# 2.0 OVERVIEW OF TRAVIS AFB ENVIRONMENTAL PROGRAMS

## 2.1 Non-CERCLA Environmental Programs

In addition to Travis AFB's efforts to investigate and remediate sites under the CERCLA program, Travis AFB maintains an active environmental compliance program to comply with a wide variety of non-CERCLA environmental regulations. This section briefly discusses some of the more important non-CERCLA compliance programs.

### 2.1.1 Air Force Regulations and Management Action Plan

The Air Force has developed a parallel set of environmental regulations to the federal environmental regulations. These Air Force regulations are designed to ensure that federal requirements are implemented in an appropriate manner at Air Force installations. Air Force regulation AFI 32-7005 sets up Environmental Protection Committees to oversee management of all environmental programs. The following are examples of environmental compliance subject areas where the Air Force has specific environmental regulations designed to parallel federal environmental regulations:

- Environmental Restoration Program;
- Air Quality Compliance;
- Water Quality Compliance;
- Solid and Hazardous Waste Compliance;
- Storage Tank Compliance;
- Environmental Impact Analysis Process;
- Integrated Natural Resource Management;
- Cultural Resource Management; and

- Pollution Prevention Program.

The Management Action Plan (MAP) for Travis AFB (Parsons Engineering Science, 1996) summarizes the current status of the Travis AFB environmental restoration and associated compliance programs, and presents a comprehensive strategy for implementing response action necessary to protect human health and the environment. The Air Force produced the most recent version of the MAP in January 1997. The MAP is used by Travis AFB environmental staff and Air Force headquarters to direct and monitor environmental response action and to schedule activities needed to resolve technical, administrative, and operational issues.

The Travis AFB Base General Plan, known as the Base Comprehensive Plan, a companion document to the MAP, provides an organized, systematic, and comprehensive approach to current and future planning and development. The Base General Plan is a tool that addresses a multitude of installation requirements and assists in the long-range growth of the base, including natural resources, environmental protection, land use, airfield operation, utilities, transportation, and architectural compatibility. Of particular importance is its role in environmental protection. The Plan requires addressing proper hazardous waste management and recognizing CERCLA related activities, through proper land use at Travis AFB.

### 2.1.2 Resource Conservation Recovery Act and Hazardous Waste Management Program

Travis AFB operates as a generator and facility for hazardous waste management under the Resource Conservation Recovery Act (RCRA) and State of California hazardous waste management programs. Travis AFB received a Part B hazardous waste facility storage permit from the California Department of Toxic Substances Control Division (DTSC) and the United States Environmental Protection Agency (U.S. EPA) on 5 March 1993.

### 2.1.3 Petroleum-Only Contaminated Sites Program (POCOS)

Travis AFB has a POCOS program designed to manage sites on base whose contamination is limited to petroleum-related constituents. Travis AFB and the agencies agreed to remove the POCOS from the Travis AFB CERCLA program because the law excludes petroleum as a CERCLA contaminant. The Air Force will address petroleum contamination under CERCLA if it is commingled with CERCLA contaminants.

POCOS are typically associated with surface and sub-surface releases from fuel spills, piping leaks, oil-water separators, or underground storage tanks (USTs). The POCOS program includes removal of leaking USTs and remediation of petroleum-only contaminated soil and groundwater. The agencies and the Air Force delisted the North/South Gas Station site from the CERCLA program; the site is now a POCOS. The North/South Gas Station is also a demonstration site for the Lawrence Livermore National Laboratory for a natural attenuation study. The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) is the lead oversight agency for this program.

### 2.1.4 Stormwater Discharge Permit

Travis AFB monitors stormwater outfalls in compliance with its state of California National Pollution Discharge Elimination System (NPDES) permit. The ongoing monitoring program was developed in 1992. The Air Force conducts sampling and reporting according to the permit requirements. The SFBRWQCB is the lead oversight agency for stormwater discharges.

### 2.1.5 Pollution Prevention Program

Travis AFB has an active Pollution Prevention Program which strives to reduce the generation of wastes through a hierarchy of actions. The actions range from the most preferred choice of source reduction, to recycling, treatment, and finally disposal as a last resort. The Pollution Prevention MAP (P2 MAP) defines the framework to accomplish these actions. The plan analyzes all processes generating hazardous waste streams and performs opportunity assessments of potential pollution prevention options to reduce the volume and/or toxicity of generated wastes. This program includes minimizing wastes generated by sampling activities in the IRP.

## 2.2 CERCLA Environmental Programs

This section summarizes the basic steps of the CERCLA process in Section 2.2.1. The following section, Section 2.2.2, then discusses how the Air Force has implemented the CERCLA process basewide at Travis AFB. Finally, Section 2.2.3 discusses what CERCLA activities have been, and will be, performed within the NEWIOU.

### 2.2.1 CERCLA Process

CERCLA, passed in 1980, and amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, was designed to establish a program to remediate sites contaminated with hazardous constituents to protect public health and the environment.

#### 2.2.1.1 General CERCLA Process, Remedial Investigation/Feasibility Study/Record of Decision/Proposed Plan/Remedial Design/Remedial Action

CERCLA established a series of steps designed to investigate contamination at sites and develop and implement appropriate remedial actions at these sites. The first key step is the RI. The RI serves as the mechanism for collecting data to characterize site conditions, to determine the nature of the waste, and to assess risk to human health and the environment. The Air Force generally collects data in several stages, with initial data collection efforts usually limited to developing a general understanding of the site. As the Air Force achieves a basic understanding of site characteristics, subsequent data collection efforts focus on filling identified gaps in the understanding of site characteristics and gathering information necessary to evaluate remedial alternatives.

The FS serves as the mechanism for the development, screening, and detailed evaluation of alternative remedial action. The FS consists of developing and screening of potential technologies for treatment, containment, or disposal of contaminated media. The Air Force then consolidates technologies into remedial alternatives. The Air Force then evaluates each of the alternatives against nine CERCLA criteria within the categories of effectiveness, cost, and implementability.

Following completion of the RI/FS process, the Air Force writes the Proposed Plan (PP), which outlines the preferred alternative for each site(s). This document allows the public an opportunity to comment on the preferred alternative and to gain an understanding of what alternative is proposed for implementation and why the proposed alternative best fits the problems at the site. After the public comment period, the Record of Decision (ROD) authorizes the selected alternative. The ROD summarizes all CERCLA activities at the site and selects the final remedial alternative. The ROD, which is signed by Travis AFB and the regulatory agencies, formally documents concurrence of the selected alternative. A final ROD specifies the final remedial alternative and establishes cleanup levels. An Interim ROD (IROD) does not specify final cleanup levels or/and the final selected alternative. IRODs are designed to quickly implement remedial actions to reduce contamination, reduce risk, and/or gather information that can be used to adjust the approach down the road as needed to ensure protectiveness.

The remedial design/remedial action (RD/RA) process documents all activities after the approval of the ROD or IROD, related to implementation of the selected alternative. The RD specifies the engineering design of the alternative in much more detail than was presented in the ROD or PP. The RA is the construction and operation of the selected alternatives specified in the ROD and RD. The Air Force will submit a schedule for the RD/RA to the regulatory agencies twenty-one days after the ROD or IROD is signed. The RD/RA schedule is described in Section 5.4.

### 2.2.2 CERCLA Activities at Travis AFB

The Air Force, under the Installation Restoration Program (IRP), began an effort to identify contaminated sites at Travis AFB in 1983. (The IRP is the Air Force program to address CERCLA sites at bases.) After completing the Records Search and a Phase II study to confirm problem areas, Travis AFB developed an integrated IRP Work Plan in 1986. The U.S. EPA placed Travis AFB on the National Priority List in 1989. In 1993, the Air Force divided the site into four specific OUs: the NOU, the EIOU, the WIOU, and the WABOU (Figure 1-2). The Air Force made this division into separate OUs because each OU has different types of contaminant sources (e.g., landfills in the NOU), contaminant types, and contaminated media (e.g., storm drains in the WIOU and EIOU). Also, the very large geographic size of Travis AFB necessitated that the contaminated areas be separated into OUs for efficiency and to focus the separate RIs. The Air Force combined the NOU, EIOU, and WIOU into one FS to be more cost effective. The FS for the NEWIOU is presented in the *North, East, and West Industrial Operable Unit Feasibility Study*, (Radian, 1996a).

The Air Force has decided to prepare an IROD for NEWIOU sites with contaminated groundwater (see Table 2-1) rather than a final ROD in order to speed up the site cleanup. This IROD establishes a five-year interim period after which a final ROD will establish the final remedial actions and final cleanup goals. The Air Force will publish a public notice and hold a public comment period before the ROD is finalized and approved by the regulatory agencies. The Air Force will prepare a separate final ROD for soil, sediment, and surface water in the NEWIOU later.

# Table 2-1

## Description of NEWIOU IRP Sites with Groundwater Contamination

| Operable Unit | IRP Site | Activities Leading to Current Contamination |
|---|---|---|
| NOU | LF006 | Landfill 1 was a general refuse landfill that used burn and fill disposal methods from 1943 through 1950. |
| | LF007 | Landfill 2 (Areas B, C, and D) was a general refuse landfill that used trench and fill methods from 1950 to 1973. |
| EIOU | FT004 | Fire Training Area 3. The Air Force used this area for fire fighting training exercises which burned waste fuels, oils, and solvents on the open ground. The Air Force used the area from 1953 until 1962, reportedly. |
| | FT005 | Fire Training Area 4. The Air Force used this area for fire fighting training exercises from 1962 through 1987. Throughout the 1960s, waste fuels, oils, and solvents were burned. From the early 1970s, the Air Force used only waste fuels for training. |
| | SS015 | Solvent Spill Area and Facilities 550 and 552. Solvent stripping of aircraft parts, aircraft maintenance and repair, oil/water separator activities, and hazardous waste accumulation occurred in these areas. The primary chemicals used in these facilities include thinners, methyl ethyl ketone, resins, and emulsifiers. The Air Force chemically stripped radomes of paint from 1964 to 1980 near Facility 552. |
| | SS016 | Oil Spill Area (OSA), Facilities 11, 13/14, 18, 20, 42/1941, 139/144, and selected sections of Storm Sewer Right of Way. Oil spills, degreasing operations, leaking oil/water separators, equipment maintenance and repair, aircraft washing, hazardous waste storage, vehicle maintenance, storm water run-off, and a wash rack are the principal contamination sources in these areas. Chemicals handled include lubricating oils, hydraulic fluid, solvents, and water containing solutions of these chemicals. The Air Force used the OSA from the 1940s through the 1980s. The Air Force used most of the facilities from the 1940s up to the present day. |
| | SS029 | Monitoring Well (MW) 329 Area. Unknown past activities contaminated the groundwater with trichloroethene (TCE). |
| | SS030 | MW-269 Area. Past practices near Facility 1125 (a radar facility) may have released TCE to the subsurface at an unknown time in the past. Possible sources include a leach field and/or surface disposal of TCE. |
| | SD031 | Facility 1205. Maintenance and repair of diesel powered generators, wash rack activities, and oil/water separator leaks contributed to contamination at this site. Aerial photographs suggest that the Air Force may have used the area for aircraft maintenance. The facility has handled oils, antifreeze, and solvents and has been in use from 1957 to the present. |
| | ST032 | Areas MW-107 and MW-246. Past fuel line leaks have contaminated the subsurface with fuel. |

# Table 2-1

## Description of NEWIOU IRP Sites with Groundwater Contamination (Continued)

| Operable Unit | IRP Site | Activities Leading to Current Contamination |
|---|---|---|
| WIOU | SD033 | Storm Sewer II, Facilities 810 and 1917, South Gate Area, and West Branch of Union Creek. The Air Force used these areas to handle storm water runoff, fuel transport, aircraft maintenance, and aircraft washdown including wash racks and oil/water separators. Chemicals used in these areas include fuels, lubricating oil, hydraulic fluids, chlorinated solvents, and soap solutions. The Air Force constructed Facility 1917 in 1956, and the facility is no longer in use. Facility 810 was constructed in 1955 and is currently used for aircraft maintenance. |
| | SD034 | Facility 811. An aircraft wash rack with oil/water separator and overflow pond have contributed to groundwater contamination at this site. Chemicals used at this facility include acids, solvents, antifreeze and the Stoddard solvent PD-680. The Air Force constructed this facility in 1979, and it is still in use. |
| | SS035 | Facility 818/819. Aircraft washing, painting and repair and oil/water separator activity have contributed to groundwater contamination at this site. Chemicals used at these facilities include lubricating oil, hydraulic fluids, PD-680 and water solutions of these chemicals. The Air Force constructed these facilities in 1970, and they are still in use. |
| | SD036 | Facilities 872/873/876. These facilities were constructed as multiple use shops which have included a wash rack and an oil/water separator. Current uses of the facilities include paint shops, electrical shops, landscape maintenance, paint mixing, and paint accumulation. Chemicals used include cleaning solutions, grease, degreasers, hydraulic oils and fluids, PD-680, pesticides, paints, and solvents. The Air Force constructed the shops in 1953, and they are still in use. |
| | SD037 | Sanitary Sewer System, Facilities 837, 838, 919, 977, 981, Area G Ramp, and Ragsdale/V Area. These facilities include handling of domestic and industrial waste water, aircraft maintenance, heavy equipment maintenance, air cargo, vehicle washing, fuel transport, and waste accumulation. Chemicals used and handled in these areas include wastewater, oils, hydraulic fluids, fuels, transformer fluids, and chlorinated solvents. The Air Force began operating these facilities in the 1940s and continue to the present day. |

An IROD for groundwater will allow interim remedial actions to begin quickly without increased time necessary to negotiate final cleanup levels that would be required in a final ROD. Actions taken under an IROD will use interim remedial goals, which are not enforceable standards, but simply goals to use as tools for decision making. Travis AFB and the agencies will determine the IROD/ROD strategy for the WABOU at a later time. Actions taken under different RODs and IRODs need to be coordinated into an integrated approach. For example, treatment of contaminated groundwater at Site SD033 may result in improvements to surface water and sediment water quality in West Branch of Union Creek and therefore may affect remedial actions in the ROD for soil, sediment, and surface water for SD033.

#### 2.2.2.1 Removal Actions

Travis AFB has initiated expedited cleanups or removal actions in the NEWIOU to address contaminated groundwater in portions of sites. Information obtained from these removal actions has been used to help develop the interim remedial actions.

**The Tower Area Removal Action (TARA) and Oil Spill Area (OSA), SS016** – The TARA system, located within SS016, includes extraction wells, a carbon treatment system, and discharge to irrigation lines or the storm sewer. As described in the "Engineering Evaluation/Cost Analysis" (Radian, 1994), the Air Force designed and operated TARA to remove high concentrations of volatile organic compounds (VOCs) in the groundwater and also to protect workers during construction of a hydrant system near the tower. The system has removed over 190 pounds of contaminants since the system began operation in 1995.

TARA is the only groundwater extraction system now operating at Travis AFB. The Air Force expanded this extraction system under an Explanation of Significant Differences to the "TARA EE/CA and Action Memo" (Radian, 1996d) to include the OSA and treats approximately 90 gallons per minute. The treated water is used for landscape irrigation during the dry season and will continue to be operated.

**Jet Fuel Spill Area (JFSA), SS014** – The Air Force prepared an EE/CA and environmental assessment (Earth Technology, 1994), which included a public comment period. The action installed a treatment system in the southern part of the WIOU to remove fuel floating on top of the groundwater. The system recovered more than 4,800 gallons of fuel which was then recycled. This action is completed.

**Outfall III Treatment System** – The Air Force built a surface water treatment system for VOCs at Outfall III (part of SD001) in 1995. The system was built as a part of a Time Critical Removal Action (U.S. EPA, 1992) which used a liquid phase carbon system to remove TCE from surface water collected via the storm sewer system from the upstream industrial area. The system operated from June to September 1995 at a capacity of approximately 1,500 gallons per minute. The system discharged treated water to Union Creek. The system was shut down because TCE concentrations decreased after the TARA removal action was initiated. Operation of the TARA system (SS016) may have reduced infiltration of contaminated groundwater into the storm sewer system. Travis AFB does not anticipate the need to operate the system in the future due to continued operation and expansion of the extraction system at OSA (SS016).

#### 2.2.2.2 Treatability and Pilot Studies

**Monitoring Well (MW)-269 Area, SS030** – Actions at this site, located within SS030, included a 10-month small scale treatment feasibility study conducted by Weston in 1993/94 and a week-long 2-phase extraction test conducted by Radian in 1995. The objective of this extraction test was to develop data to design a system to remediate VOC-contaminated soil and groundwater. A Treatability Study is currently underway to investigate removal of off-base contamination and control migration.

**North/South Gas Station, ST018** – The Air Force, in cooperation with Lawrence Livermore National Laboratories (LLNL), is undertaking a natural attenuation study to investigate the rate and types of natural attenuation processes for contaminants at this site. This site is now managed under the POCOS program.

**SD036** – A natural attenuation study is being conducted by the Air Force Center for Environmental Excellence (AFCEE) at SD036 (Facilities 872, 873, and 876). The study will evaluate the feasibility of natural attenuation of chlorinated solvents using the technical protocol jointly developed by AFCEE and U.S. EPA. The study is being conducted according to the "Workplan For A Risk Based Remedial Action Assessment at Facilities 872, 873, and 876 (SD036)" (January 1997). The Air Force will use this natural attenuation study as a prototype for other natural attenuation evaluations at Travis AFB.

### 2.2.3 CERCLA Activities for Groundwater at NEWIOU

#### 2.2.3.1 Human Health Risk Assessments

The Air Force conducted human health risk assessments as an element of the RI process for each of the three OUs. These assessments evaluated the risks to human health from the constituents of concern. Each of the individual RIs include the assessments. Section 3.3 discusses the results of these assessments.

#### 2.2.3.2 Ecological Risk Assessments

The Air Force also completed ecological risk assessments (ERAs) for the OUs. Each of the OU ERAs evaluates specific sites for completed exposure pathways, defines contaminants of potential ecological concern (COPECs), defines assessment and measurement endpoints, defines critical toxicity values (CTVs), and compares analytical sample data to the site specific CTVs. Following the completion of the OU-specific ERAs, a document entitled "Final Comprehensive Basewide Ecological Risk Assessment - Tier 2: Screening Assessment" (CH2M HILL, 1996), designed to quantify the potential ecological risks to plants and animals on the Base using a basewide perspective, was completed. This document provides further information on ecological risk to help guide potential interim remedial actions. Section 3.3 of the Groundwater IROD presents more information on these ecological risk assessments.

#### 2.2.3.3 RI/FS Activities

The Air Force completed remedial investigations at the three OUs (NOU, EIOU, and WIOU). The final reports for the RIs are: *Remedial Investigation, North Operable Unit, Travis Air Force Base, California* (Radian, 1995b); *East Industrial Operable Unit Remedial Investigation, Travis AFB* (Weston, 1995a); and *Remedial Investigation, West Industrial Operable Unit, Travis Air Force Base, California* (Radian, 1996b). Details regarding the RIs can be found in these reports and are summarized in Section 3.0.

The findings of the three RIs indicate similar types of soil, groundwater, surface water, and sediment contamination in the three OUs. The Air Force combined the NOU, EIOU, and WIOU into one FS to be more cost effective. The FS for the NEWIOU is presented in the *North, East, and West Industrial Operable Unit Feasibility Study*, (Radian, 1996a). The FS is summarized in Section 4.0.

#### 2.2.3.4 Community Participation

Travis AFB conducts a comprehensive effort to inform the public and involve the community in the environmental decision-making process. Following are the highlights of the community relations activities taken by Travis AFB to date:

- **Federal Facilities Agreement (FFA).** The Air Force, U.S. EPA, California Department of Health Services (now Department of Toxic Substances Control), and SFBRWQCB have negotiated an interagency agreement, which includes requirements for community relations activities based on provisions in federal (and where applicable, state) statutes, regulations, and guidelines.

- **Restoration Advisory Board (RAB).** In 1994, Travis AFB established a RAB comprised of representatives of the community and the regulatory agencies. Through its quarterly meetings and its focus groups, the RAB has provided valuable input about community concerns regarding the Restoration Program. The Technical Document Review focus group has reviewed the draft of every major report and provided comments. The Relative Risk focus group has provided input on the project prioritization, and the Community Relations focus group is working to reach out for new community members. The RAB replaced the Technical Review Committee, which met periodically to review program progress.

- **Administrative Record/Information Repository.** The Air Force established an Administrative Record of Information, used to support Air Force decision making related to the IRP at Travis AFB. In addition, the Air Force established a public information repository for the relevant portion of the Administrative Record at the Vacaville Public Library.

- **Community Relations Plan (CRP).** The Air Force implemented the first Travis AFB CRP in 1991. The Air Force revised the CRP in 1995. The Travis AFB Remedial Project Manager (RPM) is currently implementing the CRP.

- **Mailing List.** A mailing list of all interested parties in the community is maintained by Travis AFB and updated regularly. The mailing list currently totals more than 1,300 names.

- **Fact Sheets and Newsletters.** The Air Force has been publishing fact sheets describing activities and milestones in the restoration program occasionally since 1993. Since 1995 the Air Force has published and mailed quarterly newsletters to everyone on the mailing list. The newsletters contain information about public participation, issues of potential concern to the public, and program updates. The RAB co-chairs also write columns in each newsletter.

Travis AFB has had a community relations program since 1990. Public review copies of the OU RIs were made available:

- July 1995 (NOU);
- October 1995 (EIOU); and
- February 1996 (WIOU).

The Air Force released the NEWIOU FS in September 1996. These documents are available to the public at the Information Repository in Vacaville. The Air Force mailed the PP to all parties on the Travis AFB mailing list, government officials, representatives of interested community groups, and members of the media.

The Air Force held a 30-day public comment period for the NEWIOU Groundwater Proposed Plan from 25 September 1996 through 24 October 1996. The Air Force held a public meeting on the evening of 17 October 1996 from 7:00 p.m. to 9:00 p.m. At this meeting, representatives from the Air Force, Cal-EPA/DTSC, the SFBRWQCB, and U.S. EPA answered questions about the groundwater contamination off-base. Questions and comments from the public and responses are included in Part III, the Responsiveness Summary.

#### 2.2.3.5 Remedial Design/Remedial Action

The RD/RA will include the design and implementation of all actions specified in the Groundwater IROD. The regulatory agencies will be involved in the approval and oversight of the design and construction of the interim remedial actions. Experience gained through implementation of the interim remedial actions will allow for technically and economically feasible long-term remedial options in the final ROD for groundwater at Travis AFB.

The Air Force will submit the RD/RA schedule for implementing the IROD twenty-one days after signing of the IROD in accordance with the FFA. The regulatory agencies will review and approve the RD/RA schedule, as well as all reports and actions specified in the RD/RA schedule. Section 5.4 presents the elements that will be included in the RD/RA schedule.

## 3.0 SUMMARY OF NEWIOU GROUNDWATER REMEDIAL INVESTIGATION

Section 3.1 summarizes the nature and extent of groundwater contamination in the NEWIOU determined during the three separate remedial investigations for the North, West Industrial, and East Industrial OUs. Section 3.2 presents a generalized conceptual model of contamination at Travis AFB. Section 3.3 summarizes the risk evaluations performed as part of the individual OU RIs. Section 3.4 discusses contaminants of concern, and the areas requiring response actions. A summary statement is included in Section 3.5.

### 3.1 Nature and Extent of Contamination

Table 2-1 describes IRP sites with groundwater contamination within the NEWIOU. The primary activities that generated waste at the base have been aircraft and vehicle fueling, maintenance and repair. Waste streams generated at the base include used oils, contaminated fuels, used hydraulic fluids, spent chlorinated and non-chlorinated solvents, and paint thinners. Fuel handling, fire protection training, and grounds maintenance also have generated additional waste streams. The Air Force has stopped the materials handling and disposal practices that resulted in the contamination. Travis AFB now follows environmentally safe practices and guidelines for the management and disposal of all hazardous materials and wastes.

In the past, Travis AFB disposed of some hazardous waste streams in landfills, to the land surface, and by burning during fire training exercises. Starting in the 1960s, Travis AFB collected these wastes for off-base recycling or disposal. Many of the facilities include wash racks that are used for cleaning parts or aircraft. Travis AFB treated the aqueous waste streams generated by these wash racks using oil/water separators, and discharged the streams to the storm and sanitary sewers. Leakage from these separators or sewers may have contributed to the groundwater contamination at the base. Travis AFB now enforces a no-discharge policy for any industrial wastes to the storm drain system, has rerouted all such discharges to the sanitary sewer, and complies with applicable district influent limitations.

Figure 3-1 shows the locations of the NEWIOU groundwater sites and the extent of groundwater contamination.

The discussion of nature and extent focuses on groundwater contamination unless the soil contamination at the site is relevant to the site description or to groundwater remediation. Appendix A provides a summary of the pertinent environmental information for each groundwater site in the NEWIOU including a history of the site, information on the nature and extent of contamination results of the FS evaluation, the site conditions that influence selection of a remedy, and the selected interim action, including rationale.

### 3.1.1 North Operable Unit

The remedial investigation conducted at the NOU includes two landfills that were recommended for further evaluation. Groundwater contamination was identified in three areas of LF007 (Landfill 2) and in two areas of LF006 (Landfill 1). The sites and areas are shown in Figure 3-2 and are:

- LF006 – Landfill 1, Area A and Area F;
- LF007B – Landfill 2, Area B;
- LF007C – Landfill 2, Area C; and
- LF007D – Landfill 2, Area D.

In general, LF006A, LF007B, and LF007C are similar in that each is part of two former landfills with low concentrations (less than 50 micrograms per liter [µg/L] trichloroethene [TCE] at LF006A and LF007C and less than 60 µg/L benzene at LF007B) of dissolved contaminants. At LF007D, VOC concentrations are less than 50 ppb except a result of 282 µg/L for chlorobenzene was detected. The groundwater contamination at LF006 is in two general areas. Sampling results identified total petroleum hydrocarbons (TPH) contamination in the northern

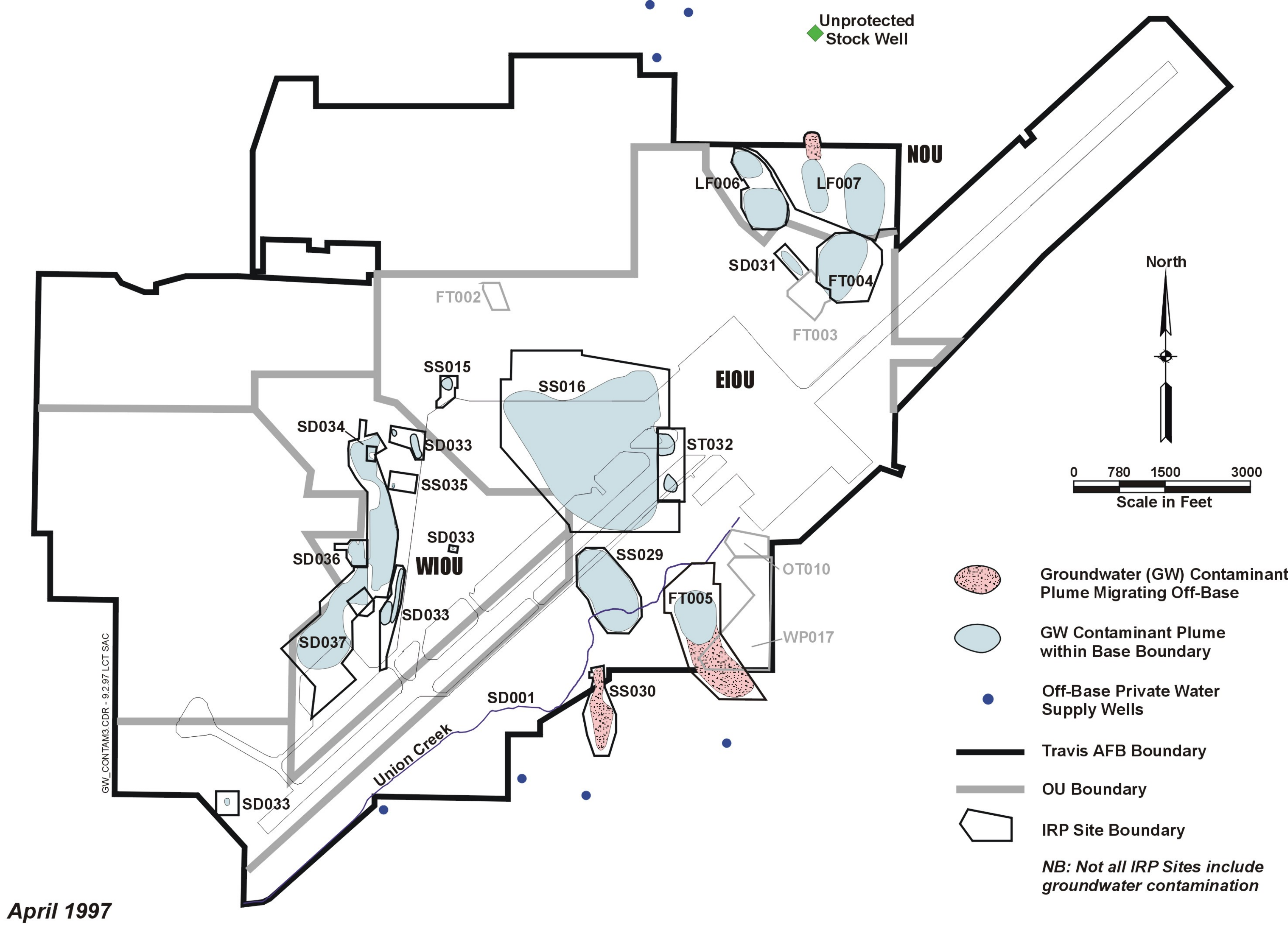


**Figure 3-1. NEWIOU Groundwater Sites and Extent of Groundwater Contamination**

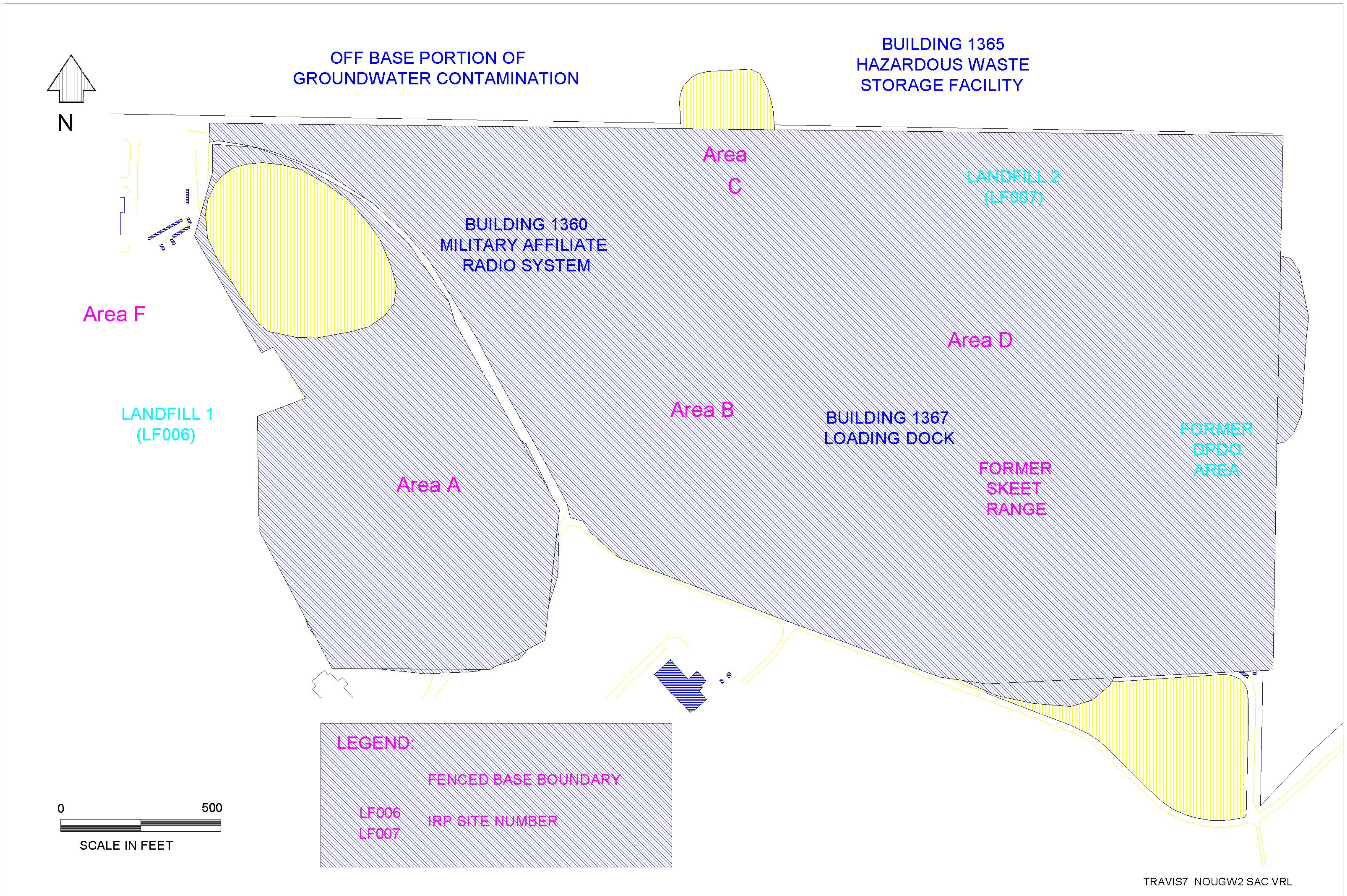


Figure 3-2. NOU Sites, and Areas with Groundwater Contamination

part of LF006 (Area F) at concentrations up to 140 µg/L. In the southern part of LF006 (LF006A), groundwater contaminants include VOCs such as TCE and TPH.

At LF007B and LF007D, other contaminants of concern (COCs) in the groundwater include semivolatile organic compounds (SVOCs), pesticides, and PCBs. Sampling results detected dioxins in groundwater samples at concentrations above the U.S. EPA Preliminary Remediation Goal (PRG) at one location in each area. The presence of PCBs and dioxins is consistent with the disposal histories of these landfills; Landfill 2 received unspecified industrial wastes. Sampling of downgradient wells in March 1996 indicate that the dioxins and PCBs have not migrated (Radian, 1995b).

At LF007C, groundwater contaminated with dissolved chlorinated solvents extends off-base no more than 200 feet based on cone penetrometer testing (CPT) data. Although the local groundwater flow directions in this area of the base are towards the south and southwest, local changes in the groundwater flow direction are caused by the irregular topography, near surface bedrock and poor surface drainage. Such a local flow variation is responsible for transporting the dissolved plume off-base to the north at LF007C.

Sampling results detected bis(2-ethylhexyl)phthalate in some groundwater samples collected at LF007B and LF007D. This compound is associated with plastics.

### 3.1.2 East Industrial Operable Unit

The remedial investigation conducted at the EIOU includes IRP sites that were recommended for further evaluation (Figure 3-3). These sites are:

- FT004 – Fire Training Area 3;
- FT005 – Fire Training Area 4;

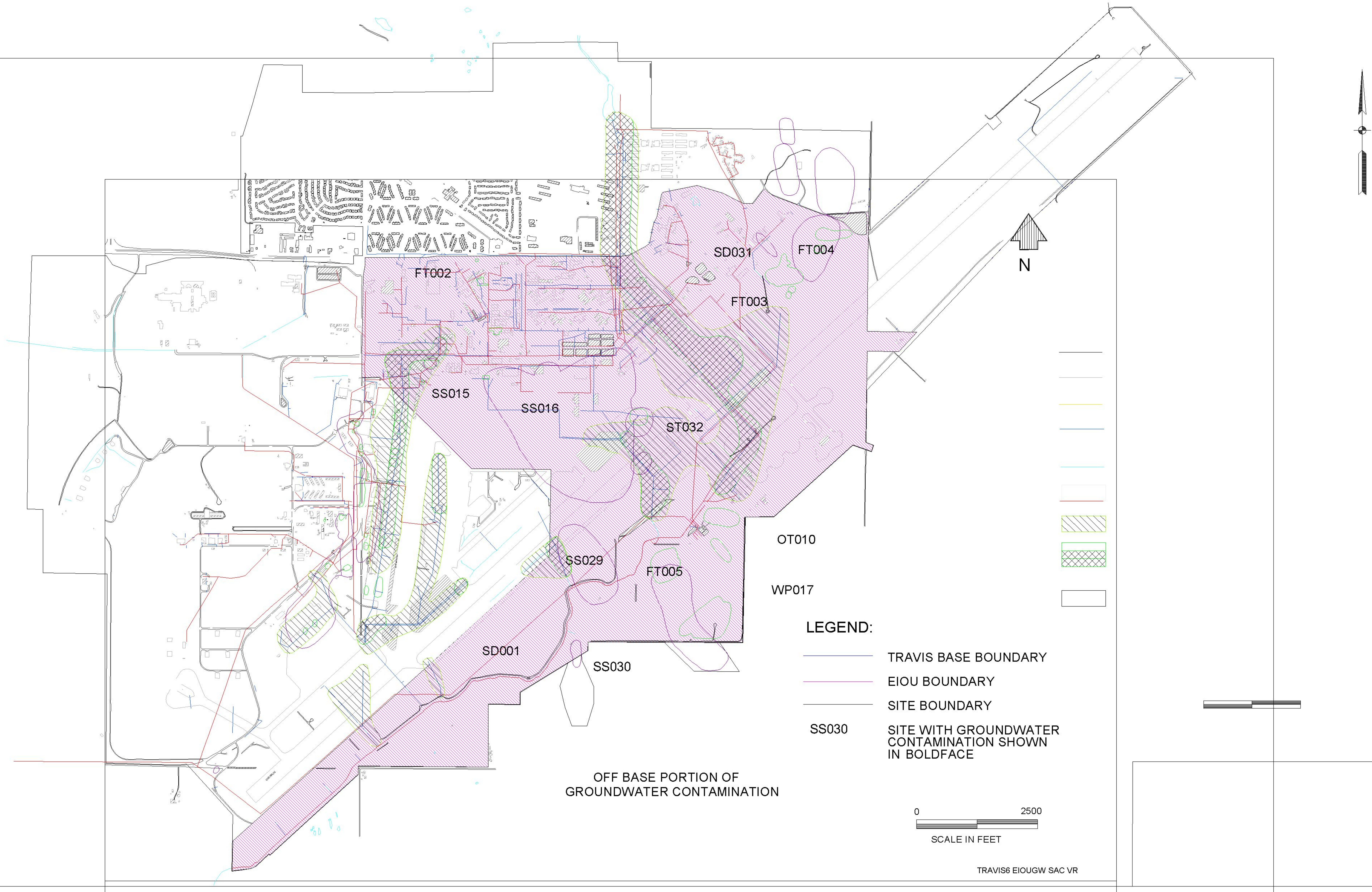


Figure 3-3. EIOU Sites with Groundwater Contamination

- SS015 – Solvent Spill Area and Facilities 550 and 552;
- SS016 – Oil Spill Area, Facilities 11, 13/14, 18, 20, 42/1941, 139/144, and selected sections of Storm Sewer Right of Way;
- SS029 – MW-329 Area;
- SS030 – MW-269 Area;
- SD031 – Facility 1205; and
- ST032 –Areas MW-107 and MW-246.

FT005, SS015, and SS029 all have dissolved chlorinated VOC groundwater plumes with COC concentrations less than 1,400 µg/L. COCs at SS029 are all VOCs, and COCs at FT005 and SS015 include VOCs, SVOCs, and metals (nickel). While the activities conducted in these areas were dissimilar in function, they all contributed to dissolved TCE (and related breakdown products) contamination. At SS029 there is no clearly identified source area. Solvent spills may be sources of contamination at SS015. The source of the contamination at FT005 is probably the fire-training activities. Contaminated groundwater at FT005 extends approximately 500 feet south of the base boundary.

FT004, SS030, and SD031 have similar maximum concentrations of dissolved chlorinated VOCs (TCE concentrations ranging from 2,400 µg/L to 8,100 µg/L. Other classes of COCs at these sites include metals (nickel), plus one SVOC bis(2-ethylhexyl)phthalate at FT004. The dissolved VOC plume from SS030 (the MW-269 area) has migrated beyond the base boundaries approximately 1,400 feet. A Pilot Study is planned for SS030, with an estimated start in the summer of 1997.

At SS016, groundwater samples from one well (MW-214) indicate the highest observed concentration of dissolved TCE detected from a monitoring well sample at the NEWIOU (32,000 µg/L). HydroPunch® groundwater samples in the area detected TCE at a concentration of 180,000 µg/L. This area is the focus of two early actions, the current OSA Removal Action and the TARA that the Air Force has initiated in SS016 to address these areas of high TCE concentrations in groundwater. Classes of COCs identified at SS016 include VOCs, one SVOC, and one metal. SS016 includes the Storm Sewer Right-of-Way which is an area of potential surface water/groundwater interaction that impacts Union Creek.

ST032 has high concentrations of dissolved fuel-related VOCs. Sampling from monitoring wells at this site detected free-phase petroleum hydrocarbons. The highest benzene groundwater concentration is 5,040 µg/L. TCE is also a COC at this site. Classes of COCs identified at ST032 include VOCs and one SVOC. There is potential interaction between surface water and groundwater at ST032 via the storm sewers that may lead to TCE and petroleum migration to Union Creek.

In groundwater samples from FT004, FT005, SS015, SS016, and ST032, the Air Force has occasionally detected bis(2-ethylhexyl)phthalate (a SVOC). Bis(2-ethylhexyl)phthalate is a common laboratory contaminant and is associated with plasticizers. There is no history of plastic disposal at this site; therefore, the detection of this chemical may not indicate groundwater contamination, although it is considered a COC at these sites based on risks.

The Air Force has identified nickel as a COC in groundwater at Sites FT004, FT005, SS015, SS016, SS030, and SD031. Treatment for metals may be needed to meet NPDES limits (see Table 6-6). Sites with metals will have treatment processes for metals. The Air Force will monitor actual levels of nickel and other metals during extraction/treatment system startup to determine the need for metals treatment. The actual source of the nickel is unknown and currently being investigated.

### 3.1.3 West Industrial Operable Unit

The remedial investigation conducted at the WIOU includes five sites that were recommended for further evaluation (Figure 3-4). These sites are:

- SD033 – Storm Sewer System II/Facilities 810 and 1917, South Gate Area, and West Branch of Union Creek;
- SD034 – Facility 811;
- SS035 – Facility 818/819;
- SD036 – Facility 872/873/876; and
- SD037 – Sanitary Sewer System, Facilities 837, 838, 919, 977, and 981, Area G Ramp, and Ragsdale/V Area.

SD033 and SD037 include the storm sewer system and the sanitary sewer system within the WIOU and several facilities. Leaks from oil/water separators (OWSs) and other industrial lines contributed to contamination in the groundwater. The Air Force has since replaced or repaired the oil/water separators. In both of these areas, dissolved contamination in the groundwater migrated along the permeable backfill around the pipes or into the storm sewer directly through breaks or damaged areas. Wastewater from the oil/water separators and other industrial lines has leaked out of damaged sewer sections into the groundwater.

Classes of COCs identified at SD033 and SD037 include VOCs and SVOCs. The dissolved contaminants in these groundwater plumes include chlorinated solvents (and related breakdown products), gasoline related compounds (TPH-G [VOCs]), and TPH-E SVOCs. The storm sewer discharges into Union Creek, and the sanitary sewer discharges to the Fairfield-Suisun Publicly Owned Treatment Works (POTW).

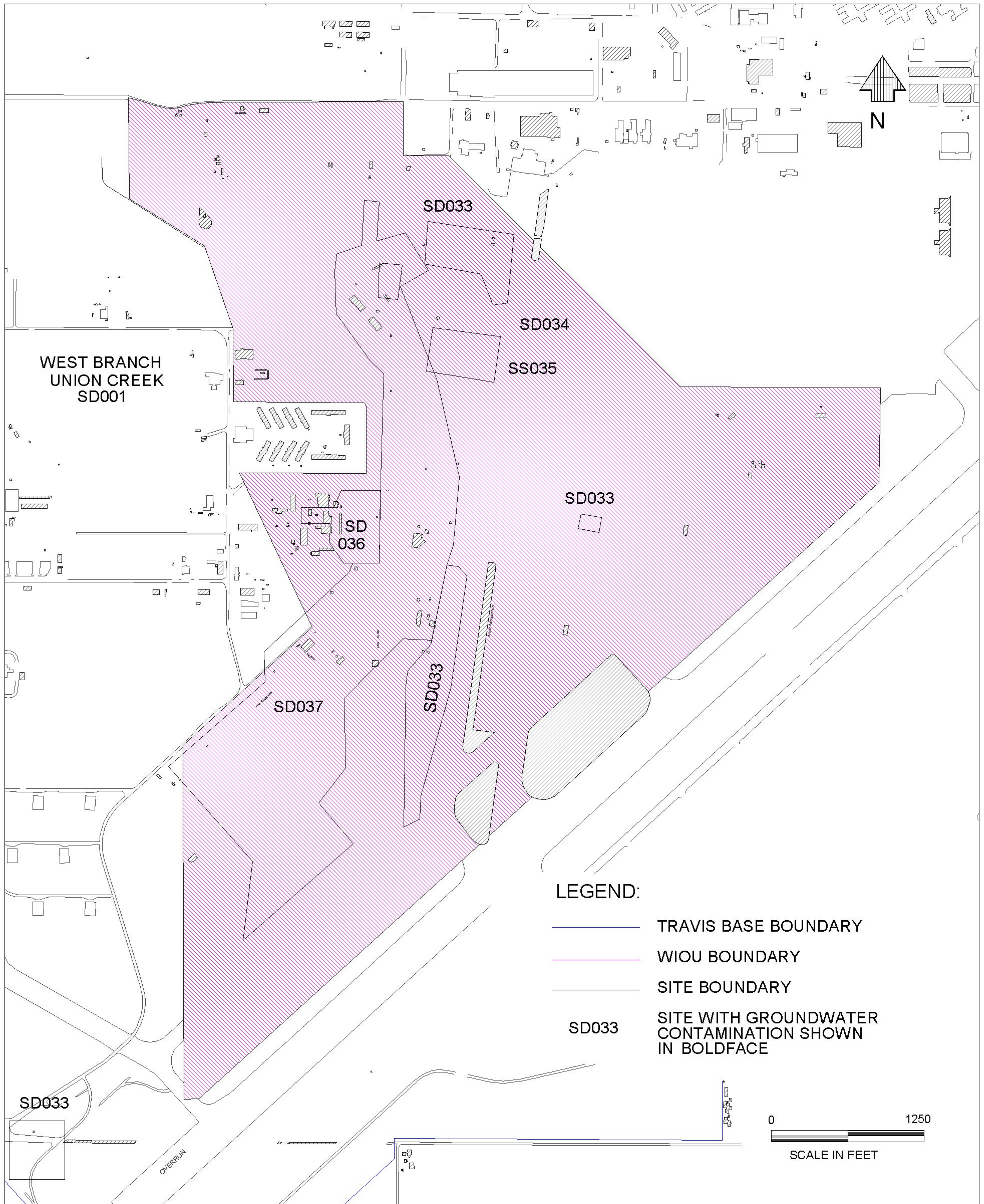


Figure 3-5. WIOU Sites with Groundwater Contamination

TRAVIS6 WIOUGW SAC VR

Groundwater at SD034 is contaminated due to the presence of hydrocarbons in the subsurface (primarily the solvent PD-680--a "Stoddard solvent" composed of 15% trimethyl benzene and 85% n-nonane) and dissolved VOCs. Classes of COCs identified at SD034 include VOCs and SVOCs. Floating product (PD-680) was found in a monitoring well located near the OWS located at Facility 811. This OWS, which has been removed, was also connected to an overflow pond located nearby. The OWS and the pond are the likely sources for the observed contamination. The VOC contaminated groundwater plume may also be mixed with contaminated groundwater at SD037.

Groundwater contamination at SS035 is characterized by low concentrations of dissolved TCE (21 µg/L) and SVOCs such as TPH-extractable (TPH-E) (160 µg/L). Dissolved contamination may have infiltrated into the aquifer due to a leaking OWS. TCE and TPH-E are the only identified COCs at SS035.

Elevated concentrations of chlorinated solvents (cis-1,2-dichloroethene [DCE] up to 3,870 µg/L) have been detected in groundwater samples from SD036. Dissolved benzene, which is thought to be associated with the wash rack or the OWS formerly located near Facility 872 has also been detected at SD036. In addition to VOCs and petroleum compounds, one SVOC was identified as a COC at SD036 (bis[2-ethylhexyl]phthalate). AFCEE is currently evaluating this site for natural attenuation of chlorinated compounds such as TCE.

## 3.2 Conceptual Model of Contamination

The details of the conceptual models for each of the groundwater sites have been discussed in the individual RIs. The site-specific summary sheets in Appendix A also contain conceptual diagrams for each site.

Contaminants of concern can reach or leave the groundwater via many pathways. The various mechanisms affecting contaminant concentrations throughout the NEWIOU include:

- Adsorption/desorption of organic chemicals to organic matter, or mineral surfaces from free-phase, vapor phase, or dissolved phase contamination;

- Dissolution of organic compounds into infiltrating precipitation, vadose zone pore water, and groundwater from adsorbed, free-phase, or vapor phase contamination;

- Volatilization of VOCs from adsorbed, dissolved, or free-phase contamination into the unsaturated zone;

- Vertical migration of dissolved VOCs and SVOCs into groundwater;

- Migration of free-phase VOCs and SVOCs through the vadose zone to the groundwater;

- Diffusion of free-phase dense nonaqueous phase liquids (DNAPLs) into fine grained silts and clays to form a secondary source;

- Migration or advection of dissolved phase contamination;

- Natural attenuation; and

- Migration of contaminated groundwater to surface water or storm sewers where groundwater flows into surface waters.

Groundwater VOC concentrations greater than 3,000 µg/L may indicate a potential for residual or DNAPL (dense nonaqueous phase liquid; TCE is heavier than water; thus is termed a DNAPL) contamination which can act as secondary sources of contamination. Free-phase DNAPL can remain as a residual liquid within the pore spaces, or it can diffuse into low permeability soils. This diffused DNAPL can also act like a residual source, even though the resultant aqueous concentrations are lower than typically expected near the source zone (Cherry, 1996). These aqueous concentrations may be from 1,000 µg/L or greater. Because Travis AFB aquifers are dominated by fine-grained silts and clays, DNAPL may have diffused into the finer sediments. Maximum contaminant concentrations in samples from monitoring wells are presented in Figure 3-5.

Figure 3-5

VOCs or SVOCs can be lost from the subsurface through volatilization and advection of vapor phase contamination. In certain areas of the NEWIOU, dissolved groundwater contaminants can enter the storm sewer systems through broken conduits and be discharged to Union Creek. Dissolved VOCs migrating with the groundwater could reach Union Creek if the groundwater table is above the elevation of the stream bed.

In Figure 3-6, areas of potential inflow of groundwater to storm sewers are shown if there are any broken pipes or fractures in the storm sewer lines. The figure shows sections that have the potential to receive inflow during the entire year or only when the water table is higher during the winter months.

Natural attenuation of organic contamination leads to decreases in concentrations and ultimately plume size. Biodegradation is the primary degradation pathway for dissolved organic contamination at Travis AFB. Fuel hydrocarbons and non-chlorinated aliphatics are more susceptible than chlorinated solvents to both aerobic and anaerobic biodegradation by microorganisms. Aerobic biodegradation of fuel hydrocarbons uses dissolved oxygen as an electron acceptor, and produces carbon dioxide and water. This can reduce dissolved oxygen concentrations to less than 1 mg/L. Below 1 mg/L in concentration the oxygen levels are low enough to permit anaerobic biodegradation to begin. Anaerobic degradation uses other compounds as electron acceptors, and produces different byproducts such as methane and sulfides (Wiedemeier et al, 1996). Natural attenuation is discussed as a remedial alternative in Section 5.0.

Chlorinated solvents can biodegrade aerobically and anaerobically. Chlorinated solvents are man-made, and these compounds undergo somewhat limited degradation due to their
microbial toxicity. These degradation mechanisms depend on complex chemical interactions between the aquifer material, the dissolved VOCs, native bacteria, and the surrounding soil vapor. Most often, these mechanisms degrade TCE or perchloroethene to 1,2-DCE or 1,1-DCE.


Figure 2-2
Areas of Potential Groundwater
Inflow into Stormwater Sewer System
Travis AFB

These byproducts can then degrade to vinyl chloride, which can then be further reduced or oxidized to benign compounds such as carbon dioxide and water (Wiedemeier et al, 1996). Throughout the NEWIOU, it is common to find chlorinated solvent degradation products dissolved in groundwater and soil vapor. This suggests that at least partial biodegradation is occurring in the NEWIOU, and supports the feasibility of using natural attenuation to remediate certain areas (Wiedemeier et al, 1996).

## 3.3 Risk Evaluation

Detailed information about the calculation of the human and ecological risks is in the OU RIs. Table 3-1 summarizes the human and ecological risks posed by the dissolved chemicals found in the groundwater at the NEWIOU IRP sites.

The objectives for the RIs and the health risk assessments conducted for the three OUs that make up the NEWIOU were to define:

- OU-specific hydrogeology and a complete conceptual model;
- Approximate nature and extent of contamination;
- Risks to human health and the environment; and
- Sites, contaminants, and affected media to be considered in the FS.

Using contaminant concentrations from the field investigation, human health risk values were calculated for a future residential scenario (adult reasonable maximum exposure [RME]) for cancer risks, and child RME for noncancer risks and for industrial workers. The future residential scenarios were the most conservative approach; although future use of groundwater by residences was evaluated for the health risk assessment (HRA), future water is likely to continue to be supplied basewide from sources outside Travis AFB. In addition, the planned future use of most sites is industrial, not residential.

# Table 3-1

## Summary of IRP Sites, Groundwater Contaminants, and Risks

| Operable Unit | IRP Designation | Name/Description | Medium | Risk Criteria Exceeded | Class of Contaminants | Risk[a] | Contaminants of Concern | Maximum Reported Concentration | Maximum Contaminant Levels[e] |
|---|---|---|---|---|---|---|---|---|---|
| NOU | LF006 | Landfill 1 | Groundwater | Human (Total Risk = $8 \times 10^{-6}$) | VOCs | $6.3 \times 10^{-6}$ | TCE | 20 µg/L | 5 µg/L |
| | | | | | | $1.7 \times 10^{-6}$ | 1,1-DCE | 0.64 µg/L | 6 µg/L |
| | | | | | | NA | TPH | 330 µg/L | TBD[e] |
| | LF007 | Landfill 2 Area B | Groundwater | Human (Total Risk = $7.8 \times 10^{-4}$) | VOCs | $3.9 \times 10^{-5}$ | Benzene | 59.3 µg/L | 1 µg/L |
| | | | | | | $1.9 \times 10^{-5}$ | 1,4-DCB | 30.8 µg/L | 5 µg/L |
| | | | | | | HI = 1.3 | Chlorobenzene | 161 µg/L | 70 µg/L |
| | | | | | SVOCs | $4.1 \times 10^{-6}$ | Bis(2-ethylhexyl)phthalate | 14.3 µg/L | 4 µg/L |
| | | | | | Pesticides[b]/PCBs | $7.0 \times 10^{-4}$ | PCBs[c] | 13.5 µg/L (PCB-1248) | 0.50 µg/L |
| | | | | | Dioxins | $1.3 \times 10^{-6}$ | 2,3,7,8-TCDDeq | 0.55 pg/L | 0.03 pg/L |
| | LF007 | Landfill 2 Area C | Groundwater | Human (Total Risk = $3.6 \times 10^{-5}$) | VOCs | $1.6 \times 10^{-5}$ | TCE | 49.1 µg/L | 5 µg/L |
| | | | | | | $5.6 \times 10^{-6}$ | Vinyl Chloride | 0.198 µg/L | 0.5 µg/L |
| | | | | | | $3.5 \times 10^{-6}$ | 1,1-DCE | 0.297 µg/L | 6 µg/L |
| | | | | | | $1.3 \times 10^{-6}$ | 1,2-DCA | 0.314 µg/L | 0.5 µg/L |
| | | | | | | $1.0 \times 10^{-5}$ | 1,2-Dichloropropane | 3.38 µg/L | 5 µg/L |

# Table 3-1

# (Continued)

| Operable Unit | IRP Designation | Name/Description | Medium | Risk Criteria Exceeded | Class of Contaminants | Risk[a] | Contaminants of Concern | Maximum Reported Concentration | Maximum Contaminant Levels[e] |
|---|---|---|---|---|---|---|---|---|---|
| NOU | LF007 | Landfill 2 Area D | Groundwater | Human (Total Risk = $5.4 \times 10^{-4}$) | VOCs | $1.4 \times 10^{-5}$ | Benzene | 25.8 µg/L | 1 µg/L |
| | | | | | | $2.9 \times 10^{-6}$ | Vinyl Chloride | 1.78 µg/L | 0.5 µg/L |
| | | | | | | $2.5 \times 10^{-5}$ | 1,4-DCB | 43.8 µg/L | 5 µg/L |
| | | | | | | $1.1 \times 10^{-6}$ | 1,1-DCE | 0.96 µg/L | 6 µg/L |
| | | | | | | HI = 15.5 | Chlorobenzene | 282 µg/L | 70 µg/L |
| | | | | | Dioxins | $2.4 \times 10^{-4}$ | 2,3,7,8-TCDDeq | 16.99 pg/L | 0.03 pg/L |
| | | | | | Pesticides*/PCBs | $2.2 \times 10^{-4}$ | PCBs[c] | 14.1 µg/L (PCB-1242) | 0.50 µg/L |
| | | | | | SVOCs | $8.2 \times 10^{-6}$ | Bis(2-ethylhexyl)phthalate | 124 µg/L | 4 µg/L |
| EIOU | FT004 | FTA-3 | Groundwater | Human | VOCs | $1.69 \times 10^{-3}$ | TCE | 5,200 µg/L | 5 µg/L |
| | | | | | | | cis-1,2-DCE | 14.7 µg/L | 6 µg/L |
| | | | | | | | 1,2-DCA | 5.12 µg/L | 0.5 µg/L |
| | | | | | | | Chloroform* | 1.81 µg/L | 100 µg/L |
| | | | | | | | Dichlorobromomethane* | 3.1 µg/L | 100 µg/L |
| | | | | | | | 1,1-DCE* | 1.28 µg/L | 6 µg/L |
| | | | | | | | Vinyl Chloride* | 6.1 µg/L | 0.5 µg/L |
| | | | | | | | 1,4-DCB* | 3.8 µg/L | 5 µg/L |
| | | | | | SVOCs | | Bis(2-ethylhexyl)phthalate | 5.49 µg/L | 4 µg/L |
| | | | | | Metal | | Nickel | 2,540 mg/L | 0.1 mg/L |

# Table 3-1

# (Continued)

| Operable Unit | IRP Designation | Name/Description | Medium | Risk Criteria Exceeded | Class of Contaminants | Risk[a] | Contaminants of Concern | Maximum Reported Concentration | Maximum Contaminant Levels[e] |
|---|---|---|---|---|---|---|---|---|---|
| EIOU | FT005 | FTA-4 | Groundwater | Human | VOCs | $1.12 \times 10^{-4}$ | TCE | 120 µg/L | 5 µg/L |
| | | | | | | | 1,2-DCA | 14.2 µg/L | 0.5 µg/L |
| | | | | | | | cis-1,2-DCE | 19 µg/L | 6 µg/L |
| | | | | | | | Chloroform* | 10 µg/L | 100 µg/L |
| | | | | | | | Dichlorobromomethane* | 1.8 µg/L | 100 µg/L |
| | | | | | SVOCs | | Bis(2-ethylhexyl)phthalate | 35.9 µg/L | 4 µg/L |
| | | | | | Metal | | Nickel | 370 mg/L | 0.1 mg/L |
| | SS015 | SSA (Fac. 552) | Groundwater | Human | VOCs | $7.22 \times 10^{-4}$ | TCE | 25 µg/L | 5 µg/L |
| | | | | | | | cis-1,2-DCE | 370 µg/L | 6 µg/L |
| | | | | | | | Vinyl Chloride | 48 µg/L | 0.5 µg/L |
| | | | | | | | 1,4-DCB* | 3.8 µg/L | 5 µg/L |
| | | | | | | | 1,2-DCA* | 0.39 µg/L | 0.5 µg/L |
| | | | | | | | PCE | 12 µg/L | 5 µg/L |
| | | | | | SVOCs | | Bis(2-ethylhexyl)phthalate | 6.68 µg/L | 4 µg/L |
| | | | | | Metal | | Nickel | 1,500 mg/L | 0.1 mg/L |

# Table 3-1

## (Continued)

| Operable Unit | IRP Designation | Name/Description | Medium | Risk Criteria Exceeded | Class of Contaminants | Risk[a] | Contaminants of Concern | Maximum Reported Concentration | Maximum Contaminant Levels[e] |
|---|---|---|---|---|---|---|---|---|---|
| EIOU | SS016 | OSA, Fac. 11, Fac. 13/14, Fac. 20, Fac. 42/1941, Fac. 139/144 | Groundwater | Human | VOCs | $1.11 \times 10^{-2}$ | TCE | 32,000 µg/L[d] | 5 µg/L |
| | | | | | | | cis-1,2-DCE | 4,600 µg/L | 6 µg/L |
| | | | | | | | Vinyl Chloride | 56 µg/L | 0.5 µg/L |
| | | | | | | | Benzene | 6.4 µg/L | 1 µg/L |
| | | | | | | | Chloroform* | 4.7 µg/L | 100 µg/L |
| | | | | | | | 1,4-DCB* | 8.6 µg/L | 5 µg/L |
| | | | | | | | Dichlorobromomethane* | 0.9 µg/L | 100 µg/L |
| | | | | | | | 1,2-DCA | 3.97 µg/L | 0.5 µg/L |
| | | | | | | | 1,1-DCE | 5.4 µg/L | 6 µg/L |
| | | | | | | | PCE | 220 µg/L | 5 µg/L |
| | | | | | SVOCs | | Bis(2-ethylhexyl)phthalate | 67.3 µg/L | 4 µg/L |
| | | | | | Metal | | Nickel | 460 mg/L | 0.1 mg/L |

# Table 3-1

## (Continued)

| Operable Unit | IRP Designation | Name/Description | Medium | Risk Criteria Exceeded | Class of Contaminants | Risk[a] | Contaminants of Concern | Maximum Reported Concentration | Maximum Contaminant Levels[e] |
|---|---|---|---|---|---|---|---|---|---|
| EIOU | SS029 | MW-329 Area | Groundwater | Human | VOCs | $4.22 \times 10^{-4}$ | TCE | 1,300 µg/L | 5 µg/L |
| | | | | | | | 1,2-DCA | 1.13 µg/L | 0.5 µg/L |
| | | | | | | | cis-1,2-DCE | 80 µg/L | 6 µg/L |
| | | | | | | | Benzene* | 0.55 µg/L | 1 µg/L |
| | | | | | | | Chloroform* | 0.61 µg/L | 100 µg/L |
| | | | | | | | 1,1-DCE* | 0.57 µg/L | 6 µg/L |
| | | | | | | | Vinyl Chloride* | 0.22 µg/L | 0.5 µg/L |
| | SS030 | MW-269 Area | Groundwater | Human | VOCs | $7.6 \times 10^{-4}$ | TCE | 2,400 µg/L | 5 µg/L |
| | | | | | | | Chloroform* | 1.2 µg/L | 100 µg/L |
| | | | | | | | Dichlorobromomethane* | 0.53 µg/L | 100 µg/L |
| | | | | | | | 1,2-DCA* | 0.34 µg/L | 0.5 µg/L |
| | | | | | Metal | | Nickel | 903 mg/L | 0.1 mg/L |
| | SD031 | Fac. 1205 | Groundwater | Human | VOCs | $5.24 \times 10^{-2}$ | TCE | 8,100 µg/L | 5 µg/L |
| | | | | | | | Benzene | 6.75 µg/L | 1 µg/L |
| | | | | | | | 1,1-DCE | 7,300 µg/L | 6 µg/L |
| | | | | | | | cis-1,2-DCE | 3,600 µg/L | 6 µg/L |
| | | | | | | | Carbon Tetrachloride | 11 µg/L | 0.5 µg/L |
| | | | | | | | Chloroform | 4.34 µg/L | 100 µg/L |
| | | | | | | | 1,2-DCA | 0.41 µg/L | 0.5 µg/L |
| | | | | | | | Vinyl Chloride | 0.22 µg/L | 0.5 µg/L |
| | | | | | Metal | | Nickel | 2,050 mg/L | 0.1 mg/L |

# Table 3-1

# (Continued)

| Operable Unit | IRP Designation | Name/Description | Medium | Risk Criteria Exceeded | Class of Contaminants | Risk[a] | Contaminants of Concern | Maximum Reported Concentration | Maximum Contaminant Levels[e] |
|---|---|---|---|---|---|---|---|---|---|
| EIOU | ST032 | MW-107 Area and MW-246 Area | Groundwater | Human | VOCs | $1.5 \times 10^{-2}$ | Benzene | 5,040 µg/L | 1 µg/L |
| | | | | | | | TCE | 64 µg/L | 5 µg/L |
| | | | | | | | 1,1-DCE* | 0.36 µg/L | 6 µg/L |
| | | | | | | | Xylenes* | 6,702 µg/L | 1,750 µg/L |
| | | | | | SVOCs | | Bis(2-ethylhexyl)phthalate* | 153 µg/L | 4 µg/L |
| WIOU | SD033 | Storm Sewer System II (former Storm Sewer System B) (includes Facilities 810, 1917, and South Gate Area, and the West Branch of Union Creek | Groundwater | Human (Total Risk = $5.6 \times 10^{-5}$) | VOCs | $3.6 \times 10^{-5}$ | TCE | 941 µg/L | 5 µg/L |
| | | | | | | $1.7 \times 10^{-6}$ | 1,1-DCE | 0.420 µg/L | 6 µg/L |
| | | | | | | Exceeds MCL | 1,2-DCA | 1.36 µg/L | 0.5 µg/L |
| | | | | | | Exceeds MCL | cis-1,2-DCE | 199 µg/L | 6 µg/L |
| | | | | | | NA | TPH-gasoline | 1,000 µg/L | TBD[e] |
| | | | | | SVOCs | NA | TPH-E | 1,420 µg/L | TBD[e] |

# Table 3-1

## (Continued)

| Operable Unit | IRP Designation | Name/Description | Medium | Risk Criteria Exceeded | Class of Contaminants | Risk[a] | Contaminants of Concern | Maximum Reported Concentration | Maximum Contaminant Levels[e] |
|---|---|---|---|---|---|---|---|---|---|
| WIOU | SD034 | Facility 811 | Groundwater | Human (Total Risk = $6.2 \times 10^{-4}$) | VOCs | NA | LNAPL (PD-680) | ~ 1 foot thick | NA |
| | | | | | | $3.0 \times 10^{-5}$ | TCE | 740 µg/L | 5 µg/L |
| | | | | | | $3.1 \times 10^{-5}$ | Vinyl Chloride | 2.38 µg/L | 0.5 µg/L |
| | | | | | | $1.2 \times 10^{-6}$ | 1,1-DCE | 0.317 µg/L | 6 µg/L |
| | | | | | | Exceeds MCL | Benzene | 6.8 µg/L | 1 µg/L |
| | | | | | | Exceeds MCL | cis-1,2-DCE | 496 µg/L | 6 µg/L |
| | | | | | | $1.2 \times 10^{-5}$ | PCE | 88 µg/L | 5 µg/L |
| | | | | | | NA | TPH-gasoline | 10,600,000 µg/L | TBD[e] |
| | | | | | SVOCs | NA | TPH-E | 13,000,000 µg/L | TBD[e] |
| | | | | | | $3.3 \times 10^{-4}$ | Bis(2-ethylhexyl)phthalate | 6,390 µg/L | 4 µg/L |
| | SS035 | Facilities 818 and 819 | Groundwater | NA | VOCs | Exceeds MCL | TCE | 21 µg/L | 5 µg/L |
| | | | | | SVOCs | NA | TPH-E | 160 µg/L | TBD[e] |

# Table 3-1

# (Continued)

| Operable Unit | IRP Designation | Name/Description | Medium | Risk Criteria Exceeded | Class of Contaminants | Risk[a] | Contaminants of Concern | Maximum Reported Concentration | Maximum Contaminant Levels[e] |
|---|---|---|---|---|---|---|---|---|---|
| WIOU | SD036 | Facilities 872, 873, and 876 | Groundwater | Human (Total Risk = $1.3 \times 10^{-3}$) | VOCs | $2.1 \times 10^{-3}$ | Vinyl Chloride | 198 µg/L | 0.5 µg/L |
| | | | | | | $2.4 \times 10^{-5}$ | TCE | 308 µg/L | 5 µg/L |
| | | | | | | $2.2 \times 10^{-5}$ | 1,1-DCE | 3.71 µg/L | 6 µg/L |
| | | | | | | HI = 6.2 | cis-1,2-DCE | 3,870 µg/L | 6 µg/L |
| | | | | | | Exceeds MCL | 1,2-DCA | 1.36 µg/L | 0.5 µg/L |
| | | | | | | $1.2 \times 10^{-6}$ | Benzene | 3.87 µg/L | 1 µg/L |
| | | | | | | $1.0 \times 10^{-6}$ | Bromodichloromethane | 2.26 µg/L | 0.18 µg/L |
| | | | | | | $1.6 \times 10^{-4}$ | PCE | 382 µg/L | 5 µg/L |
| | | | | | | NA | TPH-gasoline | 4,380 µg/L | TBD[e] |
| | | | | | | NA | TPH-E | 480 µg/L | TBD[e] |

# Table 3-1

# (Continued)

| Operable Unit | IRP Designation | Name/Description | Medium | Risk Criteria Exceeded | Class of Contaminants | Risk[a] | Contaminants of Concern | Maximum Reported Concentration | Maximum Contaminant Levels[e] |
|---|---|---|---|---|---|---|---|---|---|
| WIOU | SD037 | Sanitary Sewer (includes Facilities 837, 838, 981, 919, the Area G Ramp, and Ragsdale/V Area) | Groundwater | Human (Total Risk = $1.6 \times 10^{-4}$) | VOCs | $1.1 \times 10^{-6}$ | 1,1-DCE | 0.598 µg/L | 6 µg/L |
| | | | | | | Exceeds MCL | 1,2-DCA | 0.597 µg/L | 0.5 µg/L |
| | | | | | | $1.9 \times 10^{-7}$ | Benzene | 1.93 µg/L | 1 µg/L |
| | | | | | | Exceeds MCL | Bromodichloromethane | 0.69 µg/L | 0.18 µg/L |
| | | | | | | Exceeds MCL | Carbon Tetrachloride | 60.7 µg/L | 0.5 µg/L |
| | | | | | | $1.3 \times 10^{-8}$ | Chloromethane | 1.03 µg/L | 1.50 µg/L |
| | | | | | | $4.6 \times 10^{-5}$ | PCE | 407 µg/L | 5 µg/L |
| | | | | | | $5.4 \times 10^{-5}$ | TCE | 6,990 µg/L | 5 µg/L |
| | | | | | | $6.0 \times 10^{-5}$ | Vinyl Chloride | 60.2 µg/L | 0.5 µg/L |
| | | | | | | Exceeds MCL | cis-1,2-DCE | 340 µg/L | 6 µg/L |
| | | | | | | NA | TPH-gasoline | 4,160 µg/L | TBD[e] |
| | | | | | SVOCs | $1.4 \times 10^{-6}$ | Bis(2-ethylhexyl)phthalate | 139 µg/L | 4 µg/L |
| | | | | | | Exceeds MCL | Naphthalene | 115 µg/L | 23 µg/L |
| | | | | | | NA | TPH-E | 34,000 µg/L | TBD[e] |
| | | Facility 977 (Sanitary Sewer) (SD037) | Groundwater | NA | VOCs | NA | TPH-gasoline | 61 µg/L | TBD[e] |
| | | | | | | Exceeds MCL | TCE | 12.2 µg/L | 5 µg/L |
| | | | | | SVOCs | NA | TPH-E | 2,660,000 µg/L | TBD[e] |

# Table 3-1

## (Continued)

| Operable Unit | IRP Designation | Name/Description | Medium | Risk Criteria Exceeded | Class of Contaminants | Risk[a] | Contaminants of Concern | Maximum Reported Concentration | Maximum Contaminant Levels[e] |
|---|---|---|---|---|---|---|---|---|---|
| WIOU | SD037 | Facility 981 (Sanitary Sewer) (SD037) | Groundwater | NA | VOCs | Exceeds MCL | Benzene | 14 µg/L | 1 µg/L |
| | | | | | | Exceeds MCL | TCE | 2.65 µg/L | 6 µg/L |
| | | | | | | NA | TPH-gasoline | 790 µg/L | TBD[e] |
| | | | | | SVOCs | NA | TPH-E | 530 µg/L | TBD[e] |
| | | Area G Ramp (Sanitary Sewer) (SD037) | Groundwater | NA | VOCs | Exceeds MCL | Benzene | 2.3 µg/L | 1 µg/L |
| | | | | | | Exceeds MCL | PCE | 17 µg/L | 5 µg/L |
| | | | | | | Exceeds MCL | TCE | 6.7 µg/L | 5 µg/L |
| | | | | | | NA | cis-1,2-DCE | 1.32 µg/L | 6 µg/L |
| | | | | | SVOCs | NA | TPH-E | 4,100 µg/L | TBD[e] |

[a] = Risk is for each COC contributing to total risk. Noncarcinogenic human health risks are reported as hazard indexes (HI); an HI greater than 1 suggests there may be a potential for adverse effects. Ecological risks are reported as maximum hazard quotients (HQ); an HQ greater than 1 suggests there may be a potential for adverse effects.

[b] = Pesticides were deleted from consideration in the FS for the NOU. See FS Report for discussion.

[c] = PCBs include Arochlors 1242 and 1248.

[d] = Recent testing has documented higher concentrations of TCE, up to a maximum of approximately 180,000 ppb. However, these results were derived from Cone Penetrometer Testing (CPT) data and should not be directly compared to monitoring well data.

[e] = Maximum contaminant levels (MCLs) presented are California Department of Health Services Primary MCLs, except where noted. U.S. EPA PRGs are used for chloromethane and total petroleum hydrocarbons have no limits in groundwater, and thus are TBD.

* This table contains revisions from the numbers in Table ES-2 from the EIOU RI (Weston, 1995). Revisions are based on recalculated risks (April, 1996). Contaminants of concern that have been added to this table are noted by an asterisk (*). In addition, PCB (Aroclor-1260) was removed as a human health risk (11 April 1996) based on an industrial exposure scenario rather than a residential scenario.

Note: All metals concentrations are dissolved (filtered samples).

DCA = Dichloroethane
DCB = Dichlorobenzene
DCE = Dichloroethene
HI = Hazard Index
HQ = Hazard Quotient
µg/L = Micrograms per Liter
NA = No maximum contaminant level available for this chemical or risks not calculated
OSA = Oil Spill Area
PCB = Polychlorinated Biphenyls
PCE = Tetrachloroethene
pg/g = Picograms per Gram
SVOCs = Semivolatile Organic Compounds
TBD = To be determined
TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
TCE = Trichloroethene
TPH-E = Total Petroleum Hydrocarbons - Extractable
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds

The Air Force also completed ecological risk assessments (ERAs) for the OUs. Each of the OU ERAs evaluates specific sites for completed exposure pathways, defines COPECs, defines assessment and measurement endpoints, defines CTVs and compares analytical sample data to the site specific CTVs. Depending on the risk analysis, routes of exposure and selected indicator species, CTVs may be expressed as doses or as environmental concentrations. The comparison of modeled doses or analytical concentrations to CTVs results in a hazard quotient (HQ). HQs exceeding 1 indicate a potential for adverse ecological effects. Specific OU ERAs also included additional analyses to assess ecological impact of contaminants. These included: gross pathology of organisms; site specific bioassays; biomass analysis; and biological sampling and analysis. These ERA analyses, other than the HQ analysis, may not be chemical end-point specific, but they assume all chemical concentrations identified at a site are responsible for the observed toxic endpoint (e.g., skin lesions on fish at the site).

Following the completion of the OU-specific ERAs, a document entitled "Final Comprehensive Basewide Ecological Risk Assessment - Tier 2: Screening Assessment" (CH2M HILL, 1996), designed to quantify the potential ecological risks to plants and animals on the Base using a basewide perspective, was completed. This document provides further information on ecological risk to help guide potential interim remedial actions.

The Tier 2 report presents general surface water and sediment goals based on federal standards. A supplemental approach was required to establish ecological interim remediation goals (IRGs) in the FS, specifically for soil at the NEWIOU sites. The Air Force estimated these IRGs by back-calculating media-specific concentrations to yield an HQ = 1, using the algorithms developed in the previous ERAs. The methodology involved selecting a "most sensitive receptor" for each site or habitat type, again based on the ERAs, to represent all ecological receptors. The Air Force and regulatory agencies selected these receptors to represent species that are likely to utilize the site, have a high level of contact with the contaminated media, and have available toxicity data. Exposure pathways, bioaccumulation/bioconcentration parameters, uncertainty factors, and toxicity data were all reviewed and factored into the analysis. The Air

Force then back-calculated the individual IRGs for each COC at each site, so that the IRG concentration would result in a theoretical HQ = 1.

Specific details of the HRAs for the three OUs that compose the NEWIOU are provided in the OU RIs and the NEWIOU FS.

The site-specific figures in Appendix A summarize primary groundwater contaminants that were evaluated in the FS. The summary figures for all sites include estimated areas of contamination; a complete description of the nature and extent of contamination is contained in the specific RIs. Compounds that do not drive risk or do not exceed regulatory standards are not shown on these figures.

## 3.4 Contaminants of Concern

Following the RI field activities, the Air Force compiled the data for each site and evaluated the data in each OU RI for the presence of contaminants and their potential effects on human health and the environment. The Air Force and regulatory agencies identified COCs based on potential human health risks, ecological risks, and regulatory limits. While each OU RI considered site-specific factors, the general criteria for the identification of groundwater COCs was as follows:

1. The contaminant drove a human health risk exceeding $1 \times 10^{-6}$;
2. The contaminant had an HI exceeding 1.0; or
3. The maximum concentration of the contaminant exceeded the maximum contaminant level (MCL) (or PRGs for dioxin).

A detailed description of COC development is included in each of the OU RIs. COCs are listed in Table 3-1.

## 3.5 Summary

Releases of VOCs, as well as SVOCs, dioxins, and metals as a result of historic Base activities have contaminated the groundwater at the NEWIOU at Travis AFB. Most of the releases affecting groundwater at the NEWIOU involve TCE. Actual or threatened releases of hazardous substances from these sites, if not addressed by implementing the response actions selected in the Groundwater IROD, may present a current or potential threat to public health, and welfare, or to the environment.

As a result of the NOU, WIOU, and EIOU RIs, twenty sites were evaluated in the NEWIOU FS, fifteen of which have groundwater contamination. Five of the twenty sites (SD001, FT002, FT003, OT010, and WP017) do not have groundwater contamination. The fifteen groundwater sites are shown in Table 3-2. The Air Force and regulatory agencies delisted four sites and moved them to the Petroleum-Only Contaminated Sites (POCOS) program. These include SS014, ST018, SS027, and SS028. One site (OT011) was designated as no further action.

## Table 3-2

## Summary of NEWIOU Groundwater Sites Carried Forward to the NEWIOU FS

| OU | IRP Designation | Name |
|---|---|---|
| EIOU | FT004 | Fire Training Area (FTA)-3 |
| | FT005 | FTA-4 |
| | SS015 | Solvent Spill Area (SSA) and Facilities 550 and 552 |
| | SS016 | Oil Spill Area (OSA) Facilities 11, 13/14, 20, 42/1941, 139/144, and Storm Sewer Right of Way |
| | SS029 | Monitoring Well (MW)-329 Area |
| | SS030 | MW-269 Area |
| | SD031 | Facility 1205 |
| | ST032 | MW-246/MW-107 Areas |
| NOU | LF006 | Landfill 1 |
| | LF007 | Landfill 2 |
| WIOU | SD033 | Facilities 810 and 1917, Storm Sewer II, South Gate Area, and West Branch of Union Creek |
| | SD034 | Facility 811 |
| | SS035 | Facility 818/819 |
| | SD036 | Facility 872/873/876 |
| | SD037 | Sanitary Sewer System, Facilities 837/838, 919, 977, 981, Ragsdale/V Area, and Area G Ramp |

Note: Soil, sediment, and surface water contamination at these and other NEWIOU soil sites will be addressed in a separate ROD. For potential migration of groundwater to surface water, see Figure 3-6.