APPENDIX A

SITE-SPECIFIC SUMMARIES

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APPENDIX A
SITE-SPECIFIC SUMMARIES

Appendix A includes site-specific information for each groundwater site within the North, East, and West Industrial Operable Unit (NEWIOU). The site-specific information is presented as text as well as on a composite figure showing the general conceptual site model, the extent of groundwater contamination, and the conceptual layout for the extraction strategy. These site-specific summaries include background and contaminant information from the individual Operable Unit (OU) Remedial Investigation (RI) reports, a brief description of the Feasibility Study (FS) evaluation, including specific costs, and a description of the selected interim remedial actions and objectives.

A detailed description of the alternatives developed in the FS is included in Section 4.0 of this Interim Record of Decision (IROD). The Air Force developed the FS alternatives, as described in Section 3.0 of the NEWIOU FS, to meet the Remedial Action Objectives (RAOs) to compare alternatives based on cleanup of the contaminated groundwater to drinking water standards. The Air Force evaluated the alternatives with a scoring system developed in the FS. Each interim remedial action was scored on the basis of seven Comprehensive Environmental Response Compensation and Liability Act (CERCLA) criteria (see Figure 4-1 and Table 4-4). Scores for each action are discussed in the site summaries.

Additionally, the Air Force estimated costs in the FS for the extraction, treatment, and discharge alternatives and these costs are presented for each site in this appendix. (The Alternative numbers 3 through 9 in this section are the numbers used in the FS for the treatment alternatives. These alternatives have been combined into Alternative 3 [Extraction, Treatment, and Discharge] in the Groundwater IROD.) The interim remedial actions selected for the Groundwater IROD are the most cost-effective approach; the cost for the interim action may differ from the costs developed for the comparison of alternatives in the FS. However, these costs are included to allow comparison of alternatives. Final costs for each site will be developed

during the design phase, and will reflect the groundwater extraction strategy and the combining of extracted water from different sites for treatment at one or more locations.

Also, the Air Force will finalize the layout and design of the extraction wells (vertical or horizontal) during the design phase; the layout of extraction wells presented on the site-specific figures is conceptual. The Air Force will specify monitoring wells for all groundwater sites during the design phase and may include existing or new locations. The Air Force will use these wells to collect data at all sites for natural attenuation. The aerial extent of contamination is indicated on the site-specific figures, and an estimated volume of contaminated groundwater is included for general comparisons. The Air Force will use data obtained during the remedial design/remedial action (RD/RA) phase and analysis of site-specific data to optimize locations of extraction and monitoring wells.

The Air Force will provide the monitoring data from all sites to the regulatory agencies and the Restoration Advisory Board (RAB) for their review and comment. At sites where natural attenuation is assessed, the Air Force will also provide each site's data summary and assessment report for review and approval. A formal review at the end of the five-year interim period will address the acceptability of natural attenuation as a final cleanup action. After this five-year review, a Basewide Groundwater Proposed Plan will present the preferred final cleanup action (natural attenuation, pump and treat, or other) for each site. This Proposed Plan will have a minimum 30-day public comment period. Following the Proposed Plan, a final Groundwater Record of Decision (ROD) will finalize the cleanup decision. The Air Force will submit the Draft Final Groundwater ROD to the agencies and the RAB for review and comment. The regulatory agencies will review and approve the Draft Final Groundwater ROD.

Other chemicals that are not contaminants of concern (COCs) may also be identified in the site summaries, either in the text or on the figures. Total petroleum hydrocarbons (TPH) are not identified as COCs for any sites in the East Industrial OU (EIOU). Where TPH concentrations are greater than 1,500 µg/L or where TPH may be a potential threat to ecological receptors, TPH concentrations are presented. In addition, at some sites throughout the NEWIOU,

metals, although not COCs, may affect discharge if concentrations are above National Pollution Discharge Elimination System (NPDES) limits. In such cases, the metals that may need treatment are identified. The need for metals treatment to meet NPDES limits will be determined during the RD/RA.

These site-specific summaries present information developed during the CERCLA process to support the selected interim action(s) for each site. This information will be useful in guiding future design decisions, although each OU RI report includes a complete record of the site contaminants that may affect future engineering considerations.

A.1 SITE FT004 (FIRE TRAINING AREA 3)

A.1.1 Site Background

Site FT004 covers approximately 30 acres in the north-eastern portion of the EIOU and consists of the old Fire Training Area 3 (FTA-3). The site was used for fire training exercises from 1953 to 1962 (Weston, 1995a). During these exercises waste fuel, oils, and solvents were dumped onto frames or on the ground and burned. Some soil staining and stressed vegetation was observed during recent investigations at the site, now an unused, open field.

The Air Force conducted nine sampling rounds at sites within the EIOU during the RI. Results from Rounds 1 through 6 were used for preliminary screening of sites and data. Results from Rounds 7 through 9 were used for risk assessments based on comments from agencies. Sampling efforts are described in Section 2.0 of the EIOU RI (Weston, 1995a). Summary tables 2.2-1 through 2.2.-3 and Appendix A of the RI indicate that groundwater samples were collected from monitoring wells at FT004. The Air Force collected 28 groundwater samples in Rounds 7 through 9 and analyzed them for volatile organic compounds (VOCs), inorganic constituents, semivolatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs), and petroleum hydrocarbons. In addition, the Air Force collected subsurface samples from 7 soil borings, 3 sediment samples, and 11 surface soil samples. Sampling locations, constituents analyzed, and results can be obtained in the EIOU RI (Weston, 1995a).

COCs found in the groundwater during the RI conducted at the site are primarily VOCs, with one SVOC and one metal also identified as a COC. VOCs include trichloroethene (TCE), cis-1,2-dichloroethene (DCE), 1,2-dichloroethane (DCA), chloroform, dichlorobromomethane, 1,1-DCE, vinyl chloride, and 1,4-dichlorobenzene. The SVOC identified as a COC at FT004 is bis(2-ethylhexyl)phthalate, and the metal is nickel. Although not a COC, TPH was identified at an average of 1,000 µg/L (maximum 7,700 µg/L). Site location, contaminant concentrations, and a conceptual site model are shown on Figure A-1. Other

contaminants found at the site include dioxins and metals (copper, antimony, cadmium, lead, and zinc) in the soil.

A.1.2 Feasibility Study

The alternatives evaluated in the FS for FT004 were Alternative 1 (no action), Alternative 2 (natural attenuation and monitoring), Alternative 3 (extraction, air stripper/catalytic oxidation, ion exchange, activated carbon, and discharge), Alternative 5 (extraction, ultraviolet oxidation [UV-OX], ion exchange, activated carbon, and discharge), and Alternative 7 (extraction, ion exchange, activated carbon, and discharge). As evaluated, Alternative 1 had the lowest cost, but also the lowest total score. Alternative 2 has a capital cost of $18,600, first year operation and maintenance (O&M) cost of $72,000, and a score of 16. Alternatives 3, 5, and 7 had similar scores ranging from 27 to 29. Costs were $915,000 capital with $280,000 O&M for Alternative 3; $960,000 capital with $310,000 O&M for Alternative 5; and $3 million capital with $3 million O&M for Alternative 7.

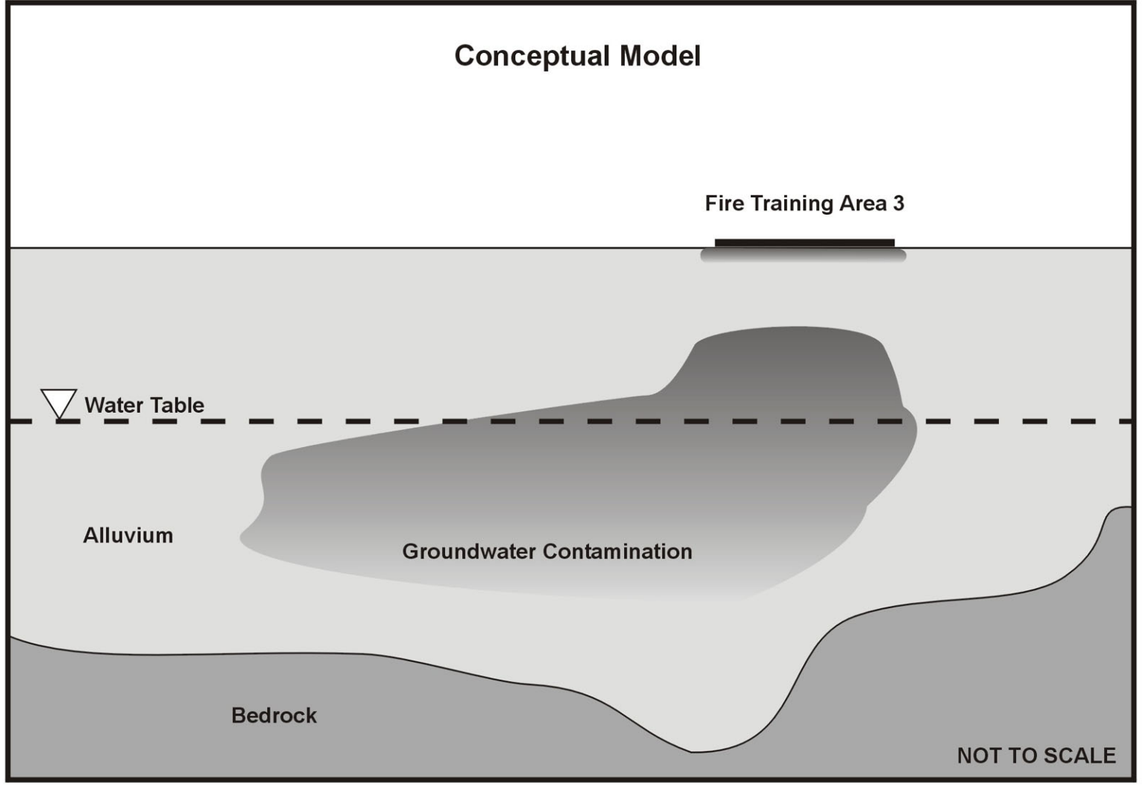
A.1.3 Selected Interim Remedial Actions/Objectives

The selected interim action for groundwater at FT004 is Alternative 3, Extraction, Treatment, and Discharge. The Air Force will accomplish this with source control for the TCE. Source control has been selected for this site because the presence of dense non-aqueous phase liquid (DNAPL) is suspected with TCE concentrations greater than 3,000 µg/L.

A.1.4 Conceptual Site Model

Fire training exercises may have led to groundwater contamination at FT004 by leaching from burned material. The groundwater COCs (VOCs, SVOC, and nickel), however, were not identified as COCs in soil. Soil contamination was detected and COCs include dioxins and metals. These contaminants in soil have low mobility and have not impacted groundwater (i.e., dioxins and the specific metals in soil are not COCs in the groundwater). Any anticipated

soil cleanup action is not expected to have an effect on groundwater because the COCs are not the same. The source of the nickel in groundwater is not known and is currently being investigated.



FT004 (Fire Training Area 3)

Primary Contaminants, Remediation Drivers and Affected Media

Medium	Contaminant Type	Remediation Driver	Contaminant of Concern	Maximum Reported Concentration
Groundwater	VOCs	Collective Human Risk for These Contaminants Is HR = 1.69×10^{-3}	TCE	5,200 mg/L
Groundwater	VOCs		cis-1,2-DCE	14.7 mg/L
Groundwater	VOCs		1,2-DCA	5.12 mg/L
Groundwater	VOCs		Chloroform	1.81 mg/L
Groundwater	VOCs		Dichlorobromomethane	3.1 mg/L
Groundwater	VOCs		1,1-DCE	1.28 mg/L
Groundwater	VOCs		Vinyl Chloride	6.1 mg/L
Groundwater	VOCs		1,4-Dichlorobenzene	3.8 mg/L
Groundwater	SVOCs		bis(2-ethylhexyl)phthalate	5.49 mg/L
Groundwater	Metals		Nickel	2,540 mg/L

Site Characteristics

- Open field, less than 10% paved area
- TCE in groundwater — 830 mg/L average, 5,200 mg/L maximum
- Estimated contaminated groundwater surface area = 530,000 ft^2, volume = 4,100,000 ft^3
- Estimated mass of dissolved VOCs equals 230 lb; DNAPL may be present
- Ar, Cr, Cu, Pb, Se, and Ag were measured at concentrations greater than NPDES discharge limits in some monitoring wells
- Depth to groundwater — 10 feet, depth to bedrock — 30 feet
- Silt and clay to 10 feet bgs, silty sand with minor gravel from 10 to 40 feet bgs
- Site also studied for surface soil contamination

Selected Interim Remedial Action/Objectives

- Alternative 3: Extraction, Treatment and Discharge
  - Source Control for TCE

Feasibility Study Treatment Alternatives and Associated Costs

- Alternative 2: Natural Attenuation/Monitoring: Capital Cost = $18,600; First Year O & M = $72,000
- Alternative 3: Extraction, Treatment and Discharge
  - FS Alternative 3: Air Stripper/Catalytic Oxidation, Ion Exchange, Activated Carbon
    Capital Cost = $915,000; First Year O & M = $280,000
  - FS Alternative 5: UV Oxidation, Ion Exchange, Activated Carbon
    Capital Cost = $960,000; First Year O & M = $310,000
  - FS Alternative 7: Ion Exchange, Activated Carbon
    Capital Cost = $3,000,000; First Year O & M = $3,000,000
- These costs derived from the FS will be refined during the remedial design phase based on combination of alternatives and site specific variables

Interim Design Assumptions

- One horizontal well, 300 feet in screened length
  (NOTE: Location and number of wells will be determined during remedial design phase)
- Extraction rate 15 gpm total
- 700 feet of untreated water piping (from well to treatment system) — 1 inch ID, sch 80 PVC
- 200 feet of discharge piping (to storm sewer) — 2 inch ID, sch 80 PVC
- 300 feet from treatment system to existing power line

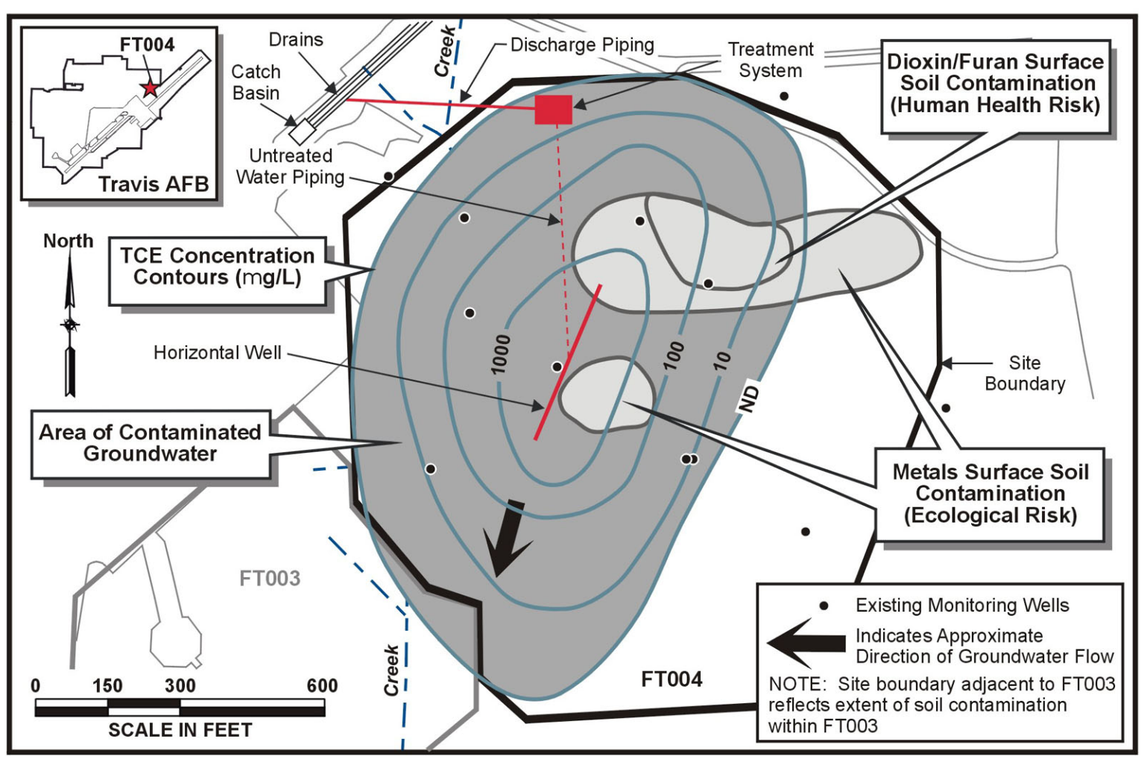


Figure A-1.
Site Summary Information
for FT004, Travis AFB

5FT004.CDR - VMG 8/19/97 SAC 1

A.2 SITE FT005 (FIRE TRAINING AREA 4)

A.2.1 Site Background

Site FT005 covers approximately 30 acres in the southeastern portion of the EIOU. The site is the location of the old Fire Training Area 4 (FTA-4) and was used for fire training exercises from 1962 through 1987, approximately. Historical aerial photographs indicate that the area may have also been used for munitions storage prior to 1958 (Weston, 1995a). From 1962 until the early 1970s, waste fuels, oils, and solvents were burned at the site during training exercises. From the early 1970s until FTA-4 was closed, only waste fuels were burned. An aboveground storage tank was installed around 1976 to hold the waste fuels and is currently located at the site. The site had no berms or dikes to contain runoff, and surface runoff may have flowed into Union Creek during training exercises. During site visits some stressed vegetation was observed in areas bordering the site and drainage swales (Weston, 1995a).

The Air Force conducted nine sampling rounds at sites within the EIOU during the RI. Results from Rounds 1 through 6 were used for preliminary screening of sites and data. Results from Rounds 7 through 9 were used for risk assessments based on comments from agencies. Sampling efforts are described in Section 2.0 of the EIOU RI (Weston, 1995a). Summary tables 2.2-1 through 2.2.-3 and Appendix A of the RI indicate that groundwater samples were collected from monitoring wells and from CPT locations at FT005 during Rounds 7 through 9. The Air Force collected 78 groundwater samples and analyzed them for VOCs, SVOCs, PCBs, pesticides, petroleum hydrocarbons, and inorganic constituents. In addition, the Air Force collected subsurface soil samples from 7 soil borings, 16 surface soil samples, and 3 sediment samples. Sampling locations, constituents analyzed, and results can be obtained in the EIOU RI (Weston, 1995a).

COCs found in the groundwater during the RI are primarily VOCs, with one SVOC and one metal also identified. VOCs include TCE, 1,2-DCA, cis-1,2-DCE, chloroform, and dichlorobromomethane. The SVOC identified as a COC is bis(2-ethylhexyl)phthalate, and the

metal is nickel. Site location, contaminant concentrations, and a conceptual site model are presented in Figure A-2. Contaminants detected in soils at the site include polynuclear aromatic hydrocarbons (PAHs), PCBs, dioxins, pesticides, and metals (chromium, copper, lead, cadmium, nickel, selenium, and zinc) in the surface and subsurface soils.

A.2.2 Feasibility Study

The alternatives evaluated in the FS for FT005 were Alternative 1 (no action), Alternative 2 (natural attenuation and monitoring), Alternative 3 (extraction, air stripper/catalytic oxidation, ion exchange, activated carbon, and discharge), Alternative 5 (extraction, UV-OX, ion exchange, activated carbon, and discharge), and Alternative 7 (extraction, ion exchange, activated carbon, and discharge). As evaluated in the FS, Alternative 1 had the lowest cost, but also the lowest total score. Alternative 2 had a capital cost of $18,600, first year O&M cost of $72,000, and a score of 16. Alternatives 3, 5, and 7 had similar scores ranging from 29 to 31. Costs were $1.8 million capital with $260,000 O&M for Alternative 3; $1.85 million capital with $295,000 O&M for Alternative 5; and $1.7 million capital with $360,000 O&M for Alternative 7.

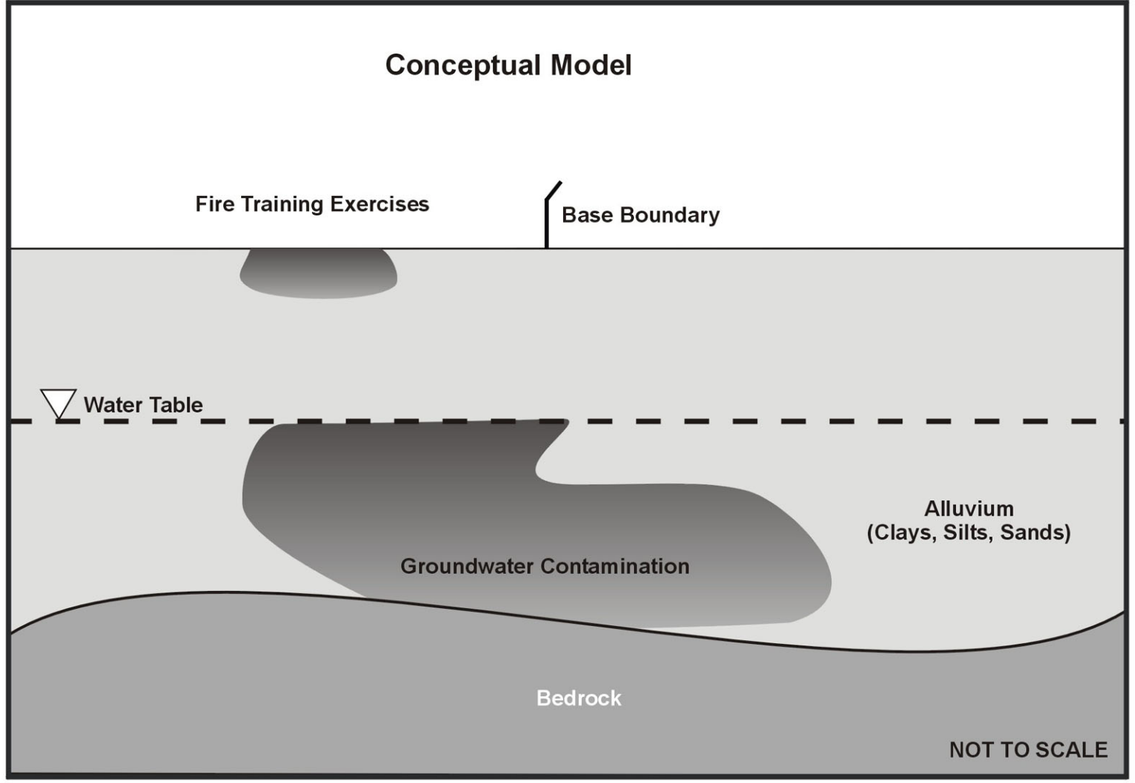
A.2.3 Selected Interim Remedial Actions/Objectives

The selected interim action for groundwater at FT005 is Alternative 3, Extraction, Treatment, and Discharge. The Air Force will accomplish this with a combination of off-base remediation for 1,2-DCA and migration control to control movement of contaminated groundwater.

A.2.4 Conceptual Site Model

Fire training exercises may have led to groundwater contamination by leaching of the solvents burned at FT005 but VOCs and fuels were not identified as COCs for soil. Surface soil contamination includes PAHs, PCBs, pesticides, dioxins, and metals. These contaminants in soil have not impacted groundwater, and any anticipated soil cleanup action is not expected to have an effect on groundwater.

Nickel is an identified COC in both the groundwater and the soil. However, the source of the nickel is not known and is currently being investigated. A portion of the groundwater plume with 1,2-DCA has migrated off-base; TCE contamination has remained on-base.



FT005 (Fire Training Area 4)

Primary Contaminants, Remediation Drivers and Affected Media

Medium	Contaminant Type	Remediation Driver	Contaminant of Concern	Maximum Reported Concentration
Groundwater	VOCs	Collective Human Risk for These Contaminants Is HR = 1.12×10^{-4}	TCE	120 mg/L
Groundwater	VOCs		1,2-DCA	14.2 mg/L
Groundwater	VOCs		cis-1,2-DCE	19 mg/L
Groundwater	VOCs		Chloroform	10 mg/L
Groundwater	VOCs		Dichlorobromomethane	1.8 mg/L
Groundwater	SVOCs		bis(2-ethylhexyl)phthalate	35.9 mg/L
Groundwater	Metals		Nickel	370 mg/L

Site Characteristics

- Site is located in an area of Travis AFB that is inactive except for explosives detonation
- TCE in groundwater — 3.3 mg/L average, 120 mg/L maximum
- Estimated contaminated groundwater surface area = 1,600,000 ft^2, volume = 12,000,000 ft^3
- Estimated mass of dissolved VOCs equals 3.9 lb; no evidence of DNAPL or LNAPL
- Cr, Cu, and Hg were measured at concentrations greater than NPDES discharge limits in some monitoring wells
- Depth to groundwater — 10 feet; depth to bedrock — 50 feet
- Permeable materials (sand and silt) occur through depths of 20 to 40 feet bgs
- Some low permeability soils (clay and silt) occur between 10 and 30 feet bgs
- Site also studied for surface soil contamination
- The bold dashed line indicates where the FT005 groundwater contamination overlaps the soil site WP017

Selected Interim Remedial Action/Objectives

- Alternative 3: Extraction, Treatment and Discharge
  - Off-base Remediation for 1,2-DCA
  - Migration Control for TCE and 1,2-DCA

Feasibility Study Treatment Alternatives and Associated Costs

- Alternative 2: Natural Attenuation/Monitoring: Capital Cost = $18,600; First Year O & M = $72,000
- Alternative 3: Extraction, Treatment and Discharge
  - FS Alternative 3: Air Stripper/Catalytic Oxidation, Ion Exchange, Activated Carbon: Capital Cost = $1,800,000; First Year O & M = $260,000
  - FS Alternative 5: UV Oxidation, Ion Exchange, Activated Carbon: Capital Cost = $1,850,000; First Year O & M = $295,000
  - FS Alternative 7: Ion Exchange, Activated Carbon: Capital Cost = $1,700,000; First Year O & M = $360,000
- These costs derived from FS will be refined during the remedial design phase based on combination of alternatives and site specific variables

Interim Design Assumptions

- 4 horizontal wells, 300 feet in screened length (NOTE: Location and number of wells will be determined during the remedial design phase)
- Extraction rate 60 gpm total, 15 gpm from each well
- 4,500 feet of untreated water piping (from well to treatment system) — 1 inch ID, sch 80 PVC
- 1,000 feet of discharge piping (to Union Creek) — 3 inch ID, sch 80 PVC
- 1,000 feet from treatment system to existing power line

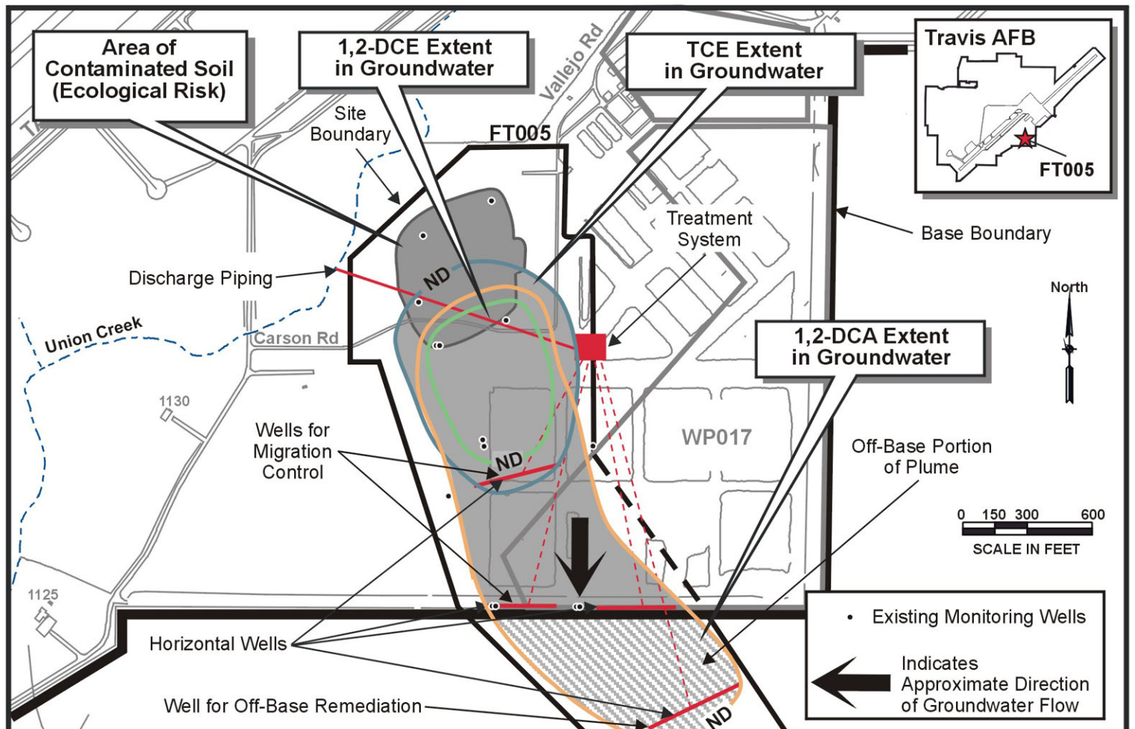


Figure A-2.
Site Summary Information for FT005, Travis AFB

A.3 SITE LF006 (LANDFILL 1)

A.3.1 Site Background

Site LF006 is the location of old Landfill 1 and covers approximately 17 acres in the North OU (NOU). Landfill 1 was operated as a burn-and-fill landfill from 1943 through 1950. Materials disposed of and burned in the landfill consisted primarily of general refuse such as wood, glass, and construction debris, although some disposal of industrial wastes was reported (Radian, 1995b). A trailer park was built over a portion of the site in 1970 and is still in use.

The Air Force collected groundwater samples in 12 locations at LF006A during the RI. Four soil borings were drilled to groundwater, where HydroPunch® samples were collected; three cone penetrometer (CPT) locations were sampled for groundwater; five monitoring wells were sampled. Groundwater samples were analyzed for petroleum products (diesel, JP4, oil, and TPH-gasoline), pesticides and PCBs, VOCs, SVOCs, dioxins/furans, gross alpha and gross beta, and inorganic constituents (Radian, 1995b).

In addition to groundwater sampling efforts, the Air Force collected the following soil gas, surface emission flux, surface water, sediment, surface soil, and subsurface soil samples from the entire NOU: approximately 286 shallow subsurface soil gas samples at 3 feet depth; 24 surface emission flux sampling locations; 22 sediment samples; 6 surface water samples; surface soil samples from 59 soil boring locations to determine if contamination was present; and subsurface soil from 52 soil borings and 7 monitoring wells. Sampling locations, constituents analyzed, and results are presented in the NOU RI (Radian, 1995b).

VOCs are the only COCs detected in the groundwater at the site during the RI. They include TCE, 1,1-DCE, and TPH.

Site location, contaminant concentrations, and a conceptual site model are presented in Figure A-3. The general extent of groundwater contamination is shown; the sampling results do not indicate plumes that can be defined by concentration isopleths. The detected concentrations indicate pockets of contamination that vary by location and show no increasing or decreasing pattern that could be contoured. The northern area of contamination is related to TPH only; the southern area of contamination includes TCE, TCE degradation by-products, and TPH.

A.3.2 Feasibility Study

The alternatives evaluated in the FS for LF006 were Alternative 1 (no action), Alternative 2 (natural attenuation and monitoring), Alternative 3 (extraction, air stripper/catalytic oxidation, ion exchange, activated carbon, and discharge), Alternative 5 (extraction, UV-OX, ion exchange, activated carbon, and discharge), and Alternative 7 (extraction, ion exchange, activated carbon, and discharge). As evaluated in the FS, Alternative 1 had the lowest cost, but also the lowest total score. Alternative 2 had a capital cost of $18,600, first year O&M cost of $72,000, and a score of 16. Alternatives 3, 5, and 7 had similar scores ranging from 27 to 29. Costs were $860,000 capital with $100,000 O&M for Alternative 3; $880,000 capital with $130,000 O&M for Alternative 5; and $640,000 capital with $61,000 O&M for Alternative 7.

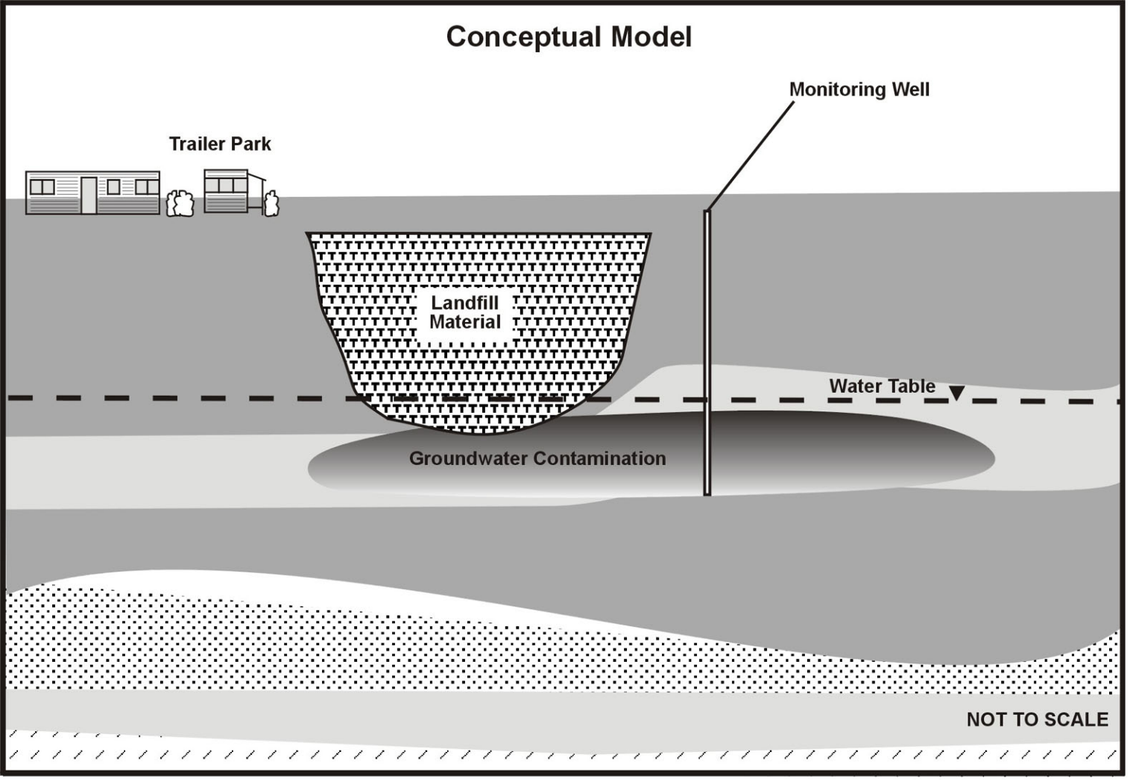
A.3.3 Selected Interim Remedial Actions/Objectives

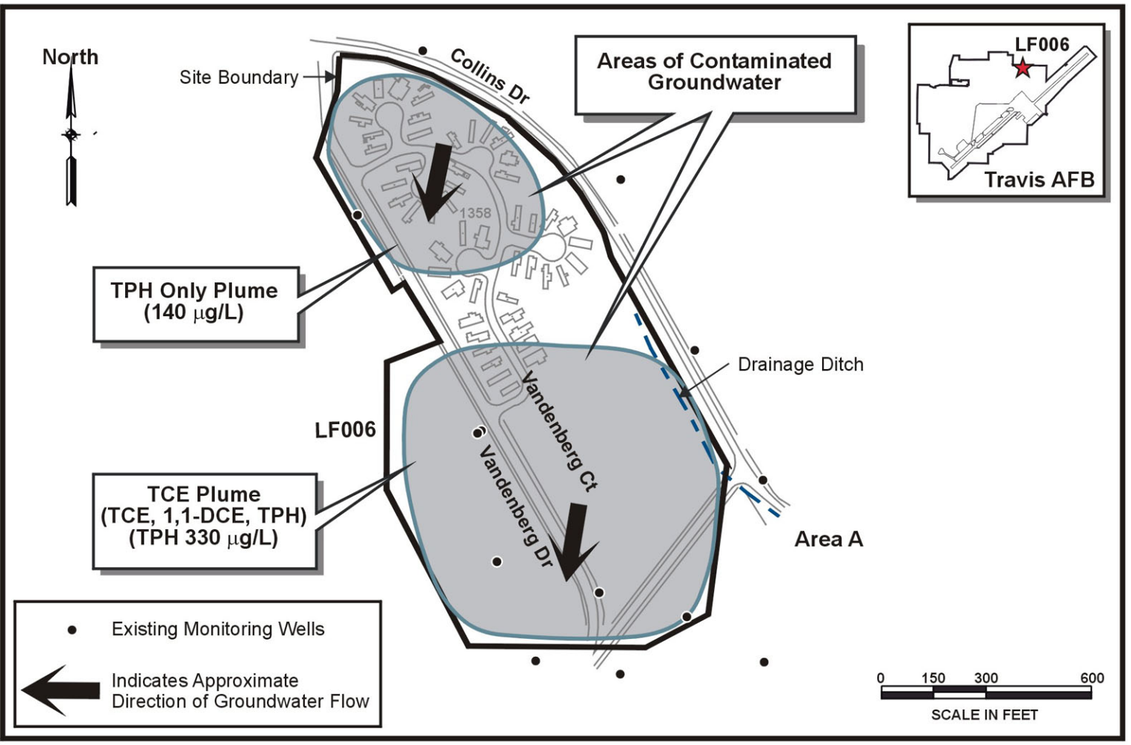
The selected interim action for groundwater at LF006 is Alternative 2, Natural Attenuation in conjunction with groundwater monitoring. Alternative 2 is a cost-effective way to meet CERCLA criteria, though at a slower rate than Alternative 3, for sites that have low concentrations (maximum 330 µg/L TPH, maximum 20 µg/L TCE) and stable plumes. The site-specific characteristics of LF006 and the groundwater sample results from the RI and 1996 quarterly sampling events provide evidence that natural attenuation is a viable remediation alternative. For instance, the clustered areal distribution of TCE concentration results within LF006 were low (highest detection limit was 20 µg/L TCE at location CPT-2) and, therefore, are susceptible to stabilization via natural attenuation. Also, with the presence of TPH at LF006,

TCE may indirectly be cometabolized as TPH is utilized as an energy source by bacteria. Furthermore, dichloroethenes, such as cis-1,2 DCE and 1,1-DCE, daughter products of the biodegradation of TCE, were detected in a number of monitoring wells, soil borings, and CPTs located in the southern portion of Site LF006 (Table A-1). Because dichloroethenes were not a primary/initial contaminant, data suggest that natural attenuation may be occurring via reductive dehalogenation of TCE. The effect of natural attenuation on reducing contaminant toxicity, mobility, and/or volume, will be documented by monitoring at strategic locations. The details of the monitoring will be included in the remedial design for the site.

A.3.4 Conceptual Site Model

Leaching from the buried waste material appears to have been the source of the groundwater contamination at LF006. There are no COCs for subsurface soil or surface soil at this site.





LF006 (Landfill 1, Area A)

Primary Contaminants, Remediation Driverts and Affected Media

Medium	Contaminant Type	Remediation Driver	Contaminant of Concern	Maximum Reported Concentration
Groundwater	VOCs		TCE	20 mg/L
Groundwater	VOCs	HR = 6.3×10^{-6}	1,1-DCE	0.64 mg/L
Groundwater	TPH	HR = 1.7×10^{-6}	NA	330 mg/L
		NA		

Site Characteristics

- Mostly flat grassland
- Mobile homes cover approximately 40% of the study area (northwest portion)
- Drainage ditches transport surface water to the south and east
- Located over former burn/fill trenches
- TCE in groundwater — 5 mg/L average, 20 mg/L maximum
- TPH in groundwater — 120 mg/L average, 330 mg/L maximum
- Estimated contaminated groundwater surface area = 440,000 ft^2, volume = 2,200,000 ft^3
- Estimated mass of dissolved VOCs equals 0.4 lb; no evidence of DNAPL or LNAPL
- Depth to groundwater — 10 feet
- Depth to bedrock — 50 feet
- Low permeability soils (clay) to about 25 feet bgs
- More permeable material (sands and silts) between 25 feet bgs and bedrock

Interim Remedial Action/Objectives

- Alternative 2: Natural Attenuation/Monitoring: Capital Cost = $18,600; First Year O & M = $72,000

Feasibility Study Treatment Alternatives and Associated Costs

- Alternative 3: Extraction, Treatment and Discharge
  - FS Alternative 3: Air Stripper/Catalytic Oxidation, Ion Exchange, Activated Carbon: Capital Cost = $860,000; First Year O & M = $100,000
  - FS Alternative 5: UV Oxidation, Ion Exchange, Activated Carbon: Capital Cost = $880,000; First Year O & M = $130,000
  - FS Alternative 7: Ion Exchange, Activated Carbon: Captal Cost = $640,000; First Year O & M = $61,000
- These costs derived from FS will be refined during the remedial design phase based on combination of alternatives and site specific variables

Interim Design Assumptions

- Monitoring Wells (NOTE: Location and number of wells will be determined during the remedial design phase)
- Sampling to Confirm Stability of Plume Size and Rate of Natural Attenuation

Figure A-3.
Site Summary Information for LF006, Travis AFB

5LF006.CDR - VMG 4/28/97 SAC 1

A.4 SITE LF007 (LANDFILL 2, AREAS B, C, AND D)

A.4.1 Site Background

Site LF007 is located at old Landfill 2 and occupies approximately 73 acres in the NOU. The landfill was operated in a trench-and-fill method beginning in the early 1950s following the closure of Landfill 1. The landfill was used primarily for the disposal of general refuse such as wood, glass, and construction debris. Small amounts of industrial wastes and fuel sludges from tank cleaning operations were also reported to have been disposed of at Landfill 2 (Radian, 1995b). Use of Landfill 2 ceased in 1974. From the early 1950s until 1964, a portion of the eastern part of the landfill was used for storage of excess and waste materials including oils, hydraulic fluid, and solvents for resale or disposal. As determined by aerial photographs, a skeet range was also located at the site around 1953; however, the exact dates of operation are not known (Radian, 1995b). Current operations at the site are limited to those conducted at Buildings 1360, 1365, and 1370. Building 1360 is the Affiliate Radio System, Building 1365 is used for hazardous waste storage, and Building 1370 houses the Small Arms Range. Artificial vernal pools (created by landfill subsidence), which may contain the endangered species fairy shrimp, are located at the site. Groundwater does not discharge to the vernal pools.

The Air Force collected groundwater samples from 30 locations at LF007. Twenty-eight HydroPunch® samples were collected from soil borings, and two monitoring wells were sampled. Groundwater samples were analyzed for petroleum products (diesel, JP4, oil, and TPH-gasoline), pesticides and PCBs, VOCs, SVOCs, dioxins/furans, gross alpha and gross beta, and inorganic constituents (Radian, 1995b).

In addition to groundwater sampling efforts, the Air Force collected the following soil gas, surface emission flux, surface water, sediment, surface soil, and subsurface soil samples from the entire NOU: approximately 286 shallow subsurface soil gas samples at 3 feet depth, 24 surface emission flux sampling locations, 22 sediment samples, 6 surface water samples; surface soil samples from 59 soil boring locations to determine if contamination was present; and

subsurface soil from 52 soil borings and 7 monitoring wells. Sampling locations, constituents analyzed, and results are presented in the NOU RI (Radian, 1995b).

Groundwater contamination has been found in three areas of the site, referred to as Areas B, C, and D. These are general areas of groundwater contamination; plumes with decreasing concentration isopleths could not be identified because of the nature of the landfill operation, and in part to a lack of migration away from the trench areas. Classes of COCs detected in the groundwater during the RI at Area B include VOCs, one SVOC, one PCB, and one dioxin. VOCs in Area B include benzene, 1,4-dichlorobenzene, and chlorobenzene, and the SVOC is bis(2-ethylhexyl)phthalate. PCB-1248 and 2,3,7,8-TCDDeq (a dioxin) were also identified as COCs at LF007B. VOCs make up all COCs detected at Area C during the RI, and include TCE, vinyl chloride, 1,1-DCE, 1,2-DCA, and 1,2-dichloropropane. Due to a local anomaly in the groundwater flow direction beneath Area C, contamination from this area has migrated off base. Classes of COCs identified at Area D include VOCs, one dioxin, one PCB, and one SVOC. VOCs include benzene, vinyl chloride, 1,4-dichlorobenzene, 1,1-DCE, and chlorobenzene. COCs also include bis(2-ethylhexyl)phthalate (a SVOC), PCB-1242, and 2,3,7,8-TCDDeq (dioxin). Site locations, contaminant concentrations, and conceptual site models for the three areas are presented in Figures A-4, A-5, and A-6. In addition, TPH (up to 4,200 µg/L at Area B, 390 µg/L at Area C, and 6,500 µg/L at Area D) has been detected in all three areas during sampling efforts conducted at the site. Contamination including PCBs, metals, and several SVOCs were detected in the surface soils at various location throughout the site during the RI.

A.4.2 Feasibility Study

The alternatives evaluated in the FS for all three areas of LF007 were Alternative 1 (no action), Alternative 2 (natural attenuation and monitoring), Alternative 3 (extraction, air stripper/catalytic oxidation, ion exchange, activated carbon, and discharge), Alternative 5 (extraction, UV-OX, ion exchange, activated carbon, and discharge), and Alternative 7 (extraction, ion exchange, activated carbon, and discharge). As evaluated in the FS Alternatives

1 and 2 had similar costs and scores for each of the three areas of LF007 as follows. Alternative 1 had the lowest cost, but also the lowest total score. Alternative 2 had a capital cost of $18,600, first year O&M cost of $72,000, and a score of 16. For all three areas evaluated Alternatives 3, 5, and 7 had similar scores, ranging from 27 to 29, but differing costs. For Area B the capital and first year O&M cost for the three alternatives were $770,000 capital with $105,000 O&M for Alternative 3; $815,000 capital with $133,000 O&M for Alternative 5; and $550,000 capital with $72,000 O&M for Alternative 7. For Area C the costs were $615,000 capital with $94,000 O&M for Alternative 3; $675,000 capital with $115,000 O&M for Alternative 5; and $450,000 capital with $58,000 O&M for Alternative 7. For Area D the costs were $1.8 million capital and $224,000 O&M for Alternative 3; $1.8 million capital and $266,000 O&M for Alternative 5; and $1.8 million capital and $266,000 O&M for Alternative 7.

A.4.3 Selected Interim Remedial Actions/Objectives

Selection of an alternative for the on-base Areas B and D at LF007 is deferred until the final Groundwater ROD so that additional data can be collected and evaluated to support the use of natural attenuation as a remedial alternative. Additional site-specific data regarding natural attenuation will be developed and evaluated as part of the Basewide Natural Attenuation Assessment Plan. Natural attenuation appears to be a viable alternative for both of these areas because of the small areal extent of contamination or the irregular distribution of contaminants that would make it difficult to design an extraction system that would be both technically effective and cost-effective. In addition, the presence of TPH (needed for cometabolism) and the presence of TCE degradation products indicate that conditions are present for natural attenuation to occur. Groundwater monitoring will be used to determine if contaminant migration is occurring, and if surface water infiltration has any impact on contaminant concentrations.

For contamination at Area C, the selected interim action includes a combination of migration control and remediation of off-base contamination. This action will be accomplished through extraction and treatment of the contaminated groundwater. Migration control on base will limit the possibility of further off-base migration of contaminants. Active extraction is the

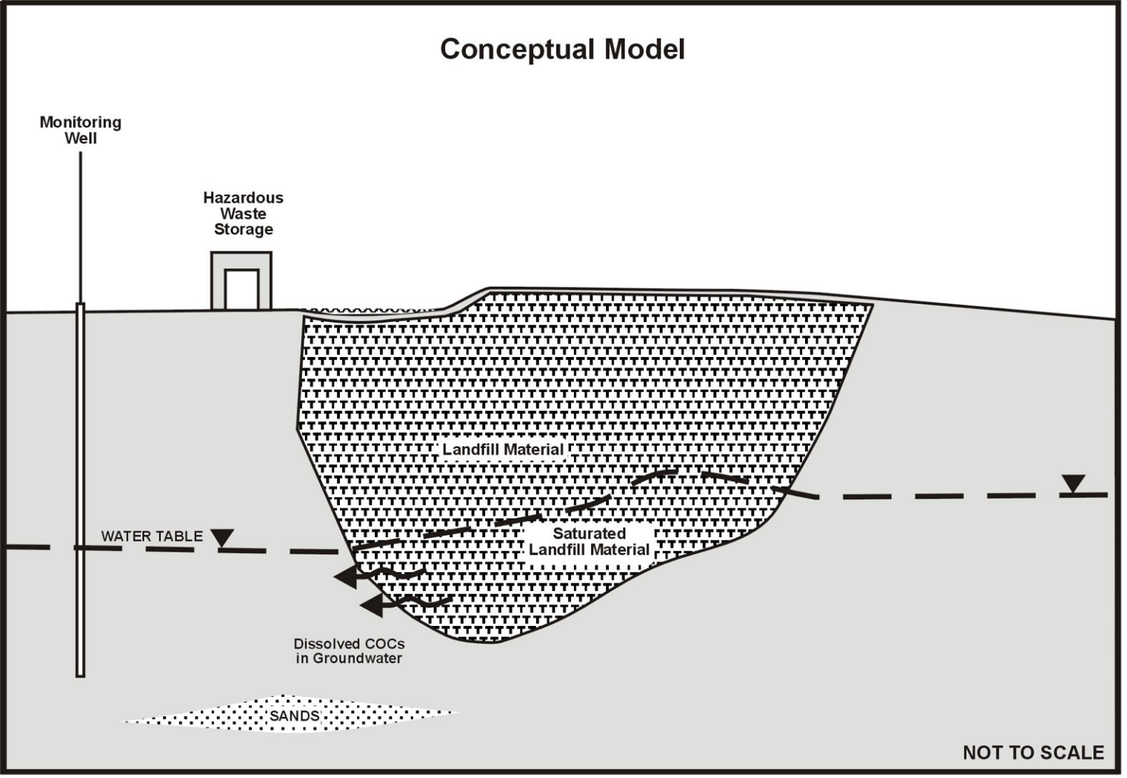
selected interim action because contamination has migrated off-base. If any portion of Area C was on-base, selection of an alternative would be deferred, and natural attenuation would be evaluated. Natural attenuation appears to be a viable alternative because of the small areal extent of contamination, TCE concentration less than 100 µg/L, the presence of TPH for cometabolism and the presence of degradation products that indicate natural attenuation is occurring. Natural attenuation with groundwater monitoring will be assessed for the on-base portion of the plume.

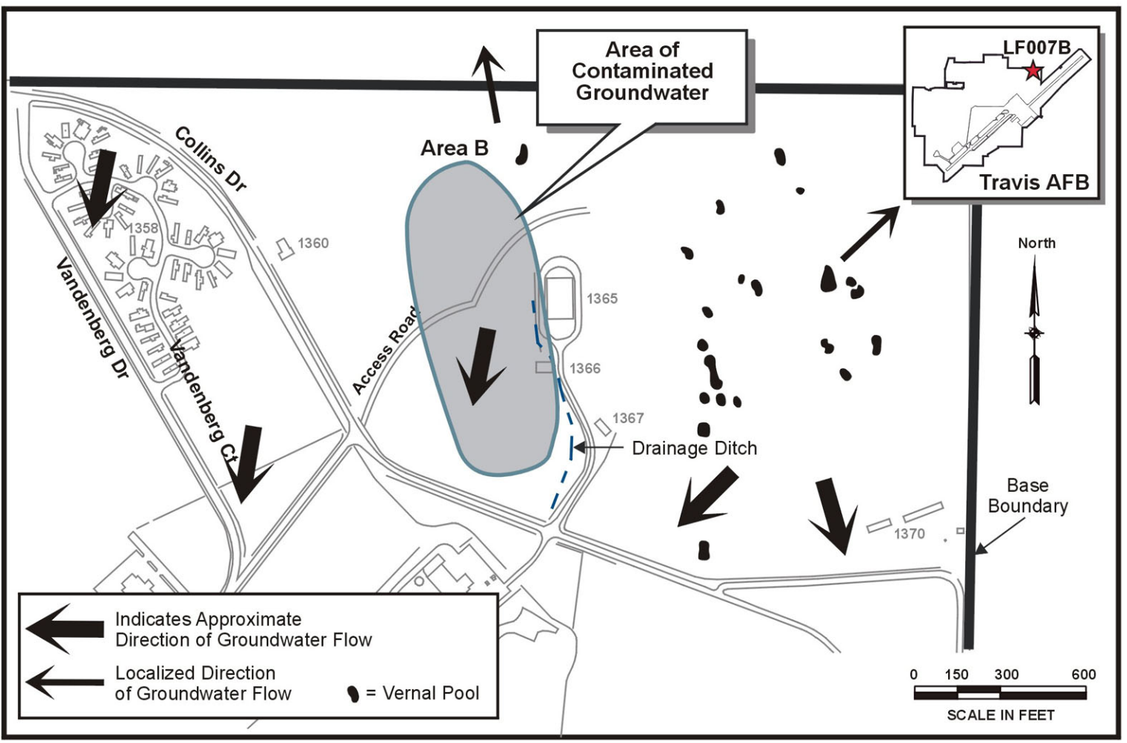
A.4.4 Conceptual Site Model

Soil contamination found in LF007 Areas B and D may be related to contamination in the groundwater found in these areas. Remediation of the surface and subsurface soils in these areas that reduces infiltration of rainwater and improves drainage may reduce the potential for vertical migration of contaminants.

A.4.5 Special Site Conditions

The current specified interim remedial action at LF007C is Alternative 3 for the portion of the plume that is off-base. If the plume were entirely on Travis AFB property, selection of an alternative would be deferred until the final Groundwater ROD.





LF007 (Landfill 2, Area B)

Primary Contaminants, Remediation Drivers and Affected Media

Medium	Contaminant Type	Remediation Driver	Contaminant of Concern	Maximum Reported Concentration
Groundwater	VOCs	HR = 3.9×10^{-5}	Benzene	59.3 mg/L
Groundwater	VOCs	HR = 1.9×10^{-5}	1,4-dichlorobenzene	30.8 mg/L
Groundwater	VOCs	HI = 1.3	Chlorobenzene	161 mg/L
Groundwater	SVOCs	HR = 4.1×10^{-6}	bis(2-ethylhexyl)phthalate	14.3 mg/L
Groundwater	Pesticides/PCBs	HR = 7.0×10^{-4}	PCBs (PCB-1248)	13.5 mg/L
Groundwater	Dioxins	HR = 1.3×10^{-6}	2,3,7,8-TCDDeq	0.55 pg/L

Site Characteristics

- Mostly grassy flatlands
- Differential settling has resulted in adjacent depressions and ridges up to 6 feet tall
- Unpaved access road
- Benzene in groundwater — 30 mg/L average, 59.3 mg/L maximum
- Chlorobenzene in groundwater — 30 mg/L average, 161 mg/L maximum
- Estimated contaminated groundwater surface area = 400,000 ft^2, volume = 2,000,000 ft^3
- Estimated mass of dissolved VOCs equals 2.3 lb; no evidence of DNAPL or LNAPL
- Depth to groundwater — 10 feet
- Depth to bedrock — 40 feet
- Backfill and landfill material ranging from 0 to 15 feet bgs
- Intermittent layers of clays and sands between landfill material and 25 feet bgs
- Intermittent layers of clays and silts from 25 to 50 feet bgs
- Site also studied for surface and subsurface soil contamination

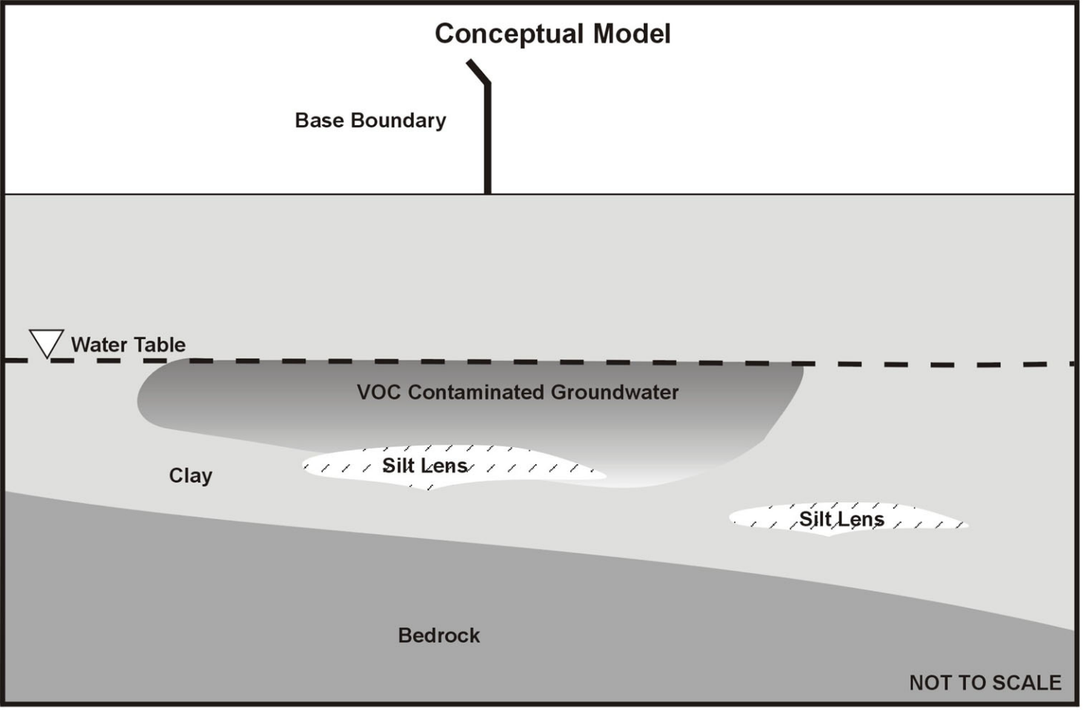
Selected Interim Groundwater Remedial Action/Objectives

- Deferred: Area will be included in Basewide Natural Attenuation Assessment Plan

Feasibility Study Treatment Alternatives and Associated Costs

- Alternative 2: Natural Attenuation/Monitoring: Capital Cost = $18,600; First Year O & M = $72,000
- Alternative 3: Extraction, Treatment and Discharge
  - FS Alternative 3: Air Stripper/Catalytic Oxidation, Ion Exchange, Activated Carbon: Capital Cost = $770,000; First Year O & M = $105,000
  - FS Alternative 5: UV Oxidation, Ion Exchange, Activated Carbon Capital Cost = $815,000; First Year O & M = $133,000
  - FS Alternative 7: Ion Exchange, Activated Carbon: Capital Cost = $550,000; First Year O & M = $72,000
- These costs derived from FS will be refined during the remedial design phase based on combination of alternatives and site specific variables

Figure A-4.
Site Summary Information for LF007, Area B, Travis AFB



LF007 (Landfill 2, Area C)

Primary Contaminants, Remediation Drivers and Affected Media

Medium	Contaminant Type	Remediation Driver	Contaminant of Concern	Maximum Reported Concentration
Groundwater	VOCs	HR = 1.6×10^{-5}	TCE	49.1 mg/L
Groundwater	VOCs	HR = 5.6×10^{-6}	Vinyl Chloride	0.198 mg/L
Groundwater	VOCs	HR = 3.5×10^{-6}	1,1-DCE	0.297 mg/L
Groundwater	VOCs	HR = 1.3×10^{-6}	1,2-DCA	0.314 mg/L
Groundwater	VOCs	HR = 1.0×10^{-5}	1,2-dichloropropane	3.38 mg/L

Site Characteristics

- Low, grassy, flat swampy area
- Travis AFB boundary bisects the study area with east-west fence
- Northern half of study area is privately-owned property
- TCE in groundwater — 20 mg/L average, 49.1 mg/L maximum
- Estimated contaminated groundwater surface area = 230,000 ft^2, volume = 1,200,000 ft^3
- Estimated mass of dissolved VOCs equals 1.5 lb; no evidence of DNAPL or LNAPL
- Depth to groundwater — varies from 1 to10 feet, depending on season
- Depth to bedrock — 30 feet
- Low permeability soils (clay) to about 20 feet bgs
- Silt lenses between 20 feet bgs and bedrock
- Site also studied for soil contamination

Selected Interim Remedial Action/Objectives

- Alternative 3: Extraction, Treatment and Discharge (for Off-Base Portion)
  - Migration Control
  - Off-base Remediation
- Selection deferred for on base portion of plume, area will be included in the Basewide Natural Attenuation Assessment Plan (If plume were entirely on base, selection would be deferred for entire plume and included in the Basewide Natural Attenuation Assessment Plan)

Feasibility Study Treatment Alternatives and Associated Costs

- Alternative 2: Natural Attenuation/Monitoring: Capital Cost = $18,600; First Year O & M = $72,000
- Alternative 3: Extraction, Treatment and Discharge
  - FS Alternative 3: Air Stripper/Catalytic Oxidation, Ion Exchange, Activated Carbon: Capital Cost = $615,000; First Year O & M = $94,000
  - FS Alternative 5: UV Oxidation, Ion Exchange, Activated Carbon: Capital Cost = $675,000; First Year O & M = $115,000
  - FS Alternative 7: Ion Exchange, Activated Carbon: Capital Cost = $450,000; First Year O & M = $58,000
- These costs derived from FS will be refined during remedial design phase based on combination of alternatives and site specific variables

Interim Design Assumptions

- 1 horizontal well, 300 feet in screened length (NOTE: Location and number of wells will be determined during the remedial design phase)
- Extraction rate 15 gpm total
- 600 feet of conveyance piping (from well to treatment system) — 1 inch ID, sch 80 PVC
- 300 feet of discharge piping — 1-½ inch ID, sch 80 PVC
- 200 feet from treatment system to existing power line

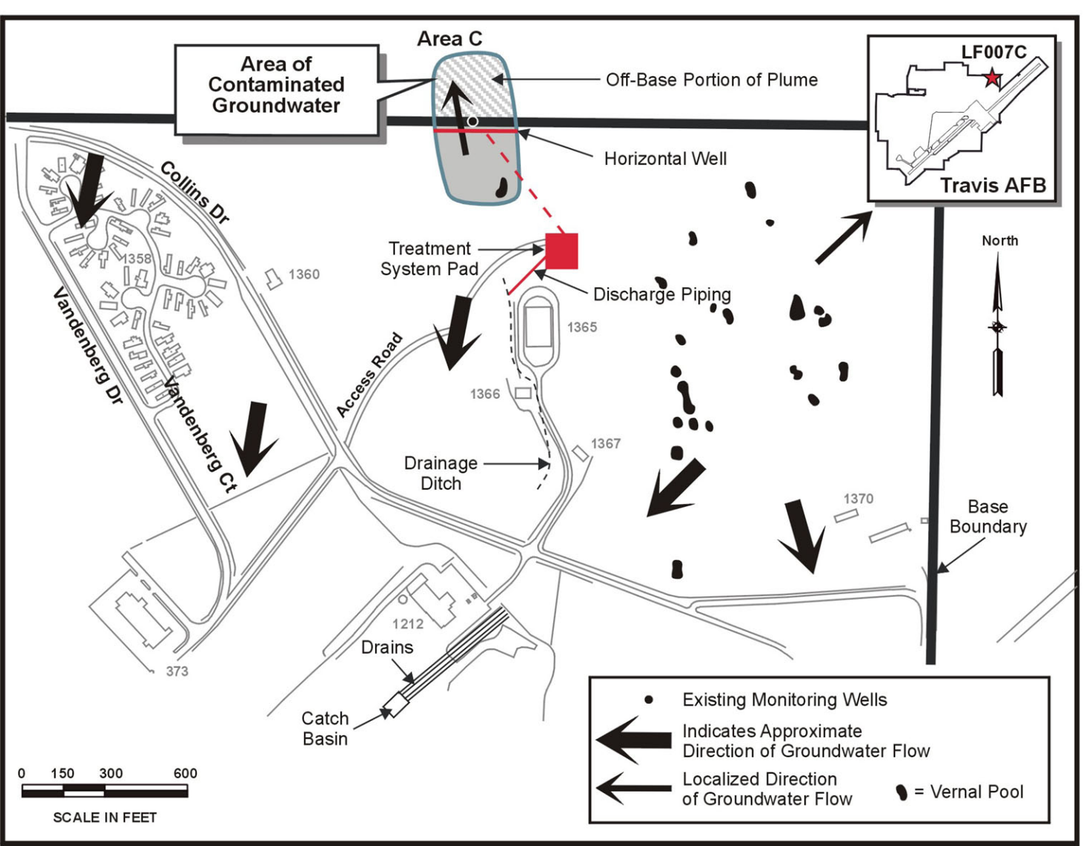


Figure A-5.
Site Summary Information
for LF007, Area C, Travis AFB

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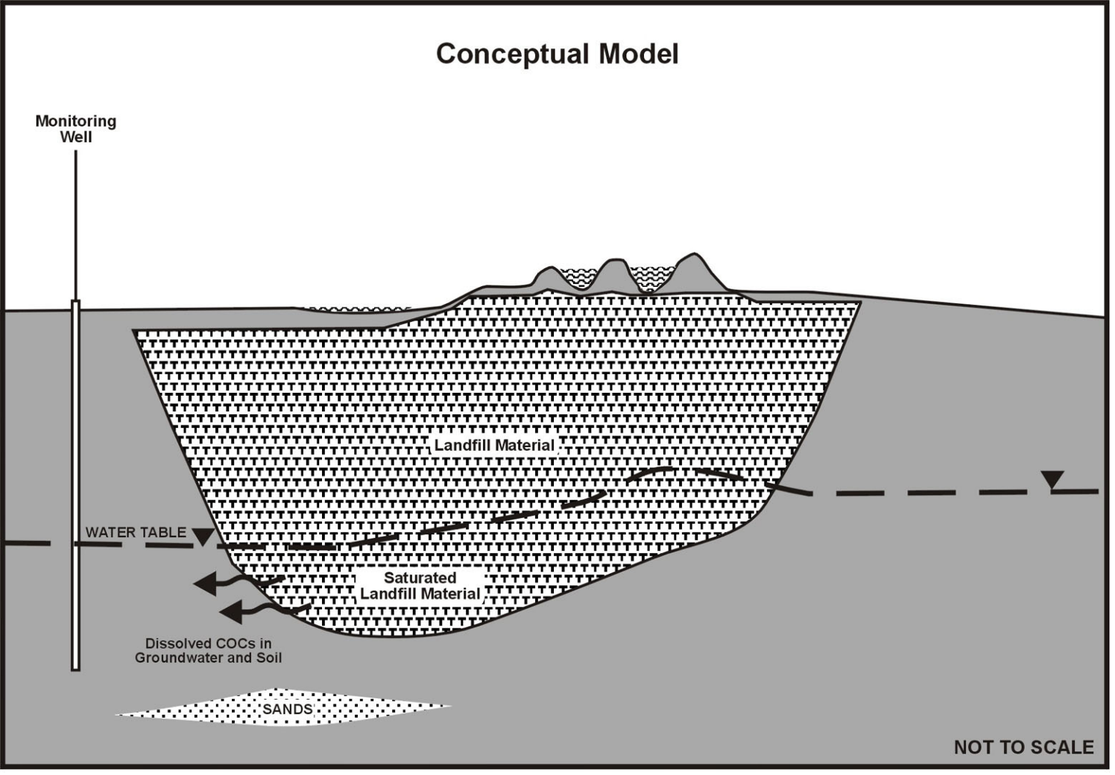

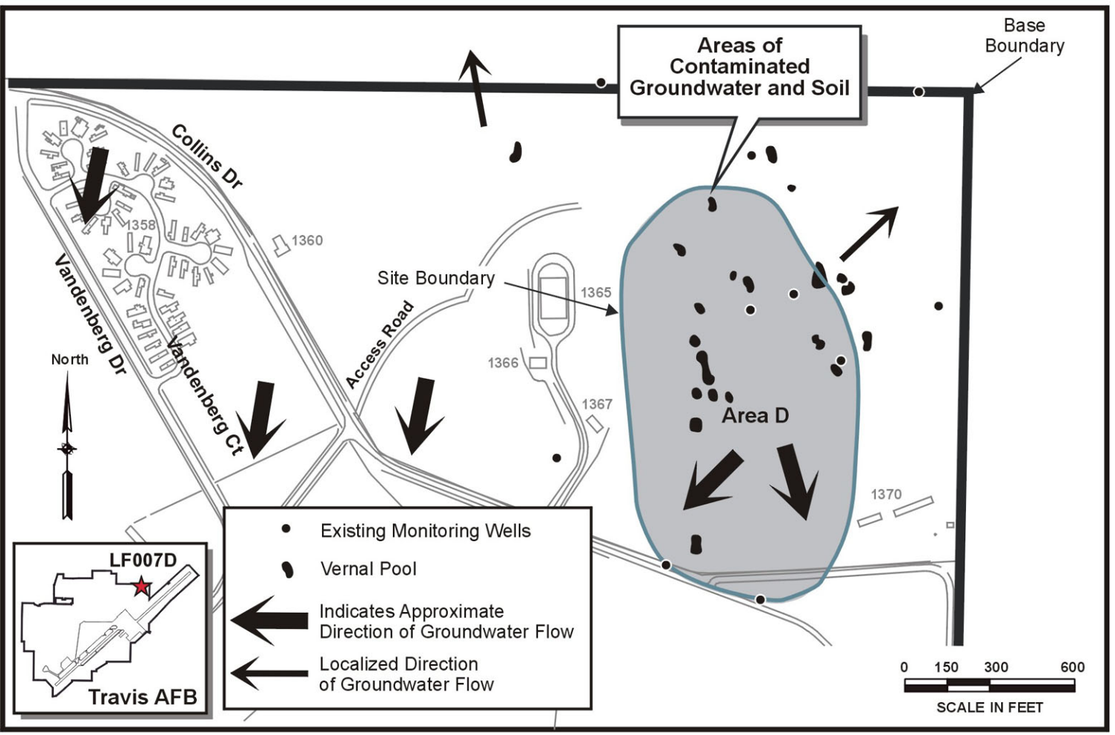

LF007 (Landfill 2, Area D)

Primary Contaminants, Remediation Drivers and Affected Media

Medium	Contaminant Type	Remediation Driver	Contaminant of Concern	Maximum Reported Concentration
Groundwater	VOCs	HR = 1.4×10^{-5}	Benzene	25.8 mg/L
Groundwater	VOCs	HR = 2.9×10^{-6}	Vinyl Chloride	1.78 mg/L
Groundwater	VOCs	HR = 2.5×10^{-5}	1,4-dichlorobenzene	43.8 mg/L
Groundwater	VOCs	HR = 1.1×10^{-6}	1,1-DCE	0.96 mg/L
Groundwater	VOCs	HI = 15.5	Chlorobenzene	282 mg/L
Groundwater	Dioxins	HR = 2.4×10^{-4}	2,3,7,8-TCDDeq	16.99 pg/L
Groundwater	Pesticides/PCBs	HR = 2.2×10^{-4}	PCBs (PCB-1242)	14.1 mg/L
Groundwater	SVOCs	HR = 8.2×10^{-6}	bis(2-ethylhexyl)phthalate	124 mg/L

Site Characteristics

- Southwestern portion of the study area is grassy flatland
- Ground surface is as much as 15 to 20 feet above natural ground surface (North-South trending)
- Differential settling in the remaining portions of the study area result in berms and trenches up to 6 feet deep
- Approximately 10-19 vernal pools in the study area
- 1,4 dichlorobenzene in groundwater — 10 mg/L average, 43.8 mg/L maximum
- bis(2-ethylhexyl)phthalate in groundwater — 10 mg/L average, 124 mg/L maximum
- Chlorobenzene in groundwater — 70 mg/L average, 282 mg/L maximum
- Benzene in groundwater — 5 mg/L average, 25.8 mg/L maximum
- Estimated contaminated groundwater surface area = 960,000 ft^2, volume = 4,800,000 ft^3
- Estimated mass of dissolved VOCs equals 26 lb; no evidence of DNAPL or LNAPL
- Depth to groundwater — varies from 1 to 10 feet, depending on season
- Depth to bedrock — 0 to 20 feet
- Landfill and back fill material extends from ground surface to about 15 feet bgs
- Clay layer extends from about 15 feet bgs to bedrock
- Site also studied for soil contamination

Selected Interim Remedial Action/Objectives

- Deferred: Area will be included in the Basewide Natural Attenuation Assessment Plan

Feasibility Study Treatment Alternatives and Associated Costs

- Alternative 2: Natural Attenuation/Monitoring: Capital Cost = $18,600; First Year O & M = $72,000
- Alternative 3: Extraction, Treatment and Discharge
  - FS Alternative 3: Air Stripper/Catalytic Oxidation, Ion Exchange, Activated Carbon: Capital Cost = $1,800,000; First Year O & M = $224,000
  - FS Alternative 5: UV Oxidation, Ion Exchange, Activated Carbon: Capital Cost = $1,800,000; First Year O & M = $266,000
  - FS Alternative 7: Ion Exchange, Activated Carbon: Capital Cost = $1,800,000; First Year O & M = $266,000
- These costs derived from FS will be refined during remedial design phase based on combination of alternatives and site specific variables

Figure A-6.
Site Summary Information
for LF007, Area D, Travis AFB