleum hydrocarbons, and metals.

- Near-shore (approximately 10 feet from shoreline) lake bottom sediment samples will be collected from the lake bottom surface to a depth of two feet. Samples will be collected every 400 feet along the shoreline adjacent to AFP 4. The samples will be analyzed for VOCs, semi-VOCs, oil and grease, total petroleum hydrocarbons and metals. Samples collected near the former NARF site will be analyzed for radionuclides.

6.4.18.2 Air Quality Monitoring

- On the basis of a review of previous meteorologic data for AFP 4, two sites will be selected to monitor upwind and downwind air quality of AFP 4. Samples will be collected for VOCs and airborne particulates. Data will be collected from the two stations concurrently with RI/FS field activities to provide baseline air quality data.

6.4.18.3 Continuous Groundwater Elevation Monitoring

- Groundwater elevation monitoring in upper zone aquifer and Paluxy aquifer system at two separate locations -- one near Lake Worth, one distant from Lake Worth.

6.4.18.4 Paluxy Aquifer System Characterization

- Subsurface boring, logging, and monitoring well construction to provide lithologic and hydrologic data at additional locations.

- Aquifer testing on new and existing wells in the Paluxy aquifer system. Hydraulic response in other formations will be monitored to evaluate interconnectedness.

- Core analysis to determine vertical hydraulic conductivity, total organic carbon content, and organic partition and distribution coefficients.

- Groundwater sampling and analysis samples will be analyzed for VOCs, semi-VOCs, and metals.

6.4.18.5 Archaeological Survey

52 83

- Review of existing historical information available from local libraries, historical societies, and previous archeological surveys of the AFP 4 area.

- Surface archaeological survey conducted in known or suspected archaeological sites based on the literature search to be performed by an experienced archeologist.

6.4.18.6 Ecological Survey

- Inventory of flora and fauna in areas adjacent to AFP 4. List will be compared with list of threatened or endangered species.

- Collection of tissue and/or organs from select biota for trace contaminant analysis.

6.4.18.7 Meandering Road Creek Survey

- Surface water sampling and analysis for VOCs, semi-VOCs, metals, total petroleum hydrocarbons, and oil and grease.

- Sediment sampling and analysis for VOCs, semi-VOCs, metals, total petroleum hydrocarbons, and oil and grease.

- Sampling and analysis of groundwater from seeps along the Meandering Road Creek drainage. Samples will be analyzed for VOCs, semi-VOCs, metals, total petroleum hydrocarbons, and oil and grease.

- Measurements of water quality parameters will be made at each water sampling location (pH, conductivity, temperature).

6.4.18.8 Background Sampling

- Collection of two soil samples at one foot intervals (0-1 and 1-2) at each background location. Samples will be analyzed for VOCs, semi-VOCs, metals, total petroleum hydrocarbons, and oil and grease.

- Collection of one soil gas sample from a depth of four feet at each background location for analysis for VOCs.

6.4.18.9 Leachability Testing

- Collection of at least one soil sample from each type of hazardous waste site to be analyzed for TCLP.

6.4.18.10 Common Ions

- Collection of groundwater samples at approximately 20 percent of the proposed sample locations for laboratory analysis of common ions. Alkalinity, DO, and Eh will be measured in the field at these locations. Sample locations will be selected on the basis of a minimum of one sample from each study area.

6.5 SUBTASK 1.5 SAMPLE ANALYSIS/VALIDATION

A general outline of the sample analyses were provided in the discussion of Subtask 1.3, Field Investigations. Details of the methods of sample analysis and validation activities are provide in the Sampling and Analysis Plan (SAP), Volume II, for AFP 4.

Analyses for volatile organics, metals, and inorganics will be conducted by UNC Geotech at the U.S. DOE Grand Junction Projects Office (GJPO), Grand Junction, Colorado. Semi-volatile organic analyses will be performed by a subcontract laboratory. All methods will be equivalent to currently approved U.S. EPA procedures. To ensure the accuracy and validity of analytical data, a Quality Assurance Project Plan (QAPP), Volume III, for AFP 4 has been prepared. This plan provides a description of quality assurance/quality control (QA/QC) procedures that will be followed for RI/FS activities at AFP 4. Requirements for the number and type of QA/QC samples to be taken in support of field activities at AFP 4 are presented in the Sampling and Analysis Plan, Volume II.

6.6 SUBTASK 1.6 DATA EVALUATION

After data have been validated as being accurate and within established control limits, the data obtained from previous investigations and data from UNC Geotech investigations will be evaluated and used to develop effective remedial action plans for sites requiring remediation. These data will also be used to develop evidence to support a "No Further Action" alternative decision for those sites found not to be a threat to the human or natural environment, and to formulate recommendations for additional data collection where data gaps are found to occur. Examples of the types of data that will be collected include:

- Lithologic logs
- Field water-quality data
- Field toxic gas or vapor monitoring
- Soil organic-vapor monitoring
- Daily field observation logs
- Water-level data
- Aquifer-test data
- Laboratory analyses of ground and surface water
- Laboratory analyses of soil and sediment samples

The data will be organized into discrete field data files and will be evaluated and processed to provide the following information:

- Lithologic and geologic cross sections
- Aquifer-thickness maps
- Groundwater-level maps
- Groundwater contaminant plume maps
- Soil contamination cross sections
- Contaminant concentration contour maps
- Analysis of individual well tests
- Calculation of groundwater flow rates
- Sorting of data to show locations of contaminants exceeding regulatory thresholds
- Estimation of source terms for identified contaminant source areas.

6.7 SUBTASK 1.7 ASSESSMENT OF RISKS

A baseline risk assessment will be conducted for AFP 4 to evaluate the potential threat to the human or natural environment resulting from the release of contaminants in the absence of any remedial action at AFP 4. This assessment will be used as a basis for determining whether remedial action is necessary. The components of the baseline risk assessment as specified in the Superfund Human Health Evaluation Manual (USEPA, 1989a) will be:

- Selection of indicator chemicals
- Assessment of contaminant concentrations and comparison of projected exposure point concentrations to applicable or relevant and appropriate requirements (ARARs)
- Estimation of human intakes
- Evaluation of toxicity of indicator chemicals
- Quantitative characterization of risk

The determination of indicator chemicals will be based on selecting those chemicals or contaminants that pose the greatest potential risk to public health from all contaminants identified as having been released to the environment at AFP 4. Generally, these chemicals will represent the most toxic, mobile and persistent chemicals at the site or those found in the largest amounts (i.e. TCE which is prevalent in upper zone groundwater over much of AFP 4).

The contaminants and their concentrations at the point of potential exposure will be compared with the local, state and federal ARARs to determine if they exceed the mandatory or recommended maximum concentrations.

Estimates of human uptake of the indicator chemicals will be based on the size of the population and proximity to the potential exposure point for each contaminant pathway as well as predictions of the type of exposure (i.e. ingestion, inhalation, adsorption).

The physiochemical properties of the indicator chemicals will be reviewed as they relate to potential harm to human health. The chemicals are usually classified as toxic, hazardous, or carcinogenic and have established exposure limits. These exposure limits will be compared with the concentrations and anticipated lengths of exposure for human receptors of contaminants present at AFP 4.

The quantitative characterization will utilize all of the above information which will be entered into a computer data base and both on-site and off-site quantification of risk will be calculated using formulas contained in the U.S. EPA's Risk Assessment Guidance for Superfund: Environmental Evaluation Manual (USEPA, 1989b). Calculations will be made on both the "worst case" and "most probable case" and compared to the EPA's "acceptable risk" threshold.

In addition to public health, a qualitative assessment, fashioned after U.S. Department of Interior Type B evaluations (43 CFR 11, Subpart E; U.S. DOI, 1986), of the risks to the environment will be conducted. This will include an assessment of risk to terrestrial ecosystems and aquatic ecosystems at or near AFP 4. If sufficient evidence of a significant risk to the environment exists as a result of the assessment, biological sampling may be required as part of the RI/FS.

Two interim progress reports will be prepared and submitted to U.S. EPA for review prior to completion of the risk assessment. These reports will be informal reports which present assumptions being used, indicator chemicals selected, and exposure scenarios used.

6.8 SUBTASK 1.8 TREATABILITY STUDY/PILOT TESTING

Selected samples from each different type of hazardous waste site will be analyzed for TCLP to provide preliminary leachability data for contaminants in soils. These data will be used during screening of remedial action alternatives.

It is not expected that treatability studies/pilot testing will be needed at AFP 4. However, if site characterization data generated during the RI indicate that a potential treatment technology might be effective, but the technology has not been sufficiently demonstrated, treatability studies (either at the bench or pilot testing level) will be implemented. The proposed studies will be reviewed by ASD/PMDA and the EPA to verify that an appropriate level of detail has been incorporated. Special emphasis will be given to new technologies such as bioremediation where impacts on facility operations are minimized while still achieving results that satisfy existing ARARs.

One study, although not geared toward a specific treatment technology, will be conducted to determine the effects of the introduction of a detergent (AFFF) into groundwater containing solvents such as trichloroethylene (TCE). This study will be designed to aid in the prediction of contaminant transport in the East Parking Lot/Flight Line area TCE plume. Leaking pipelines carrying AFFF have resulted in the estimated loss of 25,000 gallons of detergent. It is unknown at this time if the detergent could have a significant impact on the rate of contaminant transport.

6.9 SUBTASK 1.9 ALTERNATIVE DEVELOPMENT AND SCREENING

All work performed under Subtask 1.9 will be conducted according to the criteria specified in the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, EPA/540/G-89/004.

6.9.1 Interim Remedial Action Alternatives

In the course of the RI/FS, any areas found to contain contaminants in significant quantities or that are highly hazardous to human receptors which appear to pose an immediate threat to human health or the environment will be evaluated for possible interim remedial actions designed to minimize the hazard until a permanent remedial action can be taken.

Some interim remedial actions have already been conducted at AFP4 (i.e. Landfill 1, Chrome pit No. 3, and Die Yard Pits) and others have been proposed (Fuel Saturation Areas No. 1 and No. 3). UNC will evaluate the effectiveness of each of these interim remedial actions and will make recommendations for further remedial actions as necessary. In some cases, a Record of Decision (ROD) will be prepared and submitted for the appropriate local, state and EPA concurrence prior to the completion of the RI/FS.

Other areas such as Landfill 3, where floating product occurs adjacent to Meandering Road Creek, will be evaluated for possible interim remedial action designed to minimize the potential for future significant contamination of environmental pathways. The areas will be further characterized during the RI/FS since the interim remedial action is only designed to mitigate immediate threats to the human or natural environment.

6.9.2 Alternative Development and Screening

6.9.2.1 Developing a Range of Remedial Action Alternatives

A list of technologies will be developed to meet the remedial action objectives which are ultimately designed to eliminate or contain contamination to a level that protects human health and the environment. Each technology will be explored to determine if it is appropriate when site-specific conditions are considered. To be studied further, the technologies must achieve standards for effectiveness, implementability, and cost. Technologies that are clearly inappropriate because they are unreliable, perform poorly on the contaminants of concern, or are not sufficiently developed will be eliminated. Advanced, innovative, or alternative processes will be included whenever possible.

6.9.2.2 Alternative Screening

Remedial action alternatives will be developed from the list of technologies that have passed the initial screening. One or more technologies will be combined to achieve the general response objectives of source control or management of migration. Source control actions will prevent or minimize migration of hazardous substances from the source material. Management of migration remedial actions are necessary if hazardous materials have moved from the source and pose a threat to public health or the environment. Those remedial action alternatives that permanently contain, immobilize, destroy, or recycle contaminants will receive the most consideration.

The alternatives will be screened for environmental considerations, including compliance with chemical and location specific Applicable or Relevant and Appropriate Regulations (ARARs). The ability of an alternative to protect workers and the community during remedial actions will be weighed, along with the time required to complete the action. Long-term considerations, such as residuals or untreated wastes and reliability of the alternative, will be accounted for.

A cost screening will be performed on each alternative to exclude those alternatives that are orders of magnitude more expensive without providing significant additional protection of human health or the environment.

The list of screened remedial action alternatives which will be passed on to the next phase of alternative selection (Detailed Analysis of Alternatives) will include the "No Action" alternative for each site.

The screening process may be repeated several times through the RI/FS process as more site data are collected to reflect improved understanding of the site. The initial development and screening will begin during the RI so that additional field data requirements needed for specific remedial action

alternatives can be defined. The initial screening will utilize the objectives established through the use of the conceptual site model which provides a preliminary assessment of contaminants, pathways, and receptors.

6.10 SUBTASK 1.10 DETAILED ANALYSIS OF ALTERNATIVES

Detailed analysis of each of the remaining remedial action alternatives, following the alternative screening process, will provide a basis for informed decision making concerning the best alternative(s) for each site. The alternatives will be assessed using the following nine criteria established in the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA, 1988):

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

Evaluations of alternatives will be performed that cover technical, public health, environmental, institutional and cost issues.

6.10.1 Detailed Technical Evaluation

The technical evaluation will include performance, reliability, implementability, and safety. The alternatives will be rated for the degree of control of hazards to the public health or workers while achieving the desired remedial objectives over the life of the action. The time required to implement the action, as well as the time to complete the action will be major considerations when evaluating an alternative.

Two aspects of remedial actions determine their desirability on the basis of performance: effectiveness and useful life. The effectiveness will be evaluated as the degree to which a particular action will prevent or minimize substantial danger to public health, welfare and the environment. The effectiveness will be an estimate of the expected amount of reduction in the toxicity of the chemicals present, mobility of the contaminants, or volume of contaminants expressed in percentage of the total estimated volume. The evaluation of effectiveness will also evaluate the estimated amount and/or relative concentrations of contaminants remaining following remedial action using a specific technology.

The useful life will be defined as the length of time that the desired level of effectiveness can be maintained using a particular remedial action alternative. This evaluation will look primarily at the short-term and long-term effectiveness of the technology. The effectiveness of some technologies such as bioremediation tend to diminish over time as the contaminant levels are reduced.

Reliability of a remedial action alternative will be measured in terms of the operation and maintenance requirements and whether or not the particular technology being evaluated has been demonstrated as being reliable at other similar sites. For new technologies, results of treatability/pilot testing will be evaluated, and if warranted, additional studies may be performed on contaminated materials at AFP 4 during the RI phase of the project to provide sufficient information to evaluate the alternative during the FS portion of RI/FS at AFP 4.

The relative ease of installation and the time required to achieve a given level of response will be evaluated as the implementability of a specific remedial action technology. Ease of installation (often referred to as constructibility) will be determined in terms of the difficulties which may be associated with construction and the uncertainties related to construction. For the areas that have or will have undergone interim remedial action, the evaluation will consider the ability of the system to be modified or changed to achieve the desired long-term remedial action objectives. One such evaluation will be performed for the French Drains installed in Landfill 1 which were originally designed as a interim action to intercept leachate from the Landfill prior to entering Meandering Road Creek. In addition to the constructibility portion of the implementability evaluation, the time requirements required to implement a technology and the time required before results are actually realized will also be evaluated. Impacts to the daily operation of AFP 4 will also be assessed as part of the implementability evaluation.

Each remedial alternative will be evaluated with regard to safety which includes short-term threats to the safety of workers, to nearby communities, and to the environment as a result of implementation of a remedial action alternative. Ways to minimize the potential safety hazards will be assessed when performing a detailed analysis of an alternative.

6.10.2 Evaluation of Institutional Requirements

Institutional requirements will be addressed during a detailed analysis of the ARARs. Each remedial action will be checked for compliance with each category of ARAR -- chemical-, location-, and action-specific. The contaminant specific ARARs will be evaluated for the appropriate health-based or risk-based concentration limits for particular hazardous substances or contaminants known to be present at a specific site at AFP 4 depending upon the media in which it's found (air, soils, water, etc.) Location specific ARARS will evaluate any additional requirements placed on a site on the basis of unique characteristics of a site which could be affected as a result of remedial action (i.e. wetlands, archaeological sites, wildlife habitat). The action specific ARARs will be evaluated to determine technology-based restrictions which apply to the remedial action alternative being considered (i.e. land disposal restrictions). The effects of Federal, State, and local standards on the design, operation, and timing of each alternative will be identified. The ARARs determined by EPA Region VI and the Texas Water Commission are presented as Appendix B to this plan.

6.10.3 Evaluation of Public Health Protection

The baseline risk assessment to be performed in Subtask 1.6 will quantitatively evaluate the "No Action" remedial action alternative. The

information about chemical releases, routes of exposure, human exposure points, and the assessment of health risks determined from the no-action alternative will be used as input for further development of the proposed remedial action alternatives. Each alternative remedial action will be compared to this baseline in accordance with the Risk Assessment Guidance for Superfund: Human Health Evaluation Manual (USEPA, 1989a) and by applying a methodology analogous to that employed in the baseline risk assessment.

The scope of the Public Health Evaluation will depend on the results of the RI and the initial alternative screening. It is anticipated that remedial action will be required for several areas at AFP 4. Quantitative assessment of these areas will use as much site-specific information as possible to conduct the exposure estimates. Given the potential complexity of the individual sites and exposure pathways at AFP 4 (i.e. groundwater contamination from multiple source areas) site-specific assessments may be difficult.

The specific components that will be used for each of the areas for which remedial action alternatives are to be considered by Public Health Evaluation are as follows:

- Site-specific review of indicator chemicals
- Exposure assessment
- Toxicity assessment
- Quantitative risk characterization
- Recommendations for further action
  - No action
  - Remediation that satisfies existing ARARs
  - Remediation that exceeds existing ARARs
  - Remediation that does not meet existing ARARs but may nevertheless constitute a satisfactory approach to management of the site.

6.10.4 Detailed Cost Analysis

A detailed cost analysis of each alternative will be performed that considers the capital as well as the operating costs. A present-worth analysis for each option will compare all alternatives on the same cost basis. A sensitivity analysis will show the effects of changes in important variables on the total costs of the alternatives.

UNC Geotech will identify all capital and operation and maintenance costs for each remedial action alternative and estimate the cost of these components. The costs will also be divided into remedial action and post-closure care groups. Remedial action costs are defined as activities that are required to prevent or mitigate migration of hazardous materials released from an uncontrolled site. Remedial actions are directed at achieving cleanup goals. Post-closure activities occur after remedial action is completed and include the continued operations necessary to assure that further contaminant releases are stopped.

Cost estimates will give comparative life-cycle cost information for the remedial action alternative under consideration. Cost estimation distinctions will be made between capital and operation and maintenance costs. Cost accuracy will be in the range of -30 to +50 percent; any deviations to this range will be noted in the FS.

6.10.5 Regulatory and Community Acceptance

Technical and administrative issues and concerns, which any of the local, state, and federal regulatory agencies or local private citizens or citizen groups have concerning proposed remedial alternatives to be implemented at plant, will be addressed mainly during the review process between the completion of the RI/FS and the final ROD. Formal public comments and concerns resulting from the 30-day public comment period will be addressed in the ROD and responsiveness summary.

Regulatory concerns and issues will be addressed throughout the RI/FS process by the Technical Review Committee (TRC) process which will include participation by local, state and federal regulatory personnel as well as UNC Geotech, General Dynamics, and USAF. Results of the detailed analysis of the alternatives will be presented to the TRC prior to finalization of the FS report. This information exchange will be designed to reduce the review and comment time required to obtain a ROD.

6.11 SUBTASK 1.11 DRAFT REMEDIAL INVESTIGATION AND FEASIBILITY STUDY REPORTS

The RI and FS reports will be prepared concurrently using all of the previous and present data, and information and supporting material needed to make decisions on the remedial actions required to ensure that AFP 4 is in compliance with environmental laws and that the public and the environment are not at risk as a result of previous activities at AFP 4.

A preliminary draft RI report will be prepared following completion of RI activities at AFP 4 which will be distributed for USAF and General Dynamics review. This report will describe the results of all previous field investigations with emphasis on identification of contaminants, extent of contaminants, contaminant pathways, potential receptors, receptor exposure points, and rates of contaminant migration. The RI report will generally follow the report format outlined in the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA(EPA, 1988). The report will include a baseline risk assessment. Conclusions and recommendations for future work will also be included. Results of PA/SI studies will also be included as part of the RI since both types of investigations will be conducted concurrently at AFP 4. Recommendations for additional investigation will also be included for the PA/SI sites.

Following review of the preliminary draft, UNC Geotech will incorporate comments and address concerns and prepare a final draft report to be submitted to the State and Federal regulators for review and comment. Following review, UNC will address comments and concerns prior to release of the document for public comment.

A preliminary FS report will be prepared which summarizes the entire process whereby UNC Geotech developed, screened, and analyzed remedial action alternatives. The FS report will utilize all of the information presented in the RI report as a basis for determining the remedial action alternatives that are best suited to eliminate, minimize, or contain hazardous materials that pose a potential threat to the public or the environment. The FS will document the rationale and the assumptions made in selecting the preferred remedial alternative(s). The FS report will generally follow the format outlined in the Guidance For Conducting Remedial Investigations and

Feasibility Studies Under CERCLA(EPA, 1988). In addition to the documentation necessary for the selection of a preferred remedial action alternative, the FS report will also provide a qualitative public health impact assessment of the proposed remedial action alternatives. The preliminary draft will be presented to the USAF and General Dynamics for review and comment.

Following the initial review of the FS, UNC Geotech will address and incorporate, where appropriate, the comments and concerns received from the USAF and General Dynamics. A final draft FS report will be submitted to State and Federal regulators for review and comment. These comments will be addressed and the document will be revised prior to release for public comment.

All documents will be prepared and delivered according to the schedule established by the Interagency Agreement (IAG) between the USEPA and the USAF for AFP 4.

7.0 PROPOSED SCHEDULE

Figure 26 is the proposed work schedule for conducting RI/FS activities at AFP 4. The schedule includes several assumptions:

- Regulatory review, comment, and approvals are received within the allotted timeframe.
- The number of hazardous waste sites to be characterized remains as proposed in this plan.
- Changes in federal, state, or local laws and statutes do not occur that would require collection of additional data (i.e., lowering of contaminant MCLs).

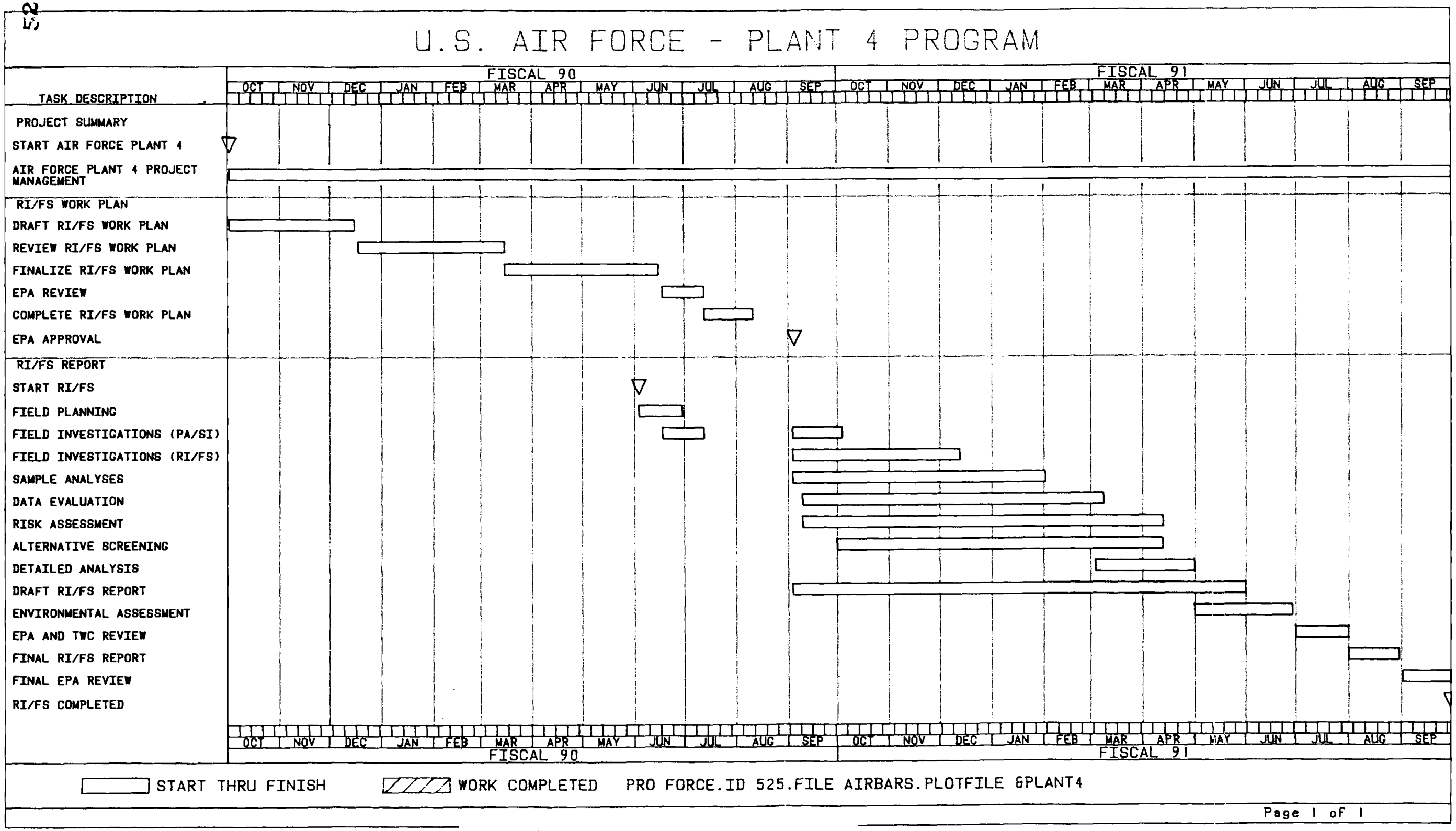


Figure 26. Schedule of RI/FS activities at AFP 4

8.0 REFERENCES

California Administrative Code, 1985. Title 22, Section 66699.

CH2M HILL, Inc., 1984. Installation Restoration Program Records Search for Air Force Plant 4, Texas. (IRP Phase I.) August 1984.

D'Appolonia, 1983. Letter Report: Seismic Refraction Survey, General Dynamics Corporation, Fort Worth Division, Fort Worth, Texas. December 2, 1983.

Freeze, R. A., and J. A. Cherry, 1979. Groundwater: Prentice-Hall, inc., Englewood Cliffs, N.J. 604 pp.

General Dynamics Corporation, Fort Worth Division, 1988. Remedial action for Fuel Saturation Areas 1 and 3 and Treating Leachate of French Drain No. 1, Part III, Statement of Work, Air Force Major Project 1-86-59, AF Tracking No. 86-FP-10-70-1-1, PSR 61 H6P, October 4, 1988.

General Dynamics Corporation, Fort Worth Division, 1990. Inventory of Groundwater Monitoring Equipment and Supplies In Storage.

Hargis + Associates, Inc., 1985a. Phase II Investigation of Subsurface Conditions at U.S. Air Force Plant No. 4, Fort Worth Texas. Volumes 1-6. September 25, 1985.

_____, 1985b. Assessment of French Drain Pumpage, U.S. Air Force Plant No. 4, Fort Worth, Texas. December 6, 1985.

_____, 1985c. Results of Soil and Groundwater Assessment for the Proposed Systems Development Laboratory and Anechoic Chamber Buildings, U.S. Air Force Plant No. 4, Fort Worth, Texas. December 16, 1985.

_____, 1987a. Summary Report, Window Area Investigation, U.S. Air Force Plant No. 4, Fort Worth, Texas. April 21, 1987.

_____, 1987b. Water Quality Data, May 1986 through May 1987. U.S. Air Force Plant No. 4, Fort Worth, Texas. August 5, 1988.

_____, 1988a. Lithologic logs from field notebooks, GDFW Window Area, March 1988 Investigation. Volumes 1-3. March 1988.

_____, 1988b. Evaluation of Condenser Water Pipeline and Interim Remedial Measures, Fuel Saturation Area No. 3, U.S. Air Force Plant No. 4, Fort Worth, Texas. July 15, 1988.

_____, 1989. Summary of Interim Remedial Investigations, January 1987 to April 1989, U.S. Air Force Plant No. 4, Fort Worth, Texas.

Hargis & Montgomery, Inc., 1983. Phase I Investigation of Subsurface Conditions at Air Force Plant 4, Fort Worth, Texas. Volumes 1-3. February 3, 1983.

References (continued)

Intellus Corporation, 1986a. Draft Remedial Action Plan and Conceptual Documents for Fuel Saturation Areas No. 1 and 3, Air Force Plant No. 4, Fort Worth, Texas. July 1986.

____, 1986b. Draft Interim Report for Ten-Site Field Investigation, Air Force Plant No. 4, Fort Worth, Texas. November 1986.

_____, 1987. Draft Assessment Report for Landfill No. 3, Air Force Plant No. 4, Fort Worth, Texas. June 1987.

_____, 1987. Assessment Report for Landfill No. 3, Air Force Plant No. 4, Fort Worth, Texas.

Leggat, E. R., 1957. Geology and Groundwater Resources of Tarrant County, Texas. Texas Board of Water Engineers bulletin 5709. September 1957.

Nordstrom, Phillip L., 1982. Occurrence, Availability, and Chemical Quality of Ground Water in the Cretaceous Aquifers of North-Central Texas. Volume I. Texas Department of Water Resources Report 269. April 1982.

Radian Corporation, 1985. Installation Restoration Program, Phase II. Confirmation/Quantification Stage 1, Carswell AFB, Texas. Volumes 1-3. September 1985.

_____, 1987. Installation Restoration Program, Phase II, Confirmation / Quantification Stage 1, Air Force Plant no. 4, Fort Worth, Texas. Volumes 1-7. December 1987.

Technical Review Committee, 1984. Meeting Notes January 20, 1984.

Texas Air Control Board, 1984. Letter form Executive Director Bill Stewart, addressed to General Dynamics, Fort Worth Division Vice-President and General Manager Herbert Rogers, dated November 21, 1984.

U.S. Army Corps of Engineers, Kansas City Division, 1986. Investigation of Groundwater Pollution at Air Force Plant No. 4, Fort Worth, Texas. October 1986.

U.S. Environmental Protection Agency. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 40 CFR Part 300 et seq.

_____, Superfund Amendments and Reauthorization Act (SARA), 40 CFR Part 300 et seq.

_____, 1986. *Test Methods for Evaluating Solid Waste*, SW-846, Third Edition, November 1986.

_____, 1988. *Draft Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*, OSWER Directive 9335.3-01.

References (continued)

U.S. Environmental Protection Agency, 1989a. *Risk Assessment Guidance for Superfund, Vol. I, Human Health Evaluation Manual (Part A)*, EPA 540/1-89/002.

_____, 1989b. *Risk Assessment Guidance for Superfund, Vol. II, Environmental Evaluation Manual* , EPA 540/1-89/001.

Walton, William C., 1987. Groundwater Pumping Tests, Design and Analysis: Lewis Publishers, Chelsea, MI, 200 pp.

9.0 ACRONYMS

ACRONYM	MEANING
AFB	Air Force Base
AFP 4	Air Force Plant No. 4
ARAR	Applicable or relevant and appropriate requirement
ASD	Aeronautics Systems Division
BTEX	Benzene, toluene, ethylbenzene, xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DCA	Dichloroethane
DCB	Dichlorobenzene
DCE	Dichloroethylene
DQO	Data quality objective
EPA	U.S. Environmental Protection Agency
FDTA	Fire Department training area
FID	Flame ionization detector
FS	Feasibility Study
FSA	Fuel saturation area
GC	Gas chromatograph
GD	General Dynamics
GOCO	Government-owned, contractor-operated
gpd/ft	gallons per day per foot
gpm	gallons per minute
HARM	Hazard assessment rating methodology
IRP	Installation Restoration Program
MEK	Methyl ethyl ketone
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
ml	milliliter
MS	Mass Spectrometer
msl	mean sea level
NARF	Nuclear Aerospace Research Facility
NCP	National Contingency Plan
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollution Discharge Elimination System
NPL	National priorities list
OSHA	Occupational Safety and Health Administration
OVA	Organic vapor analyzer
PCB	Polychlorinated biphenyls
PCE	Tetrachloroethylene
PID	Photoionization detector
ppm	parts per million
PQL	Practical quantitation limits
PRP	Potentially responsible party
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RI	Remedial investigation
ROD	Record of decision
SARA	Superfund Amendments and Reauthorization Act
ACRONYM	MEANING

SCBA	Self-contained breathing apparatus
SDWS	Secondary drinking water standards
SCS	Soil Conservation Service
TCA	Trichloroethane
TCE	Trichloroethylene
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
TRC	Technical Review Committee
TTLC	Total threshold limit concentration
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
UNC	UNC Geotech
USAF	United States Air Force
USDA	United States Department of Agriculture
VOC	Volatile organic compound

APPENDIX A

COMMUNITY RELATIONS PLAN

COMMUNITY RELATIONS PLAN FOR RI/FS ACTIVITIES AT AIR FORCE PLANT 4

A1.0 INTRODUCTION

This Community Relations Plan has been prepared for Remedial Investigation/ Feasibility Studies (RI/FS) to be performed at Air Force Plant No. 4 (AFP 4), Fort Worth, Texas. The objective of the plan is to identify, consider, and respond to issues and concerns of the Fort Worth and White Settlement communities at large and specifically to the citizens who live and work in the vicinity of AFP 4. This plan is designed to provide the basis for all of the community relations efforts associated with the RI/FS including the handling of citizen and press queries and news releases.

A2.0 BACKGROUND

Air Force Plant 4 is a Government-Owned, Contractor-Operated (GOCO) defense manufacturing facility located in Fort Worth, Texas. The plant is operated by General Dynamics, Fort Worth division, and employs approximately 30,000 people. The plant occupies approximately 602 acres and has about 6.5 million square feet of manufacturing floor space. The facility is bounded by Carswell Air Force Base to the east, Lake Worth to the north, and the city of White Settlement to the south and west.

AFP 4 began operations in 1942 as a prime assembly plant for the B-24 Liberator Bomber. Because the plant could not receive enough components from other manufacturers, it was decided that the plant wound begin producing components, as well as delivering completed aircraft. Near the end of World War II, production began on the B-32. That aircraft was followed by the B-36, the E-58, the F/FB-111, and the F-16, which General Dynamics is currently producing for the U.S. Air Force, U.S. Navy, and for several allied air forces in other countries. AFP 4 is a major component of the U.S. national defense effort.

In addition to supplying major weapons systems to the Department of Defense, AFP 4 has been a major employer and user of supplies and commodities in the Fort Worth area since the early 1940s and is an important part of the economic base of the area.

During the manufacturing processes over the years, hazardous and potentially hazardous chemicals and compounds have been used, stored, and disposed of at AFP 4. On the basis of a scoring methodology used by the U.S. Environmental Protection Agency (Hazard Ranking System), AFP 4 was placed on the proposed federal Superfund National Priorities List (NPL). Through an interagency agreement, the U.S. Air Force will perform the necessary studies and remedial action activities necessary to meet the requirements set forth by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. As part of the requirements under CERCLA and SARA, the RI/FS will be conducted. In an on-going effort to keep the communities informed and involved in the decision making processes, a community relations plan has been developed.

A3.0 PREVIOUS STUDIES

A potential environmental contamination problem was first discovered in September 1982 by a private citizen, who reported an odor from an outfall that empties into Meandering Road Creek nearby AFP 4 to the Fort Worth Water Department. General Dynamics was notified and took immediate action by installing a "French Drain" that was designed to collect the contaminated water prior to entering the creek. The french drain consisted of an open trench filled with gravel that has a perforated pipe in the bottom to collect contaminated groundwater. In addition, General Dynamics began routine testing and monitoring of the surface water in Meandering Road Creek; this testing continues to date with the results indicating that no significant contaminants have reached Lake Worth. General Dynamics, once alerted to the problem, met with Fort Worth City Health Department officials to appraise them of the situation at the plant. A soil and water sampling program was initiated to investigate the extent of the problem.

Since 1982, numerous investigations have been conducted at AFP 4 to identify and evaluate areas of known or suspected contamination. Also included were several interim remedial actions to minimize or eliminate potential environmental hazards that might affect humans or the natural environment. Aeronautical Systems Division, Wright-Patterson AFB, Ohio, which has facilities management responsibility for all Air Force-owned, contractor-operated defense plants, initially provided funding and contractual direction to General Dynamics under the existing facilities management contract to hire Hargis and Montgomery, a private hydrogeology consulting firm, to investigate the potential problems associated with Landfill 1 (site of the french drain). The results of the Hargis investigation were reported to the National Contingency Response Center, U.S. Environmental Protection Agency (EPA) region VI, Texas Department of Water Resources, and the City of Fort Worth Water Department. U.S. EPA and Texas Department of Water Resources officials visited AFP 4 and the site of the "French Drain" on November 8, 1982 and approved the interim action.

On November 15, 1982, the firm of Hargis and Montgomery was retained to conduct an investigation of subsurface conditions at the plant, and on December 1, 1982, this same firm was retained to conduct a study of the entire property. That study resulted in drilling and completion of Upper Zone groundwater and Paluxy aquifer wells; sampling and analysis of surface water, groundwater and soil; analysis and interpretation of seismic refraction surveys; analysis of geologic and hydrologic data; and review of historical waste disposal practices and groundwater monitoring. The investigation helped define the presence, magnitude, extent, direction, and rate of movement of identified contaminants.

In 1983, approximately 23,000 cubic yards of earth were excavated from the Chrome Pit No. 3 and Die Yard Chemical Pit area, and the contaminated soil was removed to a proper disposal area. These two sites were suspected sources of groundwater contaminants at AFP 4.

The Air Force installed monitoring wells at the plant's southern boundary to monitor the migration of subsurface water. Arrangements were made with officials at White Settlement, the community closest to AFP 4, for the Air Force to monitor wells supplying the community with water. In addition, the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers had

groundwater monitoring wells located between the plant and the White Settlement wells. The Air Force continues to periodically test samples from some of these wells, and results show that the White Settlement drinking water is free from any contaminants which may emanate from the plant.

CH2M Hill was retained in March 1984 to conduct and fully document a records search at AFP 4 under Phase I of the then recently implemented Air Force Installation Restoration Program (IRP). The four-phased IRP was initiated to comply with Department of Defense policy to identify and fully evaluate suspected problems associated with past hazardous material disposal sites on DoD facilities, including Government-owned, contractor-operated defense manufacturing facilities such as AFP 4; control the migration of hazardous contamination from such facilities; and control hazards to health and welfare that may have resulted from these past operations.

The records search included a detailed review of pertinent plant records, agency contacts for documents relative to the records search effort, and an on-site visit in May, 1984. Activities during the on-site visit included interviews with past and present employees, ground tours, and a detailed search of all relevant installation records. A press release announcing the study and requesting persons knowledgeable of past disposal practices to contact the plant was distributed to Fort Worth-Dallas area news media.

Findings and conclusions of the Phase I study are contained in a report dated August, 1984, and titled "Installation Restoration Program Records Search for Air Force Plant 4, Texas." Copies of this report and all final reports on the four phases of the IRP at AFP 4 will be made available to the public at a repository to be established in the Fort Worth area.

Radian Corporation, Austin, was retained to conduct Phase II Confirmation studies of the IRP at AFP 4. This phase consists of sampling and analysis to determine the extent of contamination, followed by recommendations for any clean-up and containment measures needed. Findings were presented in a report prepared in 1987 titled "Installation Restoration Program, Phase II, Confirmation/Quantification Stage 1, Air Force Plant No. 4, Fort Worth, Texas".

During early 1985, an interim air stripping facility was constructed at AFP 4 to remove volatile organic compounds from the zone of perched subsurface water beneath the plant. Contaminated water has been pumped from the ground and processed through the air stripping tower from 1985 to the present. The treated water is then discharged into the sanitary sewer system at the plant.

Over 200 monitoring wells, ranging in depth from approximately 20 feet to 120 feet, have been drilled both on the installation and off-site. Samples from these wells continue to be tested on a regular basis.

Several million dollars have been spent on environmental investigations, monitoring, and clean-up activities at AFP 4; several million additional dollars will be required to remove the plant from the proposed NPL list. No contaminants emanating from AFP 4 have been found in Lake Worth or White Settlement drinking water wells. However, several potential sources of contamination still exist within the boundaries of AFP 4. Steps will be taken to reduce or eliminate these sources to help protect the long-term quality of groundwater, surface water, and air at and near AFP 4.

A4.0 HISTORY OF COMMUNITY RELATIONS ACTIVITIES

Community relations activities have consisted primarily of planning and coordination meetings between Air Force and General Dynamics officials and officials from federal, state, and local regulating agencies, elected officials, and concerned citizens.

In order to inform the community at large, press briefings have been held at the plant announcing all major milestones in the Installation Restoration Program at AFP 4, including results of significant on-going remedial activities or investigations. These press briefings will continue to be made by the Air Force during the RI/FS process. Copies of final RI and FS reports will be available for public comment prior to the issuance of a Record of Decision (ROD) and subsequent remedial action activities.

A5.0 COMMUNITY RELATIONS WORK PLAN

A5.1 Mailing List:

A mailing list will be prepared and maintained for mailings to regulatory agencies, appropriate Government officials, media, and other interested parties. A proposed list of potential individuals and groups to be included on the list is attached. The mailing list will be continually updated. It will be used to send out news releases, fact sheets, notices, and other important information concerning the RI/FS at AFP 4. It also is used for mailing information updates to all interested parties to keep them current on the progress of the RI/FS at AFP 4.

A5.2 Administrative Records Repository

As required by CERCLA legislation, a repository will be established that will contain all pertinent administrative records associated with past and current environmental restoration activities at AFP 4. This repository will be open to the public for review. Final reports on all phases of the IRP and RI/FS at any Air Force installation or defense plant are also available to the public through the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

A5.3 Central Information Contact

Mr. Surendra Joshi of the U.S. Air Force, Aeronautical Systems Division (ASD) will be the designated person to contact for information concerning the AFP 4 IRP. His mailing address and telephone number are as follows:

Mr. Surendra Joshi
Project Officer
ASD/DEV
Wright Patterson Air Force Base
Ohio 45433

Telephone (513) 255-7716

All questions concerning the RI/FS at AFP 4 should be directed to him.

A5.4. Media Information

The media have been interested in the IRP Program at AFP 4 in the past. It is anticipated that media interest will continue throughout the RI/FS process. Press releases will be prepared for any activity, decision, update or other important milestone connected with the RI/FS which the Air Force believes is of particular interest or has a potential impact on the public. Media inquiries, releases, and answers are coordinated with the appropriate, most knowledgeable Air Force officials and are answered as quickly as possible. As stated in Section A5.3, media visits will be coordinated through the designated ASD contact. Media visits will be granted on-site whenever possible, and members of the media will be invited to the plant periodically to announce and explain significant activities and milestones related to the RI/FS. The local, regional, and national media also have access to documents and general information at the repository. In addition, there will be periodic news releases on major events and milestones, as well as fact sheet updates.

A5.5 Speakers Bureau

Speakers will be made available from AFP 4 who can address audiences that have a desire for information concerning the RI/FS. These speakers are available by contacting the Central Information Contact listed in Section A5.3 of this plan.

A5.6 Public Comment Period

The general public will have the opportunity to review the draft Remedial Investigation (RI) report, the draft Feasibility Study (FS) report and Proposed Plan prior to the preparation of a Record of Decision (ROD) for remedial action alternatives for all sites needing remedial action at AFP 4. The public will also have the opportunity to comment on these plans before they are finalized. The draft reports will be made available at the repository for a three-week period to be announced in advance in the official notices columns of local newspapers. The Proposed Plan will be available for a period of 30 days with additional time allowed if requested. A regular news release will be prepared and distributed to the mailing list and to all local media in advance. Comments should be addressed to the Central Information Contact (see Section A5.3). Public meetings will be conducted, if requested, as a means of presenting the study findings, discussing alternatives, responding to questions, and receiving public comments.

A5.7 Responsiveness Summaries

A responsiveness summary will be prepared following the three-week comment period to summarize the comments received on the draft RI/FS reports. This summary will be placed at the public repository and distributed to those persons and agencies on the mailing list, as appropriate.

A5.8 Implementation of this Plan

The Central Information Contact will be responsible for implementation of this plan. Future plans call for the establishment of an on-site Aeronautical Systems Division representative who will assume the duties of being both the

Central Information Contact and administrator of this plan. Once this on-site representative is established, an announcement letter will be distributed to the parties on the mailing list to notify them of the contact change. Assistance will be provided on request, and as appropriate, by Aeronautical Systems Division Office of Public Affairs, Wright-Patterson AFB, Ohio, and Air Force Systems Command Office of Public Affairs, Andrews AFB, Maryland.

PROPOSED MAILING LIST FOR U.S. AIR FORCE PLANT 4

NOTE: Because names of specific personnel within local, state, and regional agencies and organizations may change during the period of the RI/FS process, only the name and address of the appropriate organizations are listed. This list is tentative and will be updated as required throughout the RI/FS.

Fort Worth City Manager
1000 Throckmorton
Fort Worth, TX 76102

Texas Water Commission
Hazardous and Solid Waste Division
P.O. Box 13087 Capital Station
Austin, TX 78711

Texas Department of Health
Region 5
701 Directors Drive
Arlington, TX 76011

Texas Department of Water Resources
Solid Waste and Spill Response Section
P.O. Box 13087 Capital Station
Austin, TX 75270

Chief, Superfund Compliance Branch
U.S. Environmental Protection Agency, Region VI
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

City Manager
214 Meadow Park Dr.
White Settlement TX 76108

Governor of Texas
State Capital Building
Austin, Texas

United States Senator
912 Federal Building
Austin, Texas

Mayor of Fort Worth
1000 Throckmorton
Fort Worth, Texas

Mayor of White Settlement
214 Meadow Park Drive
White Settlement, TX 76108

Suburban Newspapers, Inc.
7820 Wyatt Drive
Fort Worth, TX 76108

Commercial Recorder
P.O. Box 11038
Fort Worth, TX 76110

Dallas Fort Worth Texas Jewish Post
P.O. Box 742
Fort Worth, TX 76101

Eastside News
P.O. Box 8427
Fort Worth, TX 76103

Fort Worth
700 Throckmorton
Fort Worth, TX 76102

Fort Worth Star - Telegram
400 West Seventh Street
Fort Worth, TX 76102

IMSA Journal
P.O. Box 8249
Fort Worth, TX 76112

News Tribune
212 S. Main
Fort Worth, TX 76104

KTVT-TV
P.O. Box 2495
Fort Worth, TX 76113

KTXA-TV
1712 E. Randol-Mill Rd
Arlington, TX 76011

KXAS-TV
Box 1780
Fort Worth, TX 76101

KDFW-TV
400 N. Griffin
Dallas, TX 75202

KERA-TV
3000 Harry Hines Blvd
Dallax, TX 75201

KXTX-TV
3900 Harry Hines Blvd.
Dallas, TX 75219

KSCS Radio
One Broadcast Hill
Ft Worth, TX 76102

APPENDIX B

PRELIMINARY ARARS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TEXAS 75202-2733

52 110

FEB 02 1990

ASD/PMDA
Building 56, Bay 8
ATTN: Mr. Surendra Joshi
Wright-Patterson AFB, OH 45433-6503

Dear Mr. Joshi:

Enclosed are the potential chemical-specific Applicable and Relevant and Appropriate Requirements (ARARs) for Air Force Plant #4. This listing is preliminary and is subject to change throughout the RI/FS process. Additional requirements will be provided as appropriate.

If you have any questions concerning this listing, please contact me at (214) 655-6735.

Sincerely,

John C. Meyer
Superfund Enforcement

cc: Greg Tipple, TWC

05 FEB. 1990

SELECTED CHEMICAL-SPECIFIC POTENTIAL ARAR'S FOR AF PLANT 4

CHEMICAL NAME	DRINKING WATER M.C.L. (ug/L)	FRESH ACUTE LOEL	FRESH CHRONIC LOEL	MARINE ACUTE LOEL	MARINE CHRONIC LOEL	WATER AND FISH INGESTION	FISH CONSUMP ONLY
		<----- CONCENTRATION IN micro grams/Liter ----->					
ACENAPHTHENE		1700	520	970	710		
ARSENIC	0.05					0.0022	0.0175
BENZENE	0.005	5300		5100	700	0.66	40
CADMIUM	0.01	1.8	0.66	43	9.3	10	
CHLOROBENZENE		250	50	160	129	488	
CHROMIUM (III)		1700	200	10000		170000	3433000
CHROMIUM (VI)		16	11	1100	50	50	
CHROMIUM, TOTAL	0.05					50	
CYANIDE		22	5.2	1		200	
DICHLOROBENZENE 1,2	0.075	1120	763	1970		400	2600
DICHLOROBENZENE 1,4		1120	763	1970		400	2600
TRANS-DICHLOROETHYLENE 1,2		11600		224000		0.033	1.35
DIETHYL PHTHALATE		940	3	2944	3.4	350000	1800000
ETHYLBENZENE		32000		430		1400	3280
FLUORANTHENE		3980		40	16	42	54
METHYLENE CHLORIDE		11000		12000	6400	0.19	15.7
LEAD	0.05	34	1.3	140	5.6	50	
MERCURY	0.002	2.4	0.012	2.1	0.025	0.144	0.146
NAPHTHALENE		2300	620	2350			
NICKEL		1100	56	140	7.1	13.4	100
FLUORENE				300		0.0028	0.0311
SELENIUM	0.01	260	35	410	54	10	
TETRACHLOROETHYLENE		5280	840	10200	450	0.8	8.85
TOLUENE		17500		6300	5000	14300	424000
TRICHLOROETHANE 1,1,1	0.2	18000		31200		18400	1030000
TRICHLOROETHANE 1,1,2		18000	9400			0.6	41.8
TRICHLOROETHYLENE	0.005	45000	21900	2000		2.7	80.7
VINYL CHLORIDE	0.002					2	525

PRELIMINARY ARARS FOR AIR FORCE PLANT 4

(Received from EPA Region VI as attachment to comment package dated July 12, 1990)

STANDARD, REQUIREMENTS CRITERIA, OR LIMITATION	CITATION	DESCRIPTION
SAFE DRINKING WATER ACT	40 U.S.C. 300	
National Primary Drinking Water Standards	40 C.F.R. Part 141	Establishes health-based standards for public water systems (maximum containment Levels, MCLs).
National Secondary Drinking Water Standards	40 C.F.R. Part 143	Establishes welfare-based standards for public water systems (secondary maximum containment Levels, SMCL).
CLEAN AIR ACT (CAA)	42 U.S.C. 7401	
National Ambient Air Quality Standards (NAAQS)	40 C.F.R. Part 50	Establishes primary and secondary standards for six pollutants to protect the public health and welfare.
STATE OF TEXAS RULES	Texas Administrative Code (T.A.C.)	
Drinking Water Standards for Public Water Supply Systems	25 T.A.C. Sections 337.1-337.18	Establishes health-based standards for a specific List of contaminants for public water supply systems.
Nuisance Conditions	31 T.A.C. Section 101.4	Prohibits emissions of air containments which tend to be injurious to or adversely affect human health or welfare.
Particulates Net Ground Level	31 T.A.C. 111.52	
Vent Gas Streams	31 T.A.C. Section 115.162	
Surface Water Quality Standards	31 T.A.C. Chapter 307	
General Criteria	307.4	Establishes general criteria for surface waters in the State and specifically applies to substances attributed to waste discharges or the activities of man.
Anti-Degradation	307.5	States that no activities subject to regulatory action will cause significant degradation of waters exceeding fishable/swimmable quality unless important economic/social

STANDARD, REQUIREMENTS CRITERIA, OR LIMITATION	CITATION	DESCRIPTION
		development priorities can be demonstrated.
Toxic Materials	307.6	States that water in the State shall be maintained to preclude adverse toxic effects on human health resulting from contact recreation, consumption of aquatic organisms, or consumption of drinking water after reasonable treatment.
Site Specific Uses & Criteria	307.7	Establishes use and numerical criteria on a site-specific basis for specified State water segments.
Texas Water Quality Act	Chapter 26, Subchapter D	"Prohibition Against Pollution"
	Chapter 26, Subchapter G	"Coastal Oil & Hazardous Spill Prevention & Control"
Groundwater Protection Act	Texas Water Code, Chapter 26 Section 26.401	Requires groundwater quality to be restored, if feasible.
NATIONAL HISTORIC PRESERVATION ACT	49 U.S.C. 470 40 C.F.R. 6.301(b) 36 C.F.R. Part 800	
ARCHAEOLOGICAL AND HISTORICAL PRESERVATION ACT	16 U.S.C. 469 40 C.F.R. 6301(c)	Establishes procedures to provide for preservation of historical and archaeological data which might be destroyed through alteration of terrain as a result of a Federal construction project or a Federally Licensed activity or program.
HISTORIC SITES, BUILDINGS AND ANTIQUITIES ACT	16 U.S.C. 461-467 40 C.F.R. 6.301(a)	Requires Federal agencies to consider the existence and location of Landmarks on the national Registry of Natural Landmarks to avoid undesirable impacts on such Landmarks.

STANDARD, REQUIREMENTS CRITERIA, OR LIMITATION	CITATION	DESCRIPTION
FISH AND WILDLIFE COORDINATION ACT	16 U.S.C. 661-666	Requires consultation when Federal department or agency proposes or authorizes any modification of any stream or other water body and adequate provision for protection of fish and wildlife resources.
ENDANGERED SPECIES ACT	16 U.S.C. 1531 50 C.F.R. Part 200 50 C.F.R. Part 402	Requires action to conserve endangered species within critical habitats upon which endangered species depend, includes consultation with Department of Interior.
CLEAN WATER ACT	33 U.S.C. 1251-1376	
Dredge or Fill Requirements (Section 404)	40 C.F.R. Parts 230-231	Requires discharges to address impact of discharge of dredge or fill material on the aquatic ecosystem.
National Pollutant Discharge Elimination System (NPDES)	40 C.F.R. Part 122 and 125	Requires permits for discharge of pollutants for any point source into waters of the United States.
Effluent Guidelines Standards for the Point Source Category	40 C.F.R.Part 414	Require specific effluent characteristics for discharge under NPDES permits.
National Pretreatment Standards	40 C.F.R. Part 403	Sets standards to control pollutants which pass through or interfere with treatment processes in public treatment works or which may contaminate sewage sludge.
Water Quality Criteria	40 C.F.R. Part 131 Quality Criteria for Water, 1976, 1980, and 1986	Sets criteria for water quality based on toxicity to human health.
Ambient Water Quality Criteria	40 C.F.R. Part 131	Sets criteria for ambient water quality based on toxicity to aquatic organisms.
SOLID WASTE DISPOSAL ACT	42 U.S.C. 6901-6987	
Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 C.F.R. Part 257	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse

STANDARD, REQUIREMENTS CRITERIA, OR LIMITATION	CITATION	DESCRIPTION
		effects on public health or the environment and thereby constitute prohibited open dumps.
Groundwater Protection	40 C.F.R. 264.90 -264.101	
Standards Applicable to Generators of Hazardous Waste	40 C.F.R. Part 262	Establishes standards for generators of hazardous wastes.
Standards Applicable to Transporters of Hazardous Waste	40 C.F.R. Part 263	Establishes standards which apply to transporters of hazardous waste within the U.S. if the transportation requires a manifest under 40 C.F.R. Part 262.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TSD) Facilities	40 C.F.R. Part 264	Establishes minimum national standards which define the acceptable management of hazardous wastes for owners and operators of facilities which treat, store or dispose of hazardous wastes.
General Facility Standards	Subpart B	Provides standards for general waste analysis, security, inspection requirements, personnel training, location standards and requirements for the handling of ignitable, reactive or incompatible wastes.
Preparedness and Prevention	Subpart C	Provides standards for facility design, required equipment testing and maintenance, and arrangements with local authorities for owners and operators of all hazardous waste facilities.
Contingency Plan	Subpart D	Provides contingency plan requirements and emergency procedures for hazardous waste management facilities.
Releases from Solid Waste Management Units	Subpart F	Imposes general groundwater monitoring and protecting requirements to detect and respond to releases in the upper aquifer from "regulated" hazardous waste management units.
Closure and Post-Closure	Subpart G	Provides general closure performance standards and requires removal or decontamination of all hazardous

STANDARD, REQUIREMENTS CRITERIA, OR LIMITATION	CITATION	DESCRIPTION
		wastes form hazardous waste management facilities.
Use and Management of Containers	Subpart I	Provides standards for the condition, compatibility, management, inspection, containment and closure for containers used in hazardous waste related activities.
Tanks	Subpart J	Provides integrity, design, installation, secondary containment, operating, inspection, corrective action, and closure standards for tanks to be used in hazardous waste management activities.
Surface Impoundments	Subpart K	Provides design, general operating and inspection requirements for the use of surface impoundments to treat, store, or dispose of hazardous waste.
Waste Piles	Subpart L	Provides containment, design, closure and post-closure care requirements for facilities that treat or store hazardous wastes in piles.
Land Treatment	Subpart M	Prohibits placement of hazardous waste in or on a land treatment facility unless the waste can be made less hazardous or nonhazardous by degradation, transportation or immobilization processes occurring in or on the soil. Establishes requirements for unsaturated zone monitoring, closure and post-closure, waste analysis, and special requirements for ignitable or reactive waste.
Landfills	Subpart N	Establishes requirements for design, operation, and closure/post-closure care for landfills that handle hazardous wastes. Also provides requirements for the handling of bulk and containerized liquors, and incompatible wastes.
Land Disposal	40 C.F.R. Part 268	Identifies hazardous wastes that are restricted from Land disposal and describes those circumstances under

PRELIMINARY ARARS FOR AIR FORCE PLANT 4

STANDARD, REQUIREMENTS CRITERIA, OR LIMITATION	CITATION	DESCRIPTION
		which an otherwise prohibited waste may be Land disposed.
Underground Injection Control Regulations	40 C.F.R. Parts 144-147	Provides for protection of underground sources of drinking water.
Hazardous Materials Transportation Regulations	49 C.F.R. Parts 107, 171-177	Regulates transportation of hazardous materials.
GENERAL		
	RCRA Section 3020	Regulates reinjection of hazardous wastes during remediation
	29 C.F.R. 1910.120	OSHA Worker Safety
	29 C.F.R. 1926 Subpart P	Excavation
	10 C.F.R. Part 20	Establish permissible levels of radiation in unrestricted areas and waste disposal requirements.
	40 C.F.R. 190	Regulates cleanup of radioactively contaminated sites.
	40 C.F.R. 440	Regulates discharges of radionucleides to surface waters.

52 11

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

52 1

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE