Final

Proposed Plan

Operable Unit 8
Hill Air Force Base, Utah
Davis County

June 2003

Introduction

Hill Air Force Base (Hill AFB), the lead agency responsible for cleanup of contaminated sites at the Base, is requesting public comments on this **Proposed Plan**. The Proposed Plan presents options for cleanup of groundwater contamination at **Operable Unit** 8 (**OU** 8), located in the southern portion of Hill AFB and in the cities of Layton and Clearfield (referred to hereafter as the off-Base area). Cleanup/remedial alternatives have been reviewed, and a preferred alternative has been selected with the oversight and concurrence of the **U.S. Environmental Protection Agency (EPA)** and the **Utah Department of Environmental Quality (UDEQ)**. This Proposed Plan has been prepared in fulfillment of the U.S. Air Force's public participation responsibilities under Sections 113(k) and 117(a) of the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**. Technical terms used in this document are highlighted in bold text and defined in the glossary of terms and acronyms beginning on page 17.

Public Involvement Process

Residents and interested parties are encouraged to read and comment on this Proposed Plan, as well as the **Remedial Investigation (RI)** Report, **Feasibility Study (FS)** Report, and any other documents in the **Administrative Record** for OU 8, which is maintained at the locations noted below. The RI report contains a summary and discussion of remedial investigation activities that were completed at OU 8 and includes a summary of the **Baseline Risk Assessment**. The FS report discusses in greater detail the evaluation of alternatives presented in this Proposed Plan. The Proposed Plan can be found online at www.em.hill.af.mil/restoration/documents.

Administrative Record Repositories

Weber State University
Stewart Library
2901 University Circle
Ogden, Utah 84408-2901
Contact: Chris Hauser

Environmental Management
Directorate
OO-ALC/EMR–Bldg. 5–NE 2nd Floor
7274 Wardleigh Road
Hill AFB, UT 84056-5137
Mon.–Fri., 7:30 A.M.-4:30 P.M.
(by appointment)
Contact: Mr. Charles Freeman
Telephone: (801) 775-6951

Mark Your Calendar

Public Comment Period

Monday, June 23, 2003
through
Tuesday, July 22, 2003

Open House

Thursday, July 10, 2003
5:00–8:00 P.M.

Location

Northridge High School
2430 N. 400 W. (Hill Field Rd.)
Layton, UT 84041
(See back cover for map)

JUNE 2003

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JULY 2003

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Public comments will be accepted from **June 23, 2003 to July 22, 2003**. Written comments can be sent to Hill AFB to the attention of Charles Freeman at the address above. All written comments must be postmarked no later than July 22, 2003. The public comment period may be extended up to 30 days if a written request is submitted to Hill AFB prior to July 22, 2003. Hill AFB will consider all submitted comments and prepare a written response to each comment. Hill AFB will make its final selection only after considering all public comments. A summary of the comments and responses will accompany the **Record of Decision (ROD)**, which will present the selected remedy for OU 8. The ROD will become part of the Administrative Record at the information repositories noted above. Hill AFB may modify the **preferred alternative**(s), select other alternatives presented in this Proposed Plan, or select a more appropriate alternative on the basis of new information or public comments.

Preferred Alternative

The preferred alternatives selected for remediation of contaminated groundwater in on-Base and off-Base areas of OU 8 include the following components:

On-Base

The preferred alternative for remediation of contaminated groundwater in the on-Base area at OU 8 includes the following components:

- **Monitored natural attenuation (MNA)** will be implemented for the on-Base portion of the contaminant **plume** through a long-term groundwater monitoring program. MNA refers to the reliance on natural attenuation processes (physical, chemical, and/or biological) to achieve site-specific remedial objectives within a reasonable time frame. Groundwater monitoring will be performed to monitor contaminant concentrations and to ensure there are no significant threats to human health or the environment. The groundwater monitoring program will also be used to verify/confirm that natural attenuation is occurring.
- **Institutional controls** will be implemented to prohibit use of contaminated groundwater until remedial action objectives are achieved.
- The OU 8 **Interim Remedial Action (IRA)** Hydraulic Containment System, which prevents further migration of contaminants from on-Base areas to off-Base areas, will continue to be operated.

Off-Base

The preferred alternative for remediation of contaminated groundwater in the off-Base area at OU 8 includes the following components:

- Contaminated groundwater in the off-Base area will be removed with two extraction well systems. Once extracted, contaminated groundwater would either be (1) treated by **air stripping** and discharged to the stormwater system, or (2) discharged (untreated) to the sanitary sewer and treated at the local **publicly-owned treatment works (POTW)**.
- Groundwater monitoring will continue to track projected declines in contaminant concentrations over time (due to natural attenuation).
- Institutional controls will be implemented to prohibit the use of contaminated groundwater until remedial action objectives are achieved.

Site Background

Hill AFB is located in northern Utah, approximately 30 miles north of Salt Lake City and 10 miles south of Ogden, (Figure 1). The Base traces its beginning to 1934 as part of the Army Air Corp. In the decades since, Hill AFB has served as a key part of the nation's defense in repairing and maintaining many thousands of aircraft and other weapon systems. The industrial operation to perform this maintenance and repair work used or generated numerous chemicals and wastes, including chlorinated and non-chlorinated solvents and degreasers, petroleum hydrocarbons, acids, bases, metals and other chemicals. For many years, these chemicals leaked from tanks and pipes or in some cases spilled or dumped on the ground. The chemicals and their associated waste products were also disposed of in chemical disposal pits or landfills on the Base and at other Air Force facilities. Prior to building an industrial waste treatment plant in 1956, chemical wastes were also piped to an open evaporation pond located near the Base's South Gate. When environmental laws and regulations were passed beginning in the 1970s, Hill AFB changed its procedures and began eliminating and reducing its use of numerous chemicals and developed better storage and disposal of these items. Today, hazardous wastes generated at the Base are treated and disposed of according to the requirements of the Resource Conservation and Recovery Act of 1976 (RCRA).

Hill AFB was placed on the U.S. EPA's **National Priorities List**, or "Superfund" Program, in July of 1987. The **Superfund Amendment and Reauthorization Act (SARA)**, enacted in 1986, requires that federal facilities follow **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)** guidelines. In addition, the program requires greater EPA involvement and oversight of federal facility cleanups. As part of the CERCLA RI/FS process, 12 Operable Units have been designated at Hill AFB (see Figure 1).

Operable Unit 8 was created in 1993, and comprises the **shallow groundwater** aquifer beneath the Industrial Complex (OU 3 and OU 7) of the Base, and off-Base areas beneath the cities of Layton and extreme eastern Clearfield (see Figure 1). Potential source areas on Base in the OU 8 area continue to be addressed as OU 3, OU 7, OU 9, and the underground storage tank (UST) program. Potential sources include Buildings 220 and 225 (OU 7); the former Berman Pond, the Hill AFB Industrial Wastewater Treatment Plant Sludge Drying Beds, the Sodium Hydroxide Tank Site, the Refueling Vehicle Maintenance Facility (RVMF), Pond 1 (OU 9); and the UST sites 260 (ST74) and 280 (ST35). Each of these potential source areas has been addressed under separate investigations and decision documents. **Remedial actions** for OUs 3 and 7 are in place and either complete or are under long-term operation and maintenance, while OU 9 sites are currently being identified and investigated. UST sites overlying the OU 8 plume are either under long-term operation and maintenance or have been remediated and are closed. To prevent further contamination from leaving the industrial area of the Base and moving south beneath the city of Layton, a groundwater extraction system was installed in 1998 across the southern Base boundary (see Figure 2). This extraction system is termed an IRA because it was installed prior to the selection of the final cleanup remedial action. This system is discussed further in this Proposed Plan under the section entitled "Remedial Actions/Corrective Measures."

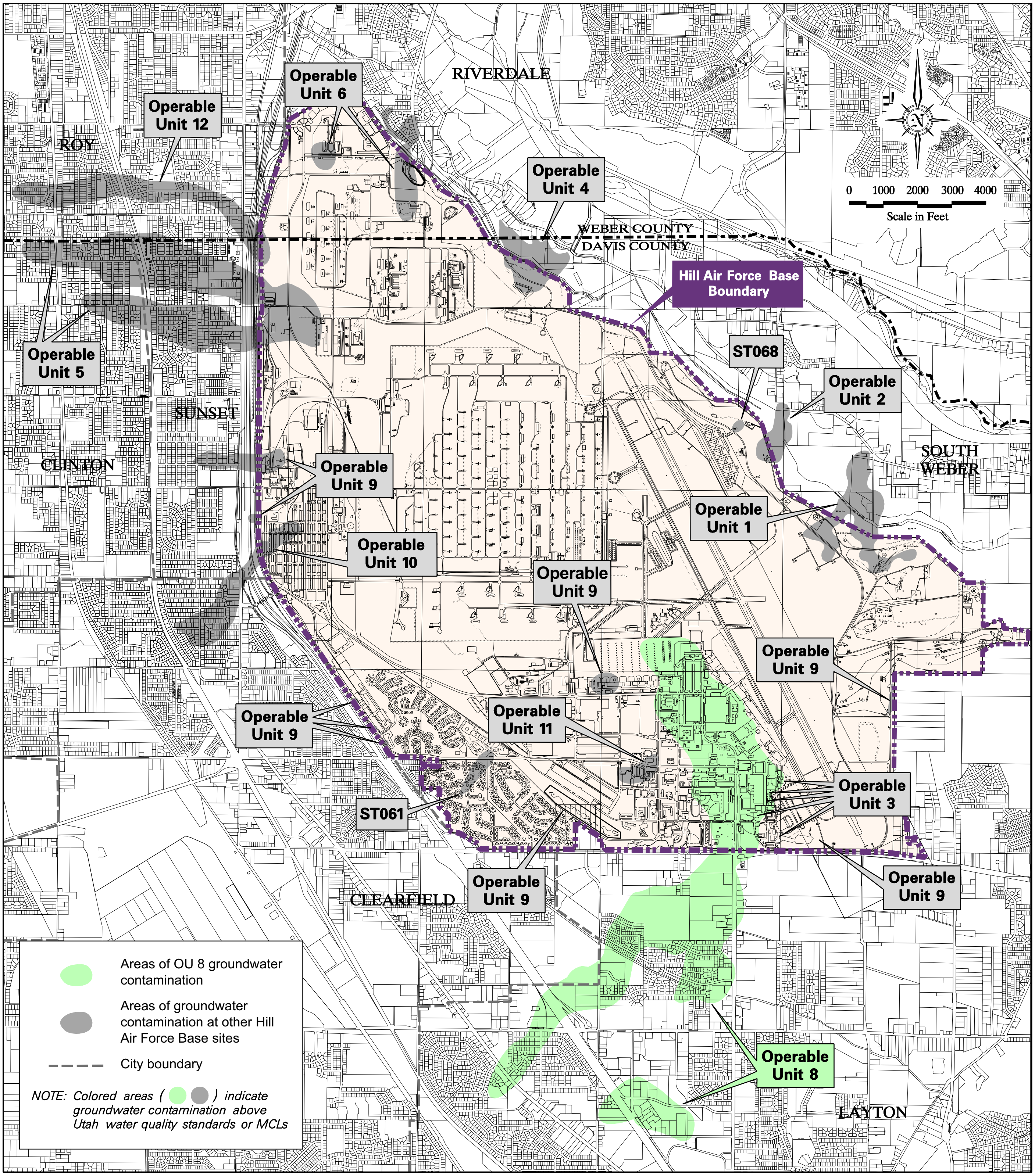

Figure 1. Location of Operable Units at Hill Air Force Base

Site Physical Characteristics

Hill AFB lies on a remnant terrace that is part of the delta formed by the Weber River as it entered Lake Bonneville, a lake which occupied the Salt Lake valley some 10,000 years ago. As the water level in this lake rose and fell over time, layers and channels of sand, silt, and clay were deposited in the delta area, resulting in very complex intermixing of sediment types.

During the operation of Hill AFB, some chemicals used in industrial processes on Base have been released on or to the ground. These chemicals, referred to as contaminants, have migrated from their point of release down through the soils and sediments to the shallow groundwater aquifer.

The contaminants then continue to move both horizontally and vertically but preferentially through the coarser sand and silty sand units. These units allow a higher flow of groundwater, and therefore more contaminants, than finer silt and clay units. On Base, a zone of sands and silty sands that is deposited west of the Industrial Complex appears to control contaminant movement. As a result, groundwater on Base flows primarily to the northwest, as illustrated in Figure 2.

Off Base, sand units within larger layers of finer-grained silts and clays appear to control migration of contaminants. In the deeper portions of the shallow aquifer off Base, downward movement of contaminants is limited by a widespread and continuous thick layer of silt and clay. This layer prevents contaminants from reaching the drinking water aquifers beneath Hill AFB and off-Base areas. While past Air Force practices have adversely impacted the shallow groundwater, the deep groundwater which is a residential drinking water source has not been affected. Off-Base groundwater flow is mainly controlled by the significant drop in ground surface elevation. Because the ground surface slopes to the south-southwest, groundwater flow also flows in this general direction.

Table 1. Contaminant Concentrations in Groundwater

Compound	Maximum Concentration Detected in Groundwater at OU 8 (µg/l)	Most Recent Maximum Concentrations (µg/l)	Federal Maximum Contaminant Level (µg/l)	State Groundwater Quality Standard (µg/l)
1,1-Dichloroethene (1,1-DCE)	200	33	7	7
1,1,1-Trichloroethane (1,1,1-TCA)	1,200	160	200	200
1,2-Dichloroethane (1,2-DCA)	697	360	5	5
Benzene	2,500	267	5	5
Chlorobenzene	6,000	550	100	NE
Ethylbenzene	996	868	700	NE
Toluene	2,500	448	1,000	NE
Trichloroethene (TCE)	2,000	680	5	5
Hexavalent Chromium	3,200	300	100	NE

µg/l micrograms per liter
NE Not established

Nature and Extent of Contamination

Groundwater quality in the OU 8 area has been monitored since 1983. This section describes the results of this monitoring and summarizes the general nature and extent of the contaminants that have been detected in the OU 8 area. The Risk Assessment section of this document identifies which of these contaminants are of concern. As with all other sections of this document, the discussion refers to both on- and off-Base contamination.

Volatile organic compounds (VOCs) are the primary contaminants detected in OU 8 groundwater. Examples of VOCs include **chlorinated solvents** such as **trichloroethene (TCE)**, which was commonly used to clean metal parts during equipment manufacture. Figure 2 shows the area within OU 8 where contaminants, mainly VOCs, present in groundwater exceed Federal and State of Utah drinking water standards. The VOCs most often detected above their respective **maximum contaminant levels (MCLs)** in OU 8 groundwater include: TCE, **1,2-dichloroethane** (**1,2-DCA**), **1,1-dichloroethene (1,1-DCE)**, **1,1,1-trichloroethane (1,1,1-TCA)**, and **chlorobenzene**. Table 1 shows the maximum concentrations of these contaminants detected in OU 8 groundwater since monitoring began, as well as the maximum concentrations detected most recently (2002). The Federal and State of Utah drinking water standards are also provided on Table 1. In addition to chlorinated solvents, organic compounds commonly found in gasoline and diesel (**benzene**, toluene, and ethylbenzene) have been detected at concentrations exceeding their respective MCLs near on-Base UST sites. Inorganic contaminants in groundwater detected above their respective MCLs include **hexavalent chromium**, **nickel**, and **lead**. These were detected on Base in the vicinity of Building 225 and the **Industrial Wastewater Treatment Plant (IWTP)**. However, with the exception of hexavalent chromium in a localized area on Base, all other inorganic contaminants have been detected sporadically and inconsistently in a few well across OU 8, with no recognizable plumes.

The most widespread contaminants at OU 8 are TCE and 1,2-DCA. The highest TCE concentrations are reported on Base in the vicinity of Building 257, the RVMF area (Buildings 511 and 514), and Building 225 (see Figure 2). Concentrations of TCE in off-Base areas are generally lower than those reported on Base. The estimated volume of groundwater contaminated with TCE at OU 8 is approximately 6 billion gallons over an area of approximately 300 acres on Base and 300 acres off Base.

As can be seen in Figure 2, the off-Base TCE plume is split into two legs: an eastern and a western leg. In addition to TCE, the western leg of the off-Base OU 8 plume also contains

1,2-DCA. The 1,2-DCA plume extends from the southern Base boundary to the area west of Main Street in Layton, as shown on Figure 2. The off-Base 1,2-DCA plume extends several thousand feet ahead of the off-Base TCE plume in the western leg of the contaminant plume. This is because 1,2-DCA is transported more easily with the groundwater than TCE.

A small area of TCE and 1,2-DCA is located in the Woodland Park office complex beneath a stormwater retention pond (see Figure 2). Shallow field drains used to manage groundwater in farmers' fields prior to residential development inadvertently collected contaminated groundwater and transported it via stormdrains to the pond.

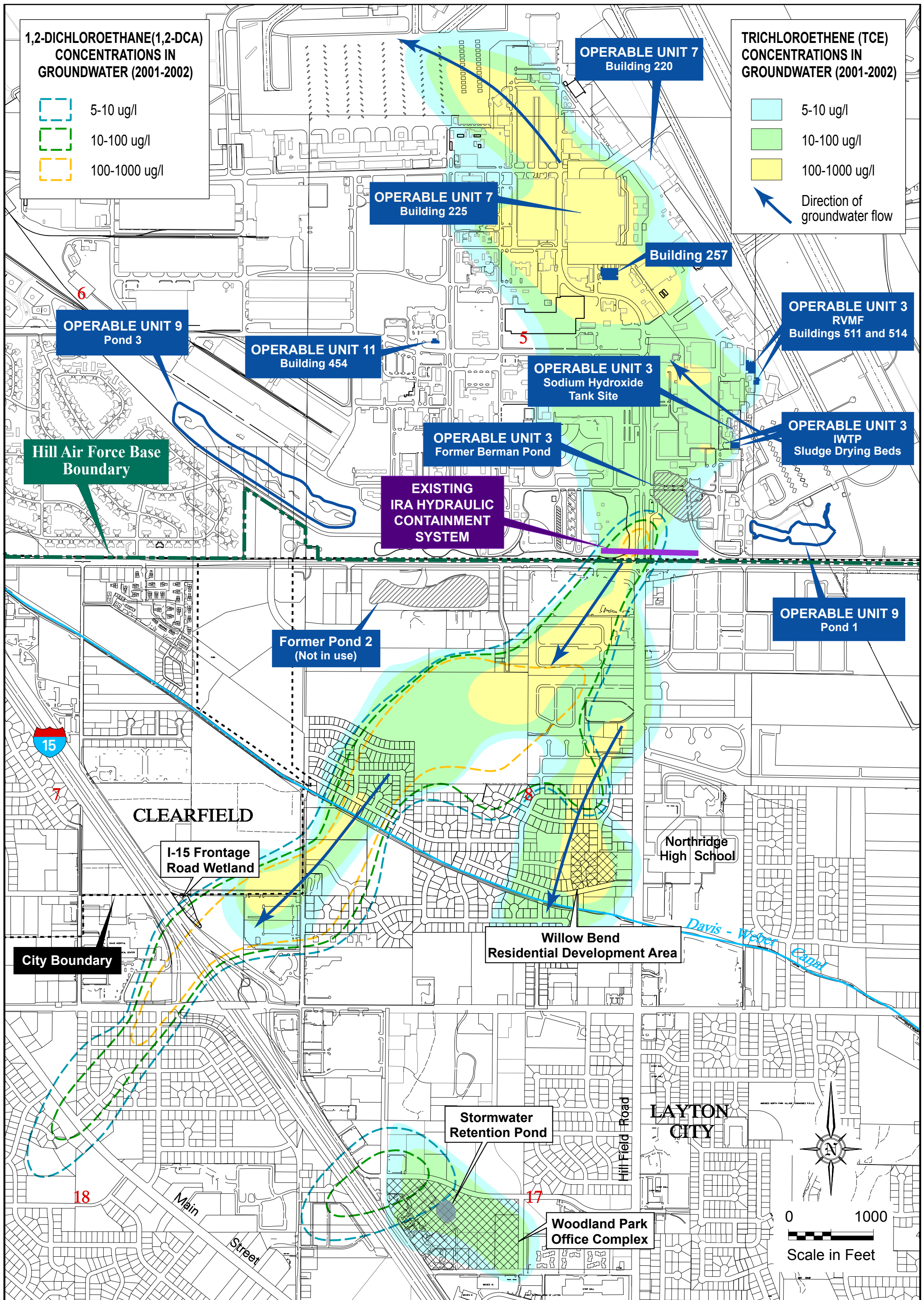

Figure 2. Extent of Trichloroethene (TCE) in Groundwater.

Risk Assessment Summary

The EPA and UDEQ provide guidelines for evaluating risks to human health and the environment. Current and potential future risks were examined in a baseline risk assessment performed for the entire OU 8 area. **Exposure pathways** through which people, plants, or animals may come in contact with environmental contamination were examined as a part of this process. The baseline risk assessment was based on groundwater, surface water, and indoor air samples collected at various locations within OU 8. This section identifies exposure scenarios that might result in an exceedance of EPA and UDEQ guidelines and pose a potentially unacceptable risk at OU 8.

Current Risk

Analytical data from indoor (basement) air samples collected from 19 residences, groundwater samples collected from representative monitoring wells, and surface water samples were used in the risk assessment. Under current conditions, possible exposure pathways include inhalation of TCE, 1,1-DCE, and 1,2-DCA vapors that migrate from groundwater into the basements of homes overlying the contaminant plume, exposure to shallow groundwater (less than 10 feet below ground surface) during construction, and playing in the woods/wetlands in Willow Bend development area located immediately west of Northridge High School (see Figure 2). However, since the time the remedial investigation was completed, the Willow Bend area has been developed into residential housing, and the wetlands have been drained. According to federal standards, none of these current exposure pathways poses an unacceptable risk to human health or the environment. Current risks are within or below the potentially acceptable cancer risk range for all receptors.

Future Risks

Future risk scenarios are based on the potential for the use of shallow groundwater as a drinking water source. Although this scenario is evaluated, it is highly unlikely because of current restrictions on groundwater imposed by the **Utah Division of Water Rights (UDWR)**. However, under potential future conditions, the potential for adverse health effects exceeded EPA and UDEQ criteria in virtually all of the areas evaluated. Future risks were also associated with breathing contaminants in indoor air, if in the future, houses are built on Base over the current industrial complex. Such construction is considered unlikely because the Base is not currently slated for closure.

Ecological Risks

Ecological risks focused on three wetland areas where the groundwater comes to the surface. These wetland areas included a small wetland in the Willow Bend subdivision, a stormwater retention basin in the Woodland Park office complex, and a wetland in a currently undeveloped pasture near East Frontage Road on the east side of Interstate Highway 15 (I-15) (Figure 2). These areas were evaluated using a screening-level ecological risk assessment protocol. None of the constituents that were detected in samples from these areas exceeded the ecological screening criteria. The wetland in the Willow Bend area has been drained to allow for construction of residential units. The wetland on the east side of I-15 is likely to be developed within the next three to five years. Based on these findings, it is unlikely that there is any potential for ecological risk to these areas or to the surrounding environment due to constituents associated with OU 8.

Existing Remedial Actions/ Corrective Measures

Several remedial actions or corrective measures have been implemented within the OU 8 area for groundwater and for source areas. These remedial actions include the OU 8 IRA Hydraulic Containment System, implementation of the OU 3 and 7 RODs, implementation of interim remedial measures at the Sodium Hydroxide Tank Site (now included in the OU 3 ROD), and implementation of corrective actions at UST Sites ST35 (Building 280) and ST74 (Building 260). Additional details regarding these remedial actions and corrective measures are presented in the OU 8 RI and FS reports. These documents are available as part of the Administrative Record for OU 8. Because the OU 8 IRA Hydraulic Containment System will be incorporated in the final remedy for OU 8, a brief discussion of the IRA is presented in the following paragraph.

OU 8 IRA Hydraulic Containment System

In an effort to reduce the potential future risks to off-Base receptors and minimize the potential migration of contaminants, Hill AFB implemented an IRA, pending completion of a comprehensive Remedial Investigation and potential future Remedial Action for OU 8. An Interim ROD for the IRA at OU 8 identified a groundwater hydraulic containment system as the selected remedy and was finalized in May 1997. The OU 8 IRA Hydraulic Containment System, which consists of eight groundwater extraction wells situated at the southern Base boundary, began operation in May 1998 and is planned to be incorporated into the final remedy for OU 8 and operated until site remedial action objectives are achieved. Based on data collected to date, the OU 8 IRA Hydraulic Containment System is achieving its objectives of preventing contaminated groundwater from moving from on-Base to off-Base areas.

Summary of Remedial Action Alternatives

Alternatives that have been developed for remediation of contaminated groundwater at OU 8 are presented and evaluated below. OU 8 has been divided into two areas: on Base and off Base. This division was made because:

- On-Base contaminated groundwater is contained on Base through the OU 8 IRA Hydraulic Containment System
- On-Base contaminated groundwater is entirely contained within Hill AFB boundaries
- Hill AFB is expected to remain under the jurisdiction of the Department of Defense, and therefore, Hill AFB can prevent use of contaminated groundwater on Base, thereby eliminating exposure pathways.

A complete discussion of the technology screening, alternative development and evaluation process, is presented in the OU 8 FS, which is available at the Administrative Record repositories listed on Page 1. Alternatives developed and evaluated for remediation of groundwater at OU 8 are summarized below and are evaluated and compared in the section that follows. Costs provided for each alternative include **capital costs** for system installation, annual costs for **operation and maintenance (O&M)** including sampling, and the total project cost for 30 years of operation adjusted to net present worth. The net present worth is the amount of money, which, if invested in the initial year of the remedy and dispersed as needed, would be sufficient to cover the costs associated with the project, which include capital costs and O&M costs.

On-Base Alternatives

A variety of proven remedial technologies were considered for remediation of contaminated groundwater on Base at OU 8. Given the remedial technologies available, five alternatives were developed for evaluation in the FS. The OU 8 IRA Hydraulic Containment System, installed to contain contaminated groundwater at the southern Base boundary, was included in all on-Base remedial alternatives. All alternatives also include ongoing groundwater sampling to monitor projected contaminant concentration declines over time. Alternative 1 is a no further action alternative and is included for comparative purposes. All alternatives but Alternative 1 include institutional controls to prohibit the use of shallow groundwater beneath the on-Base areas of OU 8. Alternative 3 includes additional analyses for groundwater sampling to verify/confirm the occurrence of natural attenuation. Alternatives 4 and 5 include active groundwater extraction with extraction wells to remove contaminated groundwater from the shallow aquifer. In computer modeling of the alternatives to evaluate effectiveness, on-going contaminant sources were assumed for each alternative. This results in localized areas where contaminant concentrations remain above standards.

On-Base Alternative 1

No Further Action

Capital Costs: $0
Annual O&M Costs: $257,843
Present Worth Cost: $4,550,000
Time to Complete Construction: Not Applicable
Estimated Restoration Timeframe: 30-plus years

This alternative includes:

- Continued operation of the OU 8 IRA Hydraulic Containment System
- Groundwater monitoring.

Institutional Controls that are currently in place will not be renewed/updated under this alternative. This alternative is intended to serve as a baseline for evaluation. Features of Alternative 1 are shown on Figure 3.

On-Base Alternative 2

Limited Action

Capital Costs: $0
Annual O&M Costs: $257,843
Present Worth Cost: $4,570,000
Time to Complete Construction: Not Applicable
Estimated Restoration Timeframe: 30-plus years

This alternative includes:

- All aspects of Alternative 1
- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Continued operation of the OU 8 IRA Hydraulic Containment System
- Groundwater monitoring.

Institutional controls that are currently in place would be maintained and expanded if necessary under Alternative 2. Features of Alternative 2 are shown on Figure 3.

On-Base Alternative 3

Monitored Natural Attenuation

Capital Costs: $0
Annual O&M Costs: $310,715
Present Worth Cost: $5,480,000
Time to Complete Construction: Not Applicable
Estimated Restoration Timeframe: 30-plus years

This alternative includes:

- All aspects of Alternative 2
- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Continued operation of the OU 8 IRA Hydraulic Containment System
- Groundwater monitoring
- Monitoring of parameters to verify/confirm natural attenuation.

Features of Alternative 3 are shown on Figure 3.

On-Base Alternative 4

Pump and Treat Option 1

Capital Costs: $1,420,000
Annual O&M Costs: $502,434
Present Worth Cost: $10,700,000
Time to Complete Construction: 18 Months
Estimated Restoration Timeframe: 30-plus years

This alternative includes:

- All aspects of Alternative 2
- Installation and operation of 10 groundwater extraction wells to extract contaminated groundwater on Base
- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Continued operation of the OU 8 IRA Hydraulic Containment System
- Groundwater monitoring.

The locations of these extraction wells were obtained using a computer model constructed for the on-Base area of OU 8. The objective of this alternative is to maximize contaminant mass removal from groundwater while limiting the total volume of groundwater extracted and treated. Once extracted, contaminated groundwater would either be (1) treated with air stripping and discharged to the stormwater system, or (2) discharged (untreated) to the sanitary sewer and treated at the local POTW. Features of Alternative 4 are shown on Figure 4.

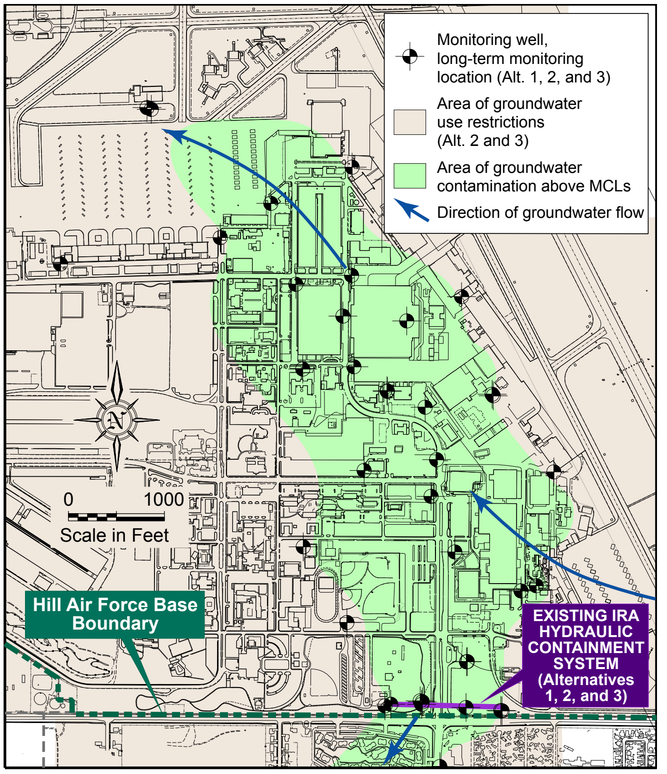

Figure 3. Features of On-Base Alternatives 1, 2, and 3.

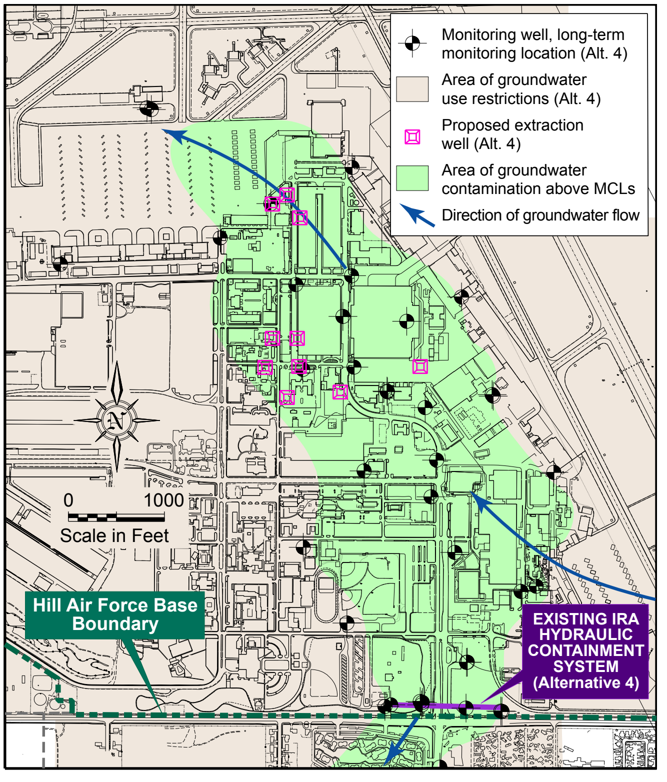

Figure 4. Features of On-Base Alternative 4.

On-Base Alternative 5

Pump and Treat Option 2

Capital Costs: $2,250,000
Annual O&M Costs: $679,303
Present Worth Cost: $14,870,000
Time to Complete Construction: 12 to 18 Months
Estimated Restoration Timeframe: 30-plus years

This alternative includes:

- All aspects of Alternative 2
- Installation and operation of 19 groundwater extraction wells to extract contaminated groundwater on Base
- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Continued operation of the OU 8 IRA Hydraulic Containment System
- Groundwater monitoring.

The locations of these wells were obtained using a computer model. The objective of this alternative is to maximize contaminant mass removal from groundwater while limiting the volume of groundwater extracted and treated. Once extracted, contaminated groundwater would either be (1) treated by air stripping and discharged to the stormwater system, or (2) discharged (untreated) to the sanitary sewer and treated at the local POTW. Alternative 5 is similar to Alternative 4, except that it includes a larger number of extraction wells. Features of Alternative 5 are shown on Figure 5.

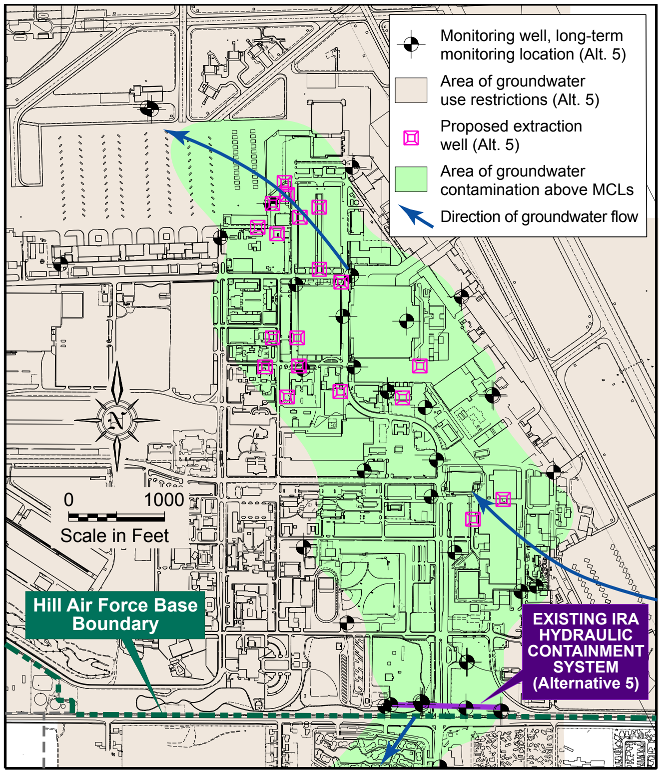

Figure 5. Features of On-Base Alternative 5.

Off-Base Alternatives

A variety of proven remedial technologies were considered for remediation of contaminated groundwater off Base at OU 8. Given the remedial technologies available, six alternatives were developed for evaluation in the FS. All alternatives include ongoing groundwater sampling to monitor projected contaminant concentration declines over time. Alternative 1 is a no action alternative and is included for comparative purposes. All alternatives but Alternative 1 include institutional controls to prohibit the use of shallow groundwater beneath the off-Base areas of OU 8. Alternative 3 includes additional analyses for groundwater sampling to verify/confirm the occurrence of natural attenuation and track its progress. Alternatives 4, 5, and 6 include active groundwater extraction using wells to remove contaminated groundwater from the shallow aquifer. Although not part of the off-Base alternatives, the OU 8 IRA Hydraulic Containment System was included in all on-Base remedial alternatives, and thus will be present to prevent further contamination from migrating to off-Base areas.

Off-Base Alternative 1

No Action

Capital Costs: $0
Annual O&M Costs: $113,512
Present Worth Cost: $2,060,000
Time to Complete Construction: Not Applicable
Estimated Restoration Timeframe: 150 years

This alternative includes:

- Groundwater monitoring.

Institutional Controls that are currently in place will not be renewed or updated under this alternative. This alternative is intended to serve as a baseline for evaluation. Features of Alternative 1 are shown on Figure 6.

Off-Base Alternative 2

Limited Action

Capital Costs: $0
Annual O&M Costs: $113,512
Present Worth Cost: $2,080,000
Time to Complete Construction: Not Applicable.
Estimated Restoration Timeframe: 150 years

This alternative includes:

- All aspects of Alternative 1

- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Groundwater monitoring.

Institutional controls that are currently in place would be maintained and expanded if necessary. Features of Alternative 2 are shown on Figure 6.

Off-Base Alternative 3

Monitored Natural Attenuation

Capital Costs: $0
Annual O&M Costs: $168,450
Present Worth Cost: $3,030,000
Time to Complete Construction: Not Applicable
Estimated Restoration Timeframe: 150 years

This alternative includes:

- All aspects of Alternative 2
- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Groundwater monitoring
- Monitoring of parameters to verify/confirm natural attenuation.

Features of Alternative 3 are shown on Figure 6.

Off-Base Alternative 4

Pump and Treat Option 1

Capital Costs: $3,750,000
Annual O&M Costs: $688,000
Present Worth Cost: $17,200,000
Time to Complete Construction: 12 to 18 Months
Estimated Restoration Timeframe: 65 years

This alternative includes:

- All aspects of Alternative 2
- Installation and operation of 38 groundwater extraction wells in three areas to extract contaminated groundwater off Base
- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Groundwater monitoring.

The locations of these extraction wells were selected to remove contaminant mass while preventing further migration (expansion) of the TCE and 1,2-DCA plumes. Once extracted, contaminated groundwater would either be (1) treated by air stripping and discharged to the stormwater system, or (2) discharged (untreated) to the sanitary sewer and treated at the local POTW. Features of Alternative 4 are shown on Figure 7.

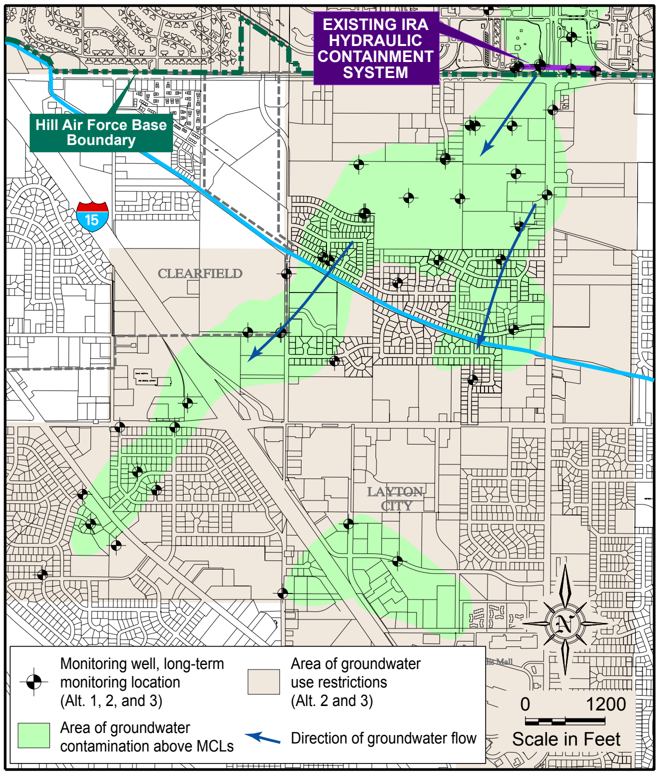

Figure 6. Features of Off-Base Alternative 1, 2, and 3.

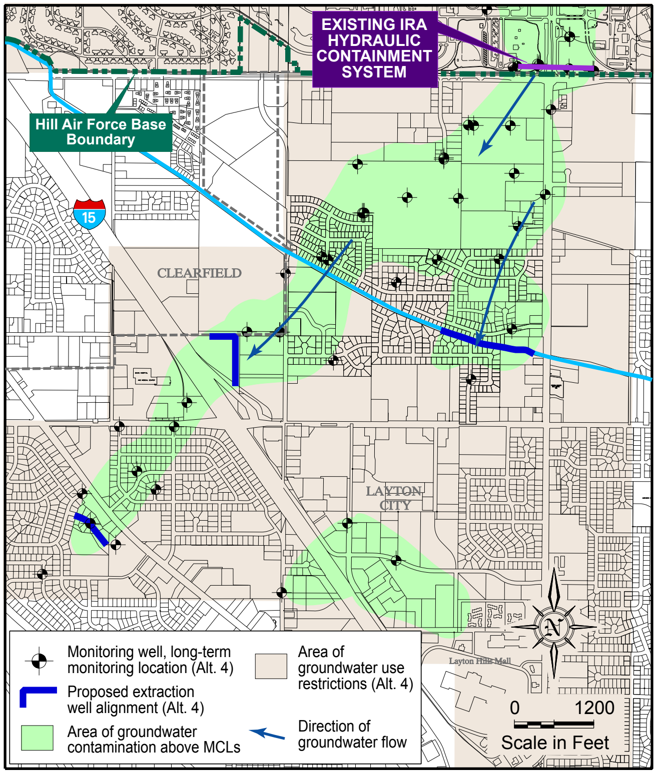

Figure 7. Features of Off-Base Alternative 4.

Off-Base Alternative 5

Pump and Treat Option 2

Capital Costs: $2,332,000
Annual O&M Costs: $434,000
Present Worth Cost: $10,800,000
Time to Complete Construction: 9 to 12 Months
Estimated Restoration Timeframe: 65 years

This alternative includes:

- All aspects of Alternative 2
- Installation and operation of 18 groundwater extraction wells in two areas to extract contaminated groundwater off Base
- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Groundwater monitoring.

This alternative is similar to Alternative 4 except that it does not include extraction wells in the eastern leg of the TCE plume. The computer model constructed for the off-Base area indicates that TCE concentrations in the eastern leg of the TCE plume will decline steadily over time without active treatment. Groundwater monitoring will continue to track projected declines in contaminant concentrations over time. As in Alternative 4, the locations of these extraction wells were selected to remove contaminant mass while preventing further migration (expansion) of the western leg of the TCE and 1,2-DCA plumes. Once extracted, contaminated groundwater would either be (1) treated by air stripping and discharged to the stormwater system, or (2) discharged (untreated) to the sanitary sewer and treated at the local POTW. Features of Alternative 5 are shown on Figure 8.

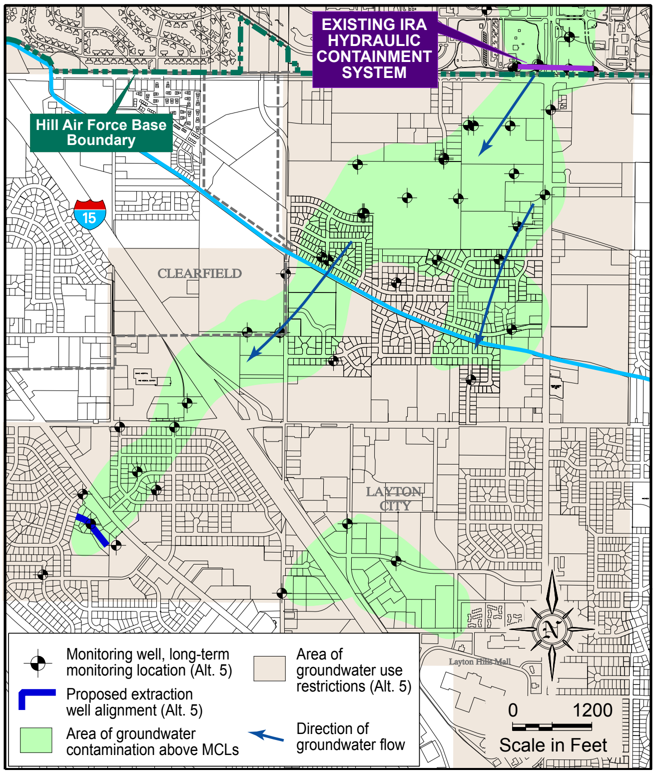

Figure 8. Features of Off-Base Alternative 5.

Off-Base Alternative 6

Pump and Treat Option 3

Capital Costs: $5,540,000
Annual O&M Costs: $877,000
Present Worth Cost: $22,600,000
Time to Complete Construction: 18 to 24 Months
Estimated Restoration Timeframe: 60 years

This alternative includes:

- All aspects of Alternative 2
- Installation and operation of 62 groundwater extraction wells throughout the contaminant plume to extract contaminated groundwater off Base
- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Groundwater monitoring.

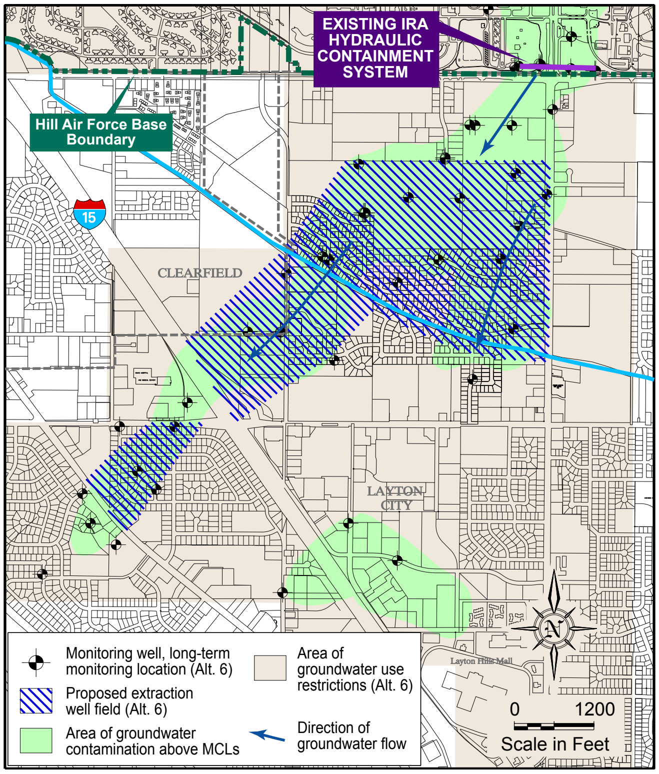

Figure 9. Features of Off-Base Alternative 6.

The locations of these extraction wells were selected to remove contaminant mass while preventing further migration (expansion) of the TCE and 1,2-DCA plumes. Once extracted, contaminated groundwater would either be (1) treated by air stripping and discharged to the stormwater system, or (2) discharged (untreated) to the sanitary sewer and treated at the local POTW. Features of Alternative 6 are shown on Figure 9.

Evaluation/Comparison of Alternatives

Summary of the Preferred Alternative

The preferred alternative by Hill AFB for OU 8 is On-Base Alternative 3 and Off-Base Alternative 5. The components of the preferred alternative are illustrated in Figure 10.

The objective of On-Base Alternative 3 is to remediate contaminated groundwater within a reasonable timeframe through monitored natural attenuation. This alternative will prohibit potential use of shallow contaminated groundwater on Base through the implementation of institutional controls. Further, this alternative also prevents further migration of contaminants from on-Base sources to off-Base areas through the continued operation of the OU 8 IRA Hydraulic Containment System.

The objective of Off-Base Alternative 5 is to remediate contaminated groundwater within a reasonable timeframe using extraction wells to remove contaminated groundwater. Further, this alternative will prohibit potential use of shallow contaminated groundwater through the implementation of institutional controls.

The following is a summary of the specific components, costs, and restoration time estimates for the preferred alternative.

On-Base Alternative 3

- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Continued operation of the OU 8 IRA Hydraulic Containment System
- Groundwater monitoring including monitoring of parameters to verify/confirm natural attenuation
- Capital Costs: $0
- O&M Costs (annual): $310,715
- Total Present Worth Costs: $5,480,000
- Estimated Restoration Timeframe: 30-plus years

Off-Base Alternative 5

- Installation and operation of 18 groundwater extraction wells in two areas to extract contaminated groundwater off Base
- Implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Groundwater monitoring
- Capital Costs: $2,332,000
- O&M Costs (annual): $434,000
- Total Present Worth Costs: $10,800,000
- Estimated Restoration Timeframe: 65 years

Alternative Evaluation Criteria

The remedial action alternatives for OU 8 are required by the NCP to be compared against nine evaluation criteria to evaluate the relative performance of each alternative. In assessing the remedial action alternatives, any remedy to be implemented must meet criteria 1 and 2, which are called “threshold criteria.” The next five criteria are called “balancing criteria.” This is where the advantages and disadvantages of each alternative are compared. The objectives of the comparison are to assess the relative advantages and disadvantages of each alternative and to identify the key trade-offs that must be balanced in selecting a preferred alternative. The nine criteria are described in the table below:

Evaluation Criteria	
1	**Protectiveness:** Will this alternative protect human health and the environment against any unacceptable risk?
2	**Compliance with Applicable or Relevant and Appropriate Requirements (ARARs):** Does the alternative comply with all existing laws and regulations? Any chosen alternative must meet this criterion, or provide grounds for obtaining a waiver.
3	**Long-term Effectiveness and Permanence:** Will the alternative provide a permanent, long-term solution to the problem?
4	**Reduction in Toxicity, Mobility and Volume through Treatment:** Will the alternative reduce the toxicity and the volume of the contaminants, or reduce their ability to migrate further through treatment?
5	**Short-term Effectiveness:** May be better defined as “short-term impact.” What impact would implementing the alternative have on the community and workers?
6	**Implementability:** Can the alternative be practically and successfully implemented, considering any technical and administrative issues that may need to be addressed?
7	**Cost:** What is the cost to design, build, and maintain the system for 30 years?
8	**State Acceptance**: Whether the UDEQ agrees with, opposes, or has no comment on the alternative.
9	**Community Acceptance:** Determines the community’s preferences for, or concerns about, the alternative.

The last two criteria are judged during and following regulatory and public review of this Proposed Plan.

Comparative Analysis of On-Base Alternatives

A graphical summary of the comparative analysis of the on-Base alternatives is presented in Table 2. The following paragraphs present brief discussions of the comparative analysis of the criteria.

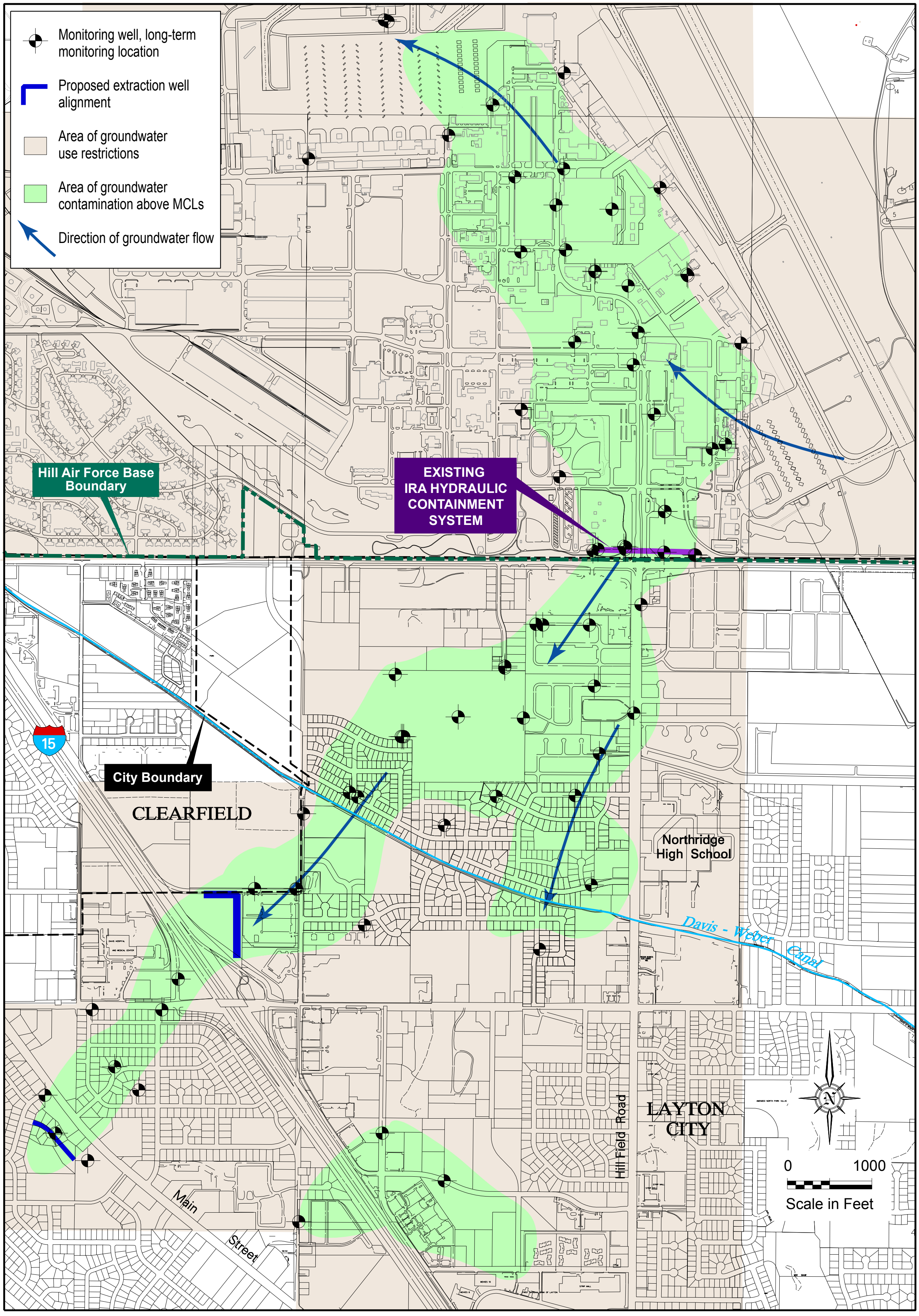

Figure 10. Features of the Preferred Alternative (On-Base Alternative 3 and Off-Base Alternative 5).

Overall Protection of Human Health and the Environment. On-Base Alternative 1 will provide protectiveness because the plume is predicted to remain within the Base boundaries. On-Base Alternatives 2 and 3 are more protective because institutional controls such as groundwater use restrictions are employed to prevent groundwater use. On-Base Alternative 4 provides more overall protectiveness because extraction of contaminated groundwater from the plume will speed the removal of the contaminants within the on-Base plume, thereby more quickly reducing the level of future risk associated with the groundwater use. On-Base Alternative 5 provides the most protectiveness by extraction of contaminated groundwater over a larger area of the plume, which will remove more contaminant mass over a wider area within the on-Base groundwater plume than On-Base Alternative 4. Groundwater contamination will remain in localized areas for all on-Base alternatives as long as or if ongoing sources remain. While many source areas have been addressed under OU 3 and OU 7, the operational history of the Industrial Complex at Hill AFB is fairly complex, and modeling groundwater flow with some continuing source presents the most conservative approach.

Compliance with ARARs. The ability to comply with groundwater quality ARARs is the main differentiator between alternatives. On-Base Alternative 1 does not meet ARARs because risk associated with residual groundwater contamination will remain and this alternative does not include institutional controls necessary to manage that risk, as required by state rule R315-101. All other on-Base alternatives comply with this requirement. Compliance with the non-degradation rule is achieved by all alternatives. Although future limited migration of the plume will initially violate the state non-degradation rule (UAC R315-101-3), groundwater modeling predicts that within 30 years the areal extent of the plume will be smaller than as presently shown under all on-Base alternatives. Based on modeling results, On-Base Alternatives 1, 2, and 3 will comply with the chemical specific ARARs over much of the current plume area within 30 years. Because continuing sources of contaminants are assumed in the on-Base computer model, localized areas of contamination above MCLs remain indefinitely. On-Base Alternative 4 reduces contaminant concentrations to below ARARs over much of the current extent of the plume slightly faster (by approximately 5 years, 25 years from remedy initiation) than On-Base Alternatives 1, 2, and 3 through active mass removal. On-Base Alternative 5 reduces contaminant concentrations sooner than all preceding alternatives (i.e., by approximately 10 years, 20 years from remedy initiation) through active extraction and treatment of groundwater across the on-Base plume. Due to the potential presence of continuing sources in all on-Base alternatives, the results of future monitoring should be used to determine if it is necessary to implement the non-MCL level cleanup provisions of UAC R315-101 and R311-211 (and federal equivalents) or apply for a technical impracticability waiver. The need for invoking these provisions would be evaluated based on the results of future monitoring and the statutory 5-year remedial action reviews.

Long-Term Effectiveness and Permanence. On-Base Alternative 1 will provide long-term effectiveness and permanence because the plume is predicted to remain within Hill AFB boundaries. All on-Base alternatives include continued operation of the OU 8 IRA Hydraulic Containment System. On-Base Alternatives 2 and 3 provide more long-term effectiveness and permanence than Alternative 1 through implementation of institutional controls, which prohibit the use of groundwater. Application of institutional controls would be required as long as ongoing sources remain and thus contaminant concentrations remain above MCLs in localized areas. On-Base Alternative 4 provides more long-term effectiveness and permanence than On-Base Alternatives 1, 2, and 3 through removal of contaminant mass in limited areas, while On-Base Alternative 5 provides the most long-term effectiveness and permanence through removal of contaminant mass over a greater area.

Table 2. Summary of On-Base Alternatives.

	Threshold Criteria		Balancing Criteria					
On-Base Alternatives	1 Protectiveness	2 Compliance with ARARs	3 Long-Term Effectiveness and Permanence	4 Reduction in Toxicity, Mobility, Volume	5 Short-term Effectiveness	6 Implementability	7 Cost ($mil)	Estimated Time to Cleanup
Alternative 1 No Further Action	Meets Criteria	Does Not Meet Criteria	Meets Criteria	Does Not Meet Criteria	Meets Criteria	Meets Criteria	4.6	30-plus years
Alternative 2: Limited Action	Meets Criteria	Meets Criteria	Meets Criteria	Does Not Meet Criteria	Meets Criteria	Meets Criteria	4.6	30-plus years
Alternative 3 (Preferred) Monitored Natural Attenuation	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria	5.5	30-plus years
Alternative 4 Pump and Treat Option 1	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria	May Meet Criteria	May Meet Criteria	11	30-plus years
Alternative 5 Pump and Treat Option 2	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria	May Meet Criteria	May Meet Criteria	15	30-plus years

Meets Criteria / May Meet Criteria / Does Not Meet Criteria

Reduction of Toxicity, Mobility, and Volume Through Treatment. The on-Base alternatives rank similarly with respect to reduction of toxicity, mobility, and volume. That is, the more active the treatment, the more reduction of toxicity, mobility and volume is obtained. On-Base Alternatives 1, 2, and 3 are similar in providing minimal reduction in toxicity, mobility, and volume through natural attenuation processes. However only On-Base Alternative 3 monitors these processes to confirm and document reductions in toxicity, mobility, and volume. On-Base Alternative 4 provides more reduction in toxicity, mobility, and volume using active extraction and treatment, while On-Base Alternative 5 provides the most reduction in toxicity, mobility, and volume through a larger extraction system and subsequent treatment.

Short-Term Effectiveness. On Base, a borderline cancer risk to workers from inhalation of contaminants exists only in the Berman Pond area, so in general, On-Base Alternatives 1 through 3 present little short-term risks to the community or workers. On-Base Alternatives 4 and 5 may present some significant short-term risks during construction of the numerous extraction wells and associated piping in high traffic and heavily used areas of Hill AFB. These short-term risks may be managed by following standard health and safety practices, proper construction safety measures, and by implementing appropriate traffic plans.

Implementability. On-Base Alternatives 1 through 3 are easily implemented, both technically and administratively. Because the extraction wells (and associated piping) need to be installed in high traffic, high utility density, and heavily used areas, On-Base Alternatives 4 and 5 present significant technical challenges related to construction and long-term O&M. Many of the wells will be installed in or near the edges of streets, which will make it difficult to perform routine O&M activities at these wells.
Also, many wells will likely be installed where security issues may prevent time critical access for performance of O&M activities.

Cost. The costs for Alternatives 1 and 2 are essentially the same, with the difference being in the costs associated with the implementation of institutional controls. However, most of the cost for these alternatives is associated with groundwater monitoring and with continued O&M of the existing OU 8 IRA Hydraulic Containment System. The cost for Alternative 3 is higher than for Alternatives 1 and 2, reflecting increased costs associated with implementation of Monitored Natural Attenuation. The costs for On-Base Alternatives 4 and 5 are significantly higher than other alternatives, due to the costs associated with installation, operation, maintenance, and sampling of the groundwater extraction, treatment, and discharge systems. Costs for On-Base Alternative 5 are greater than On-Base Alternative 4 because more wells and greater treatment volumes are required for this alternative.

Comparative Analysis of Off-Base Alternatives

A graphical summary of the comparative analysis of the off-Base alternatives is presented in Table 3. The following paragraphs present brief discussions of the comparative analysis of the criteria.

Overall Protection of Human Health and the Environment. Off-Base Alternative 1 is the least protective of the off-Base alternatives because no action is taken to actively reduce contaminant concentrations in off-Base groundwater, nor are institutional controls in place to prevent use of contaminated groundwater. Currently, existing contamination in three localized areas poses a borderline cancer risk to residents inhaling contaminants volatilizing from shallow groundwater. Significant future risks would exist if contaminated groundwater is used for drinking water. Alternatives 2 through 6 include institutional controls that prohibit groundwater use, and they are more protective than Off-Base Alternative 1. Off-Base Alternatives 4 and 5 provide more protectiveness than Off-Base Alternatives 1, 2, and 3 by controlling migration of high concentration groundwater and preventing human contact with groundwater. Off-Base Alternative 4 may provide more protectiveness than Off-Base

Table 3. Summary of Off-Base Alternatives.

	Threshold Criteria		Balancing Criteria					
Off-Base Alternatives	1 Protectiveness	2 Compliance with ARARs	3 Long-Term Effectiveness and Permanence	4 Reduction in Toxicity, Mobility, Volume	5 Short-term Effectiveness	6 Implementability	7 Cost ($mil)	Estimated Time to Cleanup
Alternative 1 No Further Action	May Meet	Does Not Meet	Does Not Meet	Does Not Meet	May Meet	Meets	2.06	150 years
Alternative 2: Limited Action	Meets	Does Not Meet	Meets	Does Not Meet	May Meet	Meets	2.08	150 years
Alternative 3 Monitored Natural Attenuation	Meets	Does Not Meet	Meets	Does Not Meet	May Meet	Meets	3.03	150 years
Alternative 4 Pump and Treat Option 1	Meets	Meets	Meets	Meets	May Meet	May Meet	17.2	65 years
Alternative 5 (Preferred) Pump and Treat Option 2	Meets	Meets	Meets	Meets	May Meet	May Meet	10.8	65 years
Alternative 6 Pump and Treat Option 3	Meets	Meets	Meets	Meets	May Meet	May Meet	22.6	60 years

Meets Criteria   May Meet Criteria   Does Not Meet Criteria

Alternative 5 due to active extraction of both the eastern and western legs of the off-Base plume. Relative to the other alternatives, Off-Base Alternative 6 provides the most protectiveness by actively extracting contaminants across a larger area.

Compliance with ARARs. The ability to comply with groundwater quality and state non-degradation rule ARARs is the main differentiator between off-Base alternatives. Off-Base Alternative 1 does not meet ARARs because risk associated with groundwater contamination will remain and this alternative does not include institutional controls necessary to manage that risk, as required by state rule R315-101. All other off-Base alternatives comply with this requirement. Off-Base Alternatives 1, 2, and 3 would not comply with the chemical specific ARARs within 150 years as no action is taken to reduce contaminant concentrations in groundwater, specifically with respect to 1,2-DCA. In addition, Off-Base Alternatives 1 through 3 do not comply with the non-degradation rule ARAR because the off-Base plume will continue to migrate, particularly the 1,2-DCA plume. Off-Base Alternatives 4 and 5 will achieve compliance with ARARs within 65 years through active extraction. Off-Base Alternative 6 would comply with ARARs in approximately 60 years through active extraction of groundwater across the off-Base plume. There are no known sources in the off-Base area and known sources on Base have been controlled by remedial actions already performed under RODs for OUs 3 and 7, and the inclusion of the OU 8 IRA Hydraulic Containment System in all of the on-Base remedial alternatives.

Long-Term Effectiveness and Permanence. Off-Base Alternatives 1, 2, and 3 do not provide long-term effectiveness and permanence as no action is taken to reduce contaminant concentrations. Application of institutional controls in Off-Base Alternatives 2 and 3 would prevent future contact with contaminated groundwater, but existing and future risks to residents from inhalation of contaminants that volatilize from shallow groundwater would remain for some time. Off-Base Alternatives 4 and 5 may provide long-term effectiveness and permanence, but long-term operation of the extraction systems would be required. Further, contaminant concentrations would decrease slowly, with risk levels dropping concurrently. Implementation of Off-Base Alternative 5 would require active monitoring of the eastern leg of the plume to assure that contaminant concentrations are dropping as predicted by the computer model. As with other criteria, Off-Base Alternative 6 provides the most long-term effectiveness and permanence through active extraction of the off-Base plume.

Reduction of Toxicity, Mobility, and Volume Through Treatment. For the reasons described for long-term effectiveness and permanence, the off-Base alternatives rank similarly with respect to reduction of toxicity, mobility, and volume. The more active the treatment, the more reduction of toxicity, mobility, and volume is obtained. Off-Base Alternatives 1, 2, and 3 reduce toxicity, mobility, and volume only through natural attenuation processes. However, only Off-Base Alternative 3 monitors these processes to confirm and document reductions in toxicity, mobility, and volume. Off-Base Alternative 4 provides more reduction in toxicity, mobility, and volume than Off-Base Alternative 5 through extraction of contaminated groundwater from both the eastern and western legs of the off-Base plume and subsequent treatment. Off-Base Alternative 6 provides the most reduction in toxicity, mobility, and volume through active extraction of contaminated groundwater throughout the off-Base plume and subsequent treatment of extracted water.

Short-Term Effectiveness. Off-Base, a borderline cancer risk to workers from inhalation of contaminants exists in three localized areas, but in general, Off-Base Alternatives 1 through 3 present little short-term risks to workers. Off-Base Alternatives 1 through 5 will have an ongoing borderline risk to the community as a result of inhalation of contaminant vapors from shallow groundwater until contaminant concentrations decrease. These risks are higher for Off-Base Alternatives 1 through 3, than for Off-Base Alternatives 4 through 6, due to longer clean-up times. Off-Base Alternatives 4, 5, and 6 presents some significant short-term risks to workers and residents during construction of the extraction wells and associated piping in residential areas off Base (particularly Alternative 6). These risks may be controlled, but not eliminated, through following standard health and safety practices, proper construction safety measures, and by implementing appropriate traffic plans.

Implementability. Off-Base Alternatives 1 through 3 are easily implemented, both technically and administratively. Because of the large number of wells (and associated piping) needing to be installed in residential and high traffic, heavily used areas, Off-Base Alternatives 4 and 5, and in particular, Off-Base Alternative 6 presents significant technical challenges related to construction and long-term O&M. Many of the wells will be installed in or near the edges of streets, which will make it difficult to perform routine O&M activities at these wells. Further, due to the large number of wells, O&M activities will be required relatively frequently.

Cost. The costs for Alternatives 1 and 2 are essentially the same, with the difference being in the costs associated with the implementation of institutional controls. However, most of the cost for these alternatives is associated with groundwater monitoring. The cost for Alternative 3 is higher than for Off-Base Alternatives 1 and 2, reflecting increased costs associated with implementation of monitored natural attenuation. Costs for Off-Base Alternative 4 are higher than for Off-Base Alternatives 1 through 3 due to the costs associated with implementation of active extraction of the TCE plumes and 1,2-DCA plume. Costs are less for Off-Base Alternative 5 compared to Off-Base Alternative 4 due to the decreased number of wells installed for extraction of only the western leg of the plume. Implementation of Off-Base Alternative 6 increases the cost of the remedy significantly due to the large number of wells required, associated piping, and treatment systems.

Impact of the Preferred Alternative on the Existing Environment

Air Quality

Construction-related impacts include dust and emissions from vehicles. These emissions are minor and can be managed using good construction practices, and therefore are not expected to have an effect on regional air quality. If air strippers are selected over direct discharge to the sanitary sewer for water treatment, some VOCs will be emitted to the atmosphere. Calculations of VOC emissions indicate that an air discharge collection and treatment system will not be necessary.

Surface Water, Groundwater, and Wetlands

No streams, rivers, or lakes exist within the OU 8 area. While there are several stormwater retention ponds and associated wetlands in the OU 8 area, there will be no impacts to these features as a result of implementation of the preferred alternative.

Vegetation

Implementation of the preferred alternative will result in minor clearing of vegetation. There are no threatened or endangered plant species in the area; therefore, a significant adverse impact on the local ecosystem is not expected. All disturbed areas will be revegetated using plants compatible with existing vegetation.

Wildlife

The OU 8 area is highly developed and does not provide critical or important habitats for any wildlife species, and no threatened or endangered species are known to inhabit the area.

Archeological Resources

There are no known cultural or archeological resources in the OU 8 area that could be affected by implementation of the preferred alternative. If previously unknown cultural resources are encountered during implementation of the preferred alternative, work will be halted and a qualified archeologist will assess the site.

Noise Levels

Major noise sources in the OU 8 area include aircraft flight and ground operations, vehicular traffic, and other human activities. Remedial construction activities would generate additional noise for a short duration. Standard noise abatement measures will be implemented as appropriate.

Glossary of Terms and Acronyms

Administrative Record: The Administrative Record consists of all documents (including studies, plans, and reports) used in the decision-making process to select a remedial action.

Air Stripping: A cleanup process that removes volatile organic compounds from water by transferring the VOC compounds from a liquid state to a vapor state (i.e., volatilization).

Applicable or Relevant and Appropriate Requirements (ARARs): A State and/or Federal environmental regulation which is applicable to, or relevant and appropriate for, a particular site. ARARs must be considered when selecting remedial actions.

Baseline Risk Assessment: A study conducted as part of a remedial investigation that evaluates risks posed to human health and/or the environment as a result of exposure to contaminants present in various media (air, soil, groundwater) at a site.

Benzene: A colorless, volatile, highly flammable toxic liquid that is used as a solvent or as a constituent of fuels (e.g., gasoline, jet fuel, and diesel). Benzene is a known cancer-causing compound.

Capital Costs: Costs associated with initial installation and startup of the components of a selected remedy. These costs include labor and materials for extraction well installation, trenching and backfilling, equipment installation and startup, instrumentation, and preparation of the O&M plans.

Chlorinated Solvents: Solvents that contain chlorine atoms in their chemical structure. Chlorinated solvents detected at OU 8 include TCE, 1,2-DCA, 1,1,1-TCA, 1,1-DCE, Chlorobenzene, and others.

Chlorobenzene: A chlorinated solvent that is commonly used as a solvent for paint. Chlorobenzene is not a cancer-causing chemical.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A law (42 USC Sec.9601) passed in 1980 that established programs to identify hazardous waste sites, ensure cleanup, evaluate damages to natural resources, and create claims procedures for parties who clean up the sites. Commonly known as "Superfund", CERCLA was modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA).

1,2-Dichloroethane (1,2-DCA): A chemical used as a solvent that can also be produced in the environment from the gradual breakdown of another more complex chemical compound, such as 1,1,1-TCA. 1,2-DCA may cause cancer in humans.

1,1-Dichloroethene (1,1-DCE): A chemical produced in the environment from the gradual breakdown of another more complex chemical compound (such as TCE or PCE). 1,1-DCE may cause cancer in humans.

Exposure Pathways: Mechanisms through which humans, animals, or plants may come in contact with environmental contamination associated with a contaminated site.

Feasibility Study: The means of development and evaluation of remedial action alternatives.

Hexavalent Chromium: A metallic contaminant commonly found in industrial discharge from metal-plating processes.

Industrial Wastewater Treatment Plant (IWTP): A wastewater treatment facility located in the southern part of Hill AFB where chemicals are removed from wastewater generated by the base. Following treatment, the wastewater is discharged to the North Davis County Sewer District's (NDCSD) sanitary sewer system.

Institutional Controls: Institutional barriers such as regulatory restrictions, water rights restrictions, and other limits on use of Air Force property, which limit access to contaminated areas or prohibit use of contaminated groundwater.

Interim Remedial Action (IRA): Early actions taken to eliminate, reduce, or control the hazards posed by a site prior to selection and implementation of the final remedy.

Lead: A bluish-white metallic element used in containers, solder, bullets, and paint.

Maximum Contaminant Limits (MCLs): Maximum concentration of a particular chemical allowed in drinking water at the tap, as promulgated under the Safe Drinking Water Act.

Micrograms per Liter (μg/L): Equivalent to parts per billion, a typical unit used to measure the concentrations of volatile organic compounds in groundwater.

Monitored Natural Attenuation (MNA): Pertains to the reliance on naturally occurring physical, chemical, and/or biological processes to achieve site-specific remedial objectives or cleanup goals within a time frame that is reasonable compared to other alternatives. Under favorable conditions, these processes act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These processes are "monitored" through sampling and analysis programs to determine the extent to which the site is remediated.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): This federal plan implements the requirements of CERCLA. It provides the organizational structure and procedures for addressing federal Superfund sites.

National Priorities List: EPA's list of top priority hazardous substance sites which are required to be investigated and, where necessary, remediated in accordance with the CERCLA.

Nickel: A silvery metallic element used in corrosion-resistant surfaces and batteries and in the U.S. 5-cent coin.

Operable Unit (OU): A distinct part of an entire cleanup action. An operable unit may be established based on a particular type of contamination, contaminated media (e.g., soil, groundwater), source of contamination, and/or geographical location.

Operation and Maintenance (O&M): Post-construction activities to ensure that the remedial system is functioning properly.

Preferred Alternative: The alternative proposed by the lead agency (in this case Hill AFB) that best fits the cleanup objectives.

Plume: A volume of groundwater that is believed to be contaminated. The plume in this case is defined by the area within which groundwater contamination exceeds State or federally mandated MCLs.

Publicly-Owned Treatment Works (POTW) A wastewater treatment plant owned and operated by a local public entity (e.g., North Davis County Sewer District).

Proposed Plan: A document prepared by the lead agency (Hill AFB in this case) and made available to the public to inform the public about alternatives considered to remediate a contaminated site. This document also describes the preferred alternative(s) for site remediation.

Record of Decision (ROD): A public document that explains the selected remedy for a Superfund site. This document also includes the lead agency's rationale for making the selection.

Remedial Action (RA): Actions taken to eliminate, reduce, or control the hazards posed by a site.

Remedial Investigation (RI): The process established by the EPA for characterizing the nature and extent of contamination and the risks posed by the presence of that contamination.

Shallow Groundwater: The first continuous occurrence of underground water contained in sand, soil, rock, or gravel particles beneath the land surface. The shallow groundwater depth beneath OU 8 varies from 2 feet below ground surface at the toe of the off-Base TCE plume to 180 feet below ground surface at the northern extent of the on-Base plume.

Superfund Amendment and Reauthorization Act (SARA): A law passed in 1986 that amended the CERCLA law of 1980.

Trichloroethene (TCE): A chlorinated hydrocarbon commonly used as a solvent or degreaser. At Hill AFB, TCE was used for cleaning aircraft parts. TCE is no longer used at Hill AFB. TCE is a known cancer-causing chemical.

1,1,1-Trichloroethane (1,1,1-TCA): A chlorinated hydrocarbon commonly used as a metal degreaser solvent. This chemical is not known to cause cancer in humans.

U.S. Environmental Protection Agency (EPA): The lead federal agency responsible for supervising the cleanup efforts at OU 8.

Utah Department of Environmental Quality (UDEQ): The lead state agency responsible for supervising the cleanup efforts at OU 8.

Utah Division of Water Rights (UDWR): A State of Utah agency that regulates appropriation and distribution of water in the state of Utah.

Volatile Organic Compounds (VOCs): Organic compounds that evaporate readily at room temperature.

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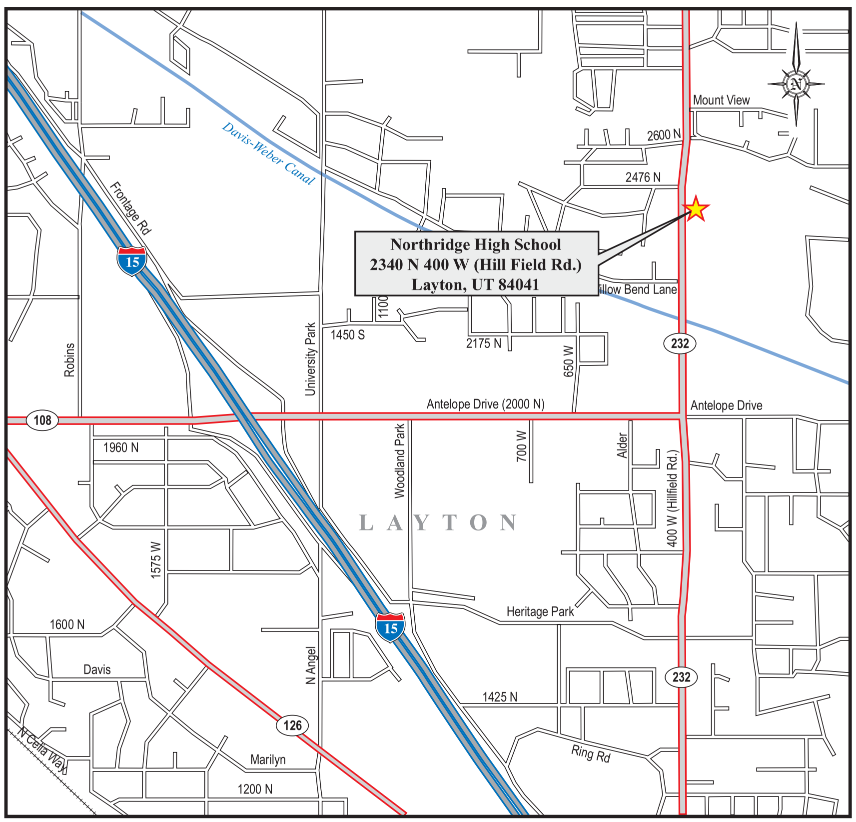

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