5.0 Interim Groundwater Remedial Actions

Travis AFB has selected interim groundwater remedial actions for the four WABOU groundwater sites. Each of the selected remedies will protect human health and the environment and comply with ARARs. They are effective at reducing contamination, are implementable and cost-effective, and are acceptable to the public and the State of California. These decisions are based on the environmental conditions and the nature and extent of groundwater contamination found at each site. They are also based on the technology and U.S. EPA criteria evaluations from the WABOU FS. The following subsections present these selected actions and the rationale for the decisions.

5.1 Building 755 (DP039)

Alternatives G5—Source Area and Groundwater Extraction/Treatment/Monitored Natural Attenuation and **G3—Containment/Treatment/Discharge** are the selected alternatives for Building 755. The Air Force believes that a combination of these two alternatives offers the best opportunity to achieve the groundwater cleanup in an efficient and cost-effective manner.

5.1.1 Alternative G5—Source Area and Groundwater Extraction/Treatment/ Monitored Natural Attenuation

Alternative G5 is a three-part strategy that starts with an aggressive approach toward removing the groundwater contamination source. The former battery acid neutralization sump was used for the disposal of chlorinated solvents, and the high solvent concentrations found in the former sump area (210,000 ppb of TCE) are indicative of the presence of dense non-aqueous phase liquid (DNAPL) beneath the water table. Since solvents tend to dissolve into water very slowly, it is likely that the groundwater alternatives that rely on standard pump-and-treat methods would take a very long time to reduce these high solvent concentrations.

The Air Force will construct a DPE system to remove the highly concentrated VOC contamination beneath the former sump area. A DPE system applies a vacuum to the subsurface soil layers and draws contaminated water into the extraction well, thereby lowering the local water table in the vicinity of the solvent pools. The vacuum also stirs up the air between the soil particles. Any undissolved solvent pools that are exposed to the air by the lowered water table will evaporate, and the vacuum will draw contaminated vapors out of the extraction well. Air is more efficient in removing solvents than water, because the solvents evaporate quickly. So, the goal of using a DPE system is to remove the source area in less time than by using standard groundwater pump-and-treat methods.

The second part of the cleanup consists of the installation of at least one extraction well in the central portion of the groundwater plume. This will reduce the high concentrations of dissolved solvents and the potential risk that they pose. The actual number and placement of the well(s) will be determined after taking into account the effect of the DPE system on the groundwater plume. Figure 5-1 shows the conceptual design of Alternative G5 at Building 755.

To ensure that the plume will not migrate any further, the Air Force has added Alternative G3 to the Alternative G5 cleanup strategy. Alternative G3 uses a row of extraction wells

around the plume to prevent its further expansion. Figure 5-2 presents the conceptual layout of this alternative. The Air Force will then test the MNA component of Alternative G5 through the collection of analytical data in accordance with U.S. EPA and California guidelines. This data will be used to determine whether the subsurface microorganisms are active and capable of breaking down the contaminants and preventing the spreading of the plume.

The implementation of the groundwater treatment strategy at Building 755 will be designed to remove the maximum amount of contamination as quickly as possible and not promote the migration of highly contaminated groundwater to areas with lower contaminant concentrations. As a result, the Air Force will use a phased approach to build the treatment system and collect groundwater data. In general, the remedial activities will start at the source area (former sump area) and continue in the downgradient direction.

5.1.1.1 Phase 1—DPE Construction

The groundwater remedial actions will begin with the construction and operational testing of the DPE system. This system will be designed to lower the local water table and volatilize the DNAPL pools that are exposed to the air. The objective of this phase is to remove the source of the existing plume and thus prevent the future generation of contaminated groundwater.

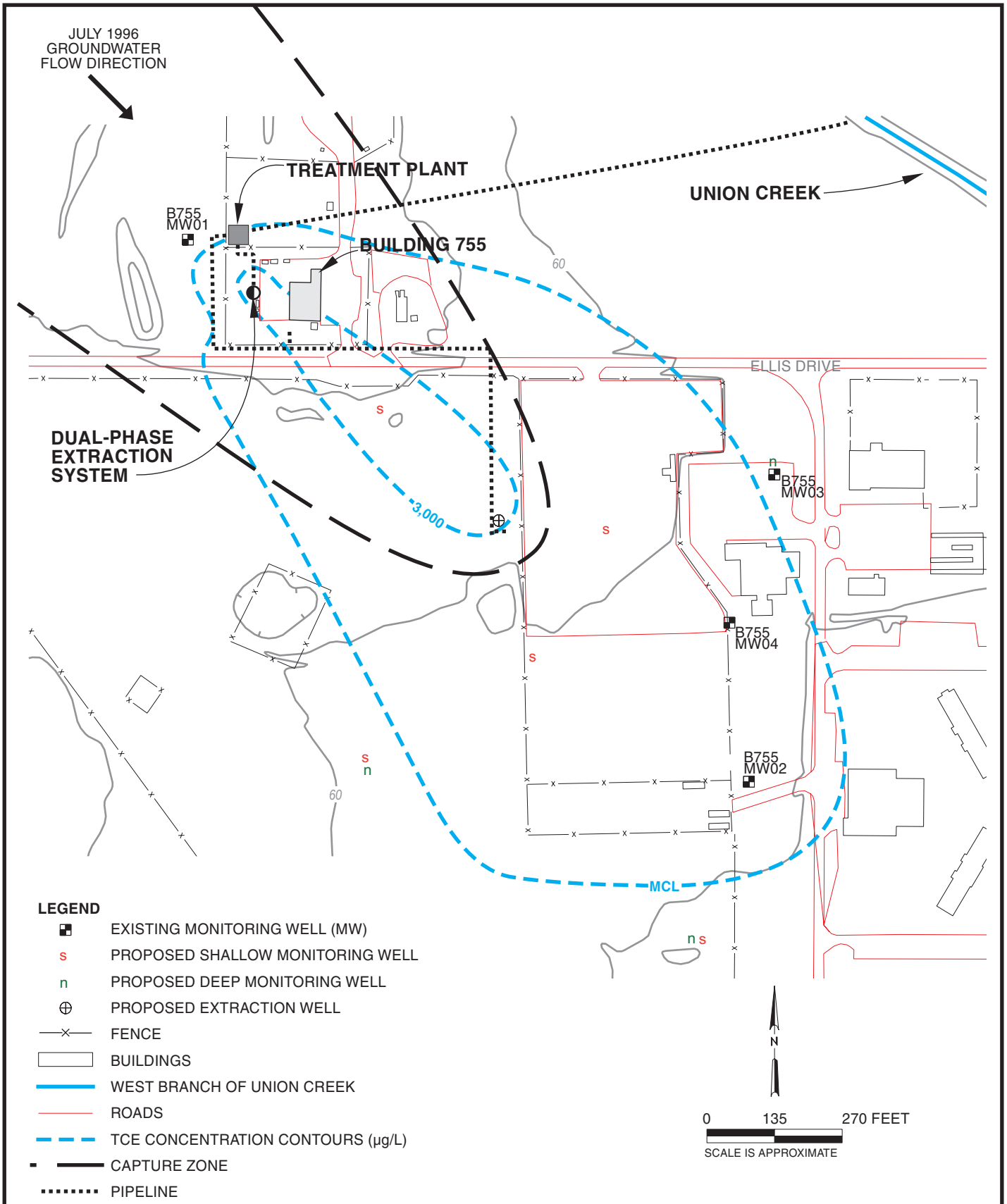
One important aspect of the DPE system operational test is the measuring of the system's radius of influence. Monitoring wells and piezometers will be adapted and installed to measure the impact of the vacuum on the downgradient strata and the local groundwater flow. This information is needed to properly design and place the downgradient extraction well(s) in the next phase.

Another activity in this phase will be the data collection for the evaluation of MNA in the downgradient portion of the plume. Monitoring wells will be installed throughout the plume, and groundwater sampling and analysis will take place. The Air Force anticipates that the operational testing of the DPE system will have no impact on this groundwater sampling effort. The first (and possibly second) round of data collection will serve as a baseline for existing environmental conditions and the status of the plume. Subsequent sampling rounds will be used to demonstrate any changes to the plume, either by MNA or by the engineered activities.

5.1.1.2 Phase 2—Groundwater Extraction

Once the DPE system is fully functional, the first groundwater extraction well will be installed. The purpose of this well is to remove the highly contaminated dissolved portion of the plume. The placement of this well will be based on the calculated capture zone of the well, taking into account the impact of the operational DPE system. The piping system will be designed to allow for flexibility in case additional downgradient extraction wells are needed. It is possible that the decision for additional extraction wells may be made once the DPE system is operational, depending on the evaluation of the collected data.

Once the groundwater extraction well(s) is/are installed, data collection will continue to determine the revised radius of influence of the overall extraction system. An attempt will be made to design and place the installed monitoring wells so that they can be used for both system monitoring and natural attenuation data collection.



NOTE

MCL FOR TCE IS 5 µg/L.

FIGURE 5-1
ALTERNATIVE G5 —
SOURCE AREA AND GROUNDWATER EXTRACTION/ TREATMENT/ MONITORED NATURAL ATTENUATION CONCEPTUAL DESIGN AT BUILDING 755
WEST/ANNEXES/BASEWIDE OPERABLE UNIT (WABOU)
WABOU GROUNDWATER IROD
TRAVIS AIR FORCE BASE, CALIFORNIA

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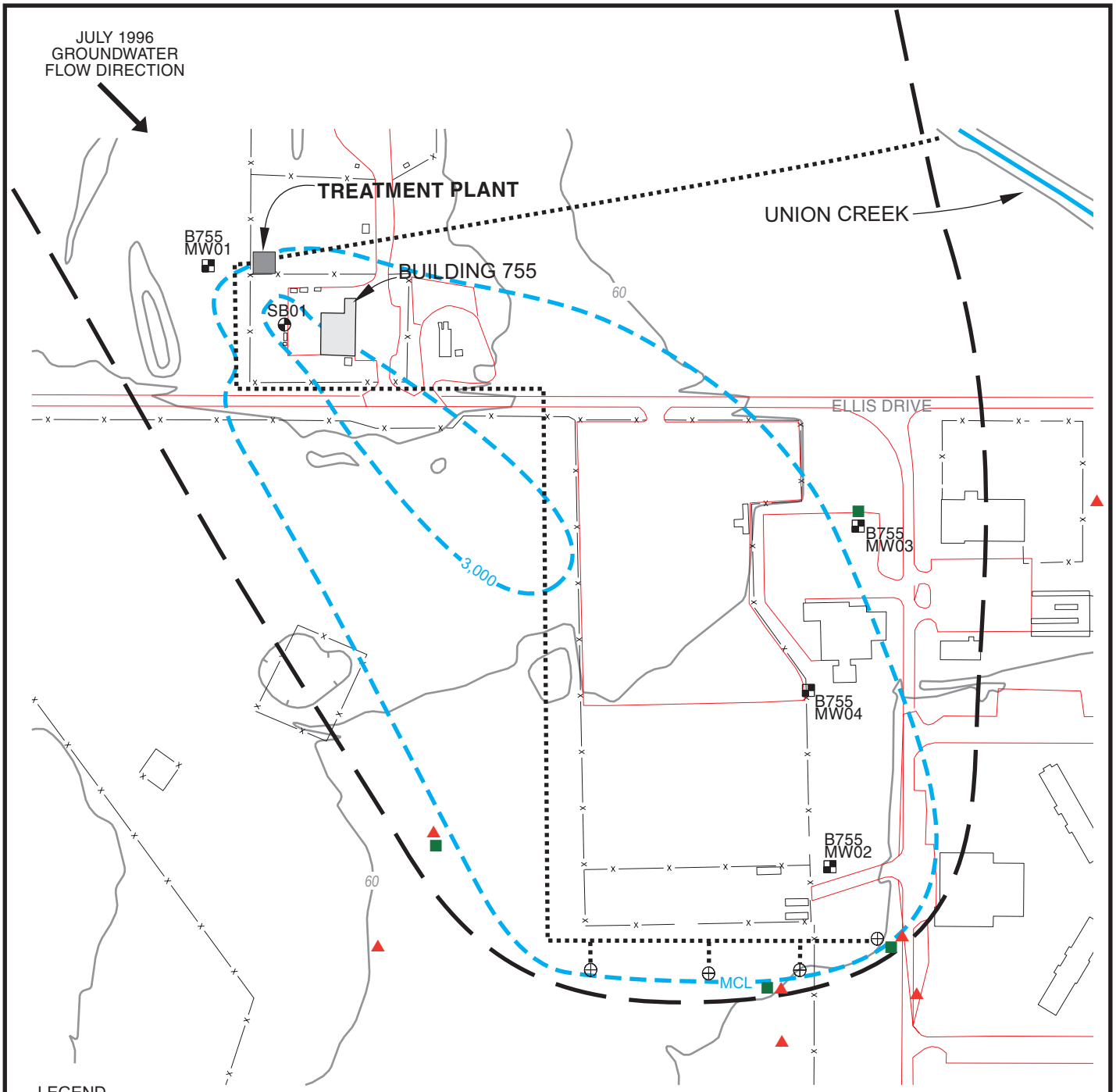

LEGEND

- EXISTING PIEZOMETER (SB)
- EXISTING MONITORING WELL (MW)
- PROPOSED SHALLOW MONITORING WELL
- PROPOSED DEEP MONITORING WELL
- PROPOSED EXTRACTION WELL
- FENCE
- BUILDINGS
- WEST BRANCH OF UNION CREEK
- ROADS
- TCE CONCENTRATION CONTOURS (µg/L)
- EXTENT OF CAPTURE ZONE
- PIPELINE

N

0 135 270 FEET

SCALE IS APPROXIMATE

NOTE
MCL FOR TCE IS 5 µg/L

FIGURE 5-2
ALTERNATIVE G3 — CONTAINMENT/TREATMENT/ DISCHARGE CONCEPTUAL DESIGN AT BUILDING 755

WEST/ANNEXES/BASEWIDE OPERABLE UNIT (WABOU)
WABOU GROUNDWATER IROD
TRAVIS AIR FORCE BASE, CALIFORNIA

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5.1.2 Alternative G3—Containment/Treatment/Discharge

The Air Force added this alternative to the Alternative G5 treatment strategy to comply with specific State ARARs that are concerned with groundwater and plume migration. The purpose of Alternative G3 is to prevent plume migration by constructing a hydraulic barrier of extraction wells near the leading edge of the plume. By definition, containment is achieved when groundwater along a flow line that originates at any location within the plume, at any depth in the aquifer, is moving toward and into an extraction well.

5.1.2.1 Phase 3—Installation of the Alternative G3 Wells

In this last construction phase the extraction wells on the outer downgradient edge of the plume will be installed. The number and placement of these wells will be based on the revised calculated capture zone of the Alternative G5 system that is already in operation. Figure 5-2 shows the conceptual design of Alternative G3 at Building 755.

There is a possibility that the Air Force will look at innovative technologies for the migration control wells. For example, researchers at the University of California, Davis, have developed a multistage in-well aeration system that is designed to remove VOCs from groundwater in an effective and inexpensive manner. The regulatory agencies will be involved in any treatability study that may be conducted to demonstrate the abilities of these types of innovative systems.

5.2 Landfill 3 (LF008)

Alternative G4—Extraction/Treatment/Discharge is the selected alternative for Landfill 3. This alternative uses standard pump-and-treat technology. Three extraction wells are placed around the pesticide trenches to prevent contaminated groundwater from moving away from the site. An additional extraction well is placed in the center of the pesticide trenches to remove contaminated groundwater from beneath the trenches. Figure 5-3 shows the conceptual design of Alternative G4 at Landfill 3.

This is the most aggressive cleanup strategy for this site. The older pesticides at this landfill are resistant to natural breakdown processes, so Alternative G2 may not be successful in stopping future plume migration. Alternative G3 would eventually meet cleanup goals, but it is not as effective at removing contamination and may have a longer cleanup time.

Before the groundwater cleanup can begin, the pesticide-contaminated debris and soil in the trenches that contribute to the groundwater contamination need to be removed. This portion of the site remediation is discussed in greater detail in the WABOU Soil Proposed Plan. It is possible that the soil remediation may not be scheduled prior to the start of the Alternative G4 treatment plant construction due to programming or funding limitations. In this case, the Air Force and the regulatory agencies will review all schedule options and select the most appropriate approach to conducting the soil and groundwater remedial actions without causing a significant project cost increase.

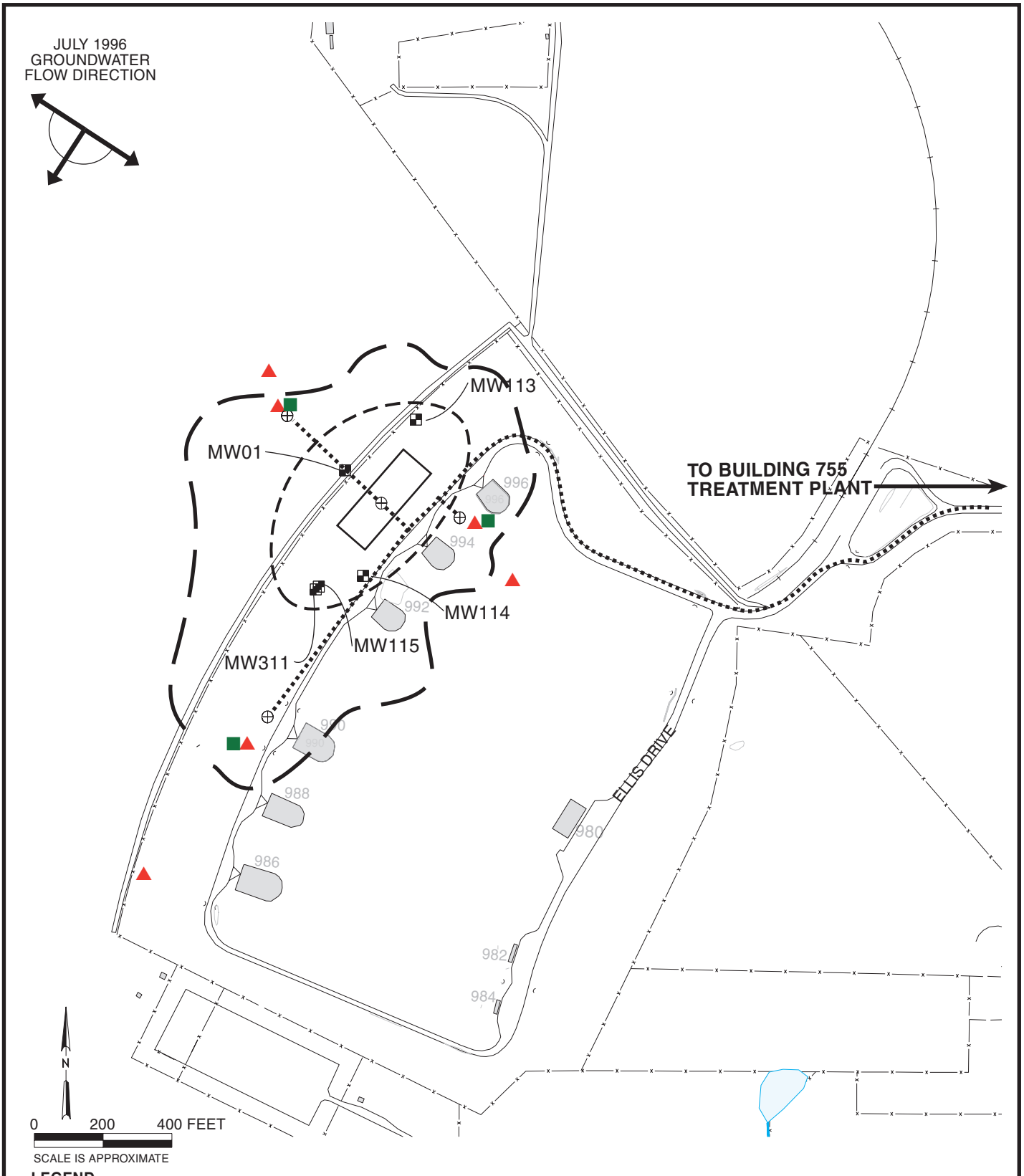

FIGURE 5-3
ALTERNATIVE G4 — EXTRACTION/TREATMENT/DISCHARGE CONCEPTUAL DESIGN AT LANDFILL 3
WEST/ANNEXES/BASEWIDE OPERABLE UNIT (WABOU)
WABOU GROUNDWATER IROD
TRAVIS AIR FORCE BASE, CALIFORNIA

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5.3 Buildings 905 (SS041) and 916 (SD043)

Alternative G3—Containment/Treatment/Discharge is the selected alternative for Buildings 905 and 916. As mentioned in previous sections, these sites are discussed together, because the two buildings are located close together, and a groundwater modeling computer program used in the WABOU FS predicted that a single extraction well would capture the contaminated groundwater from *both* sites.

The groundwater contaminants found beneath Buildings 905 and 916 are TCE, PCB-1254, and pesticides. The older pesticides at Building 905 and the PCB 1254 at Building 916 are resistant to natural degradation processes, so Alternative G2 may not be successful in stopping future plume migration.

Since the results of the computer modeling indicate that Alternative G3 is capable of capturing the groundwater plumes from both sites with only one extraction well, it is the selected alternative. Figure 5-4 presents the conceptual layout of Alternative G3 at Buildings 905 and 916.

5.4 Treatment

For Building 755, treatment of the vapor-phase VOCs generated from the DPE system will be conducted at an on-site Vapor-Phase Granular Activated Carbon (VGAC) treatment plant. Treatment of the extracted groundwater will be accomplished locally using a Liquid-Phase Granular Activated Carbon (LGAC) treatment system or through a centrally located groundwater treatment system that would be capable of treating contaminated groundwater from multiple sites.

For Landfill 3 and Buildings 905 and 916, treatment of the extracted groundwater will be by LGAC locally or by a centrally located groundwater treatment system that would be capable of treating contaminated groundwater from multiple sites.

The rationale for the selection of the treatment technologies mentioned above is found in Appendix C of the *West/Annexes/Basewide Operable Unit Feasibility Study, 60th Air Mobility Wing, Travis Air Force Base, California* (CH2M HILL, 1998).

The Air Force developed Interim Cleanup Goals for the WABOU to measure the performance of each groundwater treatment system. These goals are chemical concentrations that are defined as protective of human health and the environment. These goals are similar to the final cleanup levels that will be presented in the basewide groundwater ROD but are not enforceable standards. Table 5-1 presents the interim cleanup goals for the WABOU groundwater sites.

The Air Force will treat the extracted groundwater until contaminants have been reduced to the discharge standards presented in Section 6.0.

TABLE 5-1
Interim Cleanup Goals for Groundwater COCs

Site Name	Groundwater COC	Interim Cleanup Goal (μg/L)	California MCL[a] (μg/L)	Federal MCL (μg/L)	WABOU Reference Concentration[b]
Building 755 (DP039)	1,1-DCE	6	6	7	NA[c]
	1,2-DCA	0.5	0.5	5	NA
	1,1,1-TCA	0.5	0.5	5	NA
	1,1,2-TCA	0.5	0.5	5	NA
	acetone	5110	-	-	NA
	bromo-dichloromethane	100	100	100	NA
	methylene chloride	5	5	5	NA
	PCE	5	5	5	NA
	TCE	5	5	5	NA
Landfill 3 (LF008)	aldrin	0.023	-	-	0.023
	alpha-chlordane	0.1	0.1	2	0.02
	heptachlor	0.01	0.01	0.4	0.02
	heptachlor epoxide	0.01	0.01	0.2	0.024
Building 905 (SS041)	heptachlor epoxide	0.01	0.01	0.2	0.024
Building 916	PCB-1254	1.02	-	-	NA
(SD043)	TCE	5	5	5	NA

[a] MCL = Maximum Contaminant Level (RWQCB, 1995) for drinking water
[b] The discussion of the WABOU reference concentration is found in Section 3.3.
[c] NA – Not Applicable

5.5 Treated Water Disposal

In general, treated water from the groundwater treatment systems at all four WABOU groundwater sites will be used as beneficial use water during the dry summer months and will be discharged into Union Creek during the wet winter months. Three possible beneficial uses of the treated water are landscape irrigation of installation grassland, industrial uses such as aircraft or car washing, and dust suppression for construction activities. Travis AFB will use most of the reused treated groundwater for landscape irrigation. Travis AFB will discharge treated groundwater that cannot be beneficially used to the sanitary sewer operated by the Fairfield-Suisun Sewer District, if feasible, or to Union Creek. At times treated water may need to be discharged into Union Creek during the dry summer months if the need arises.

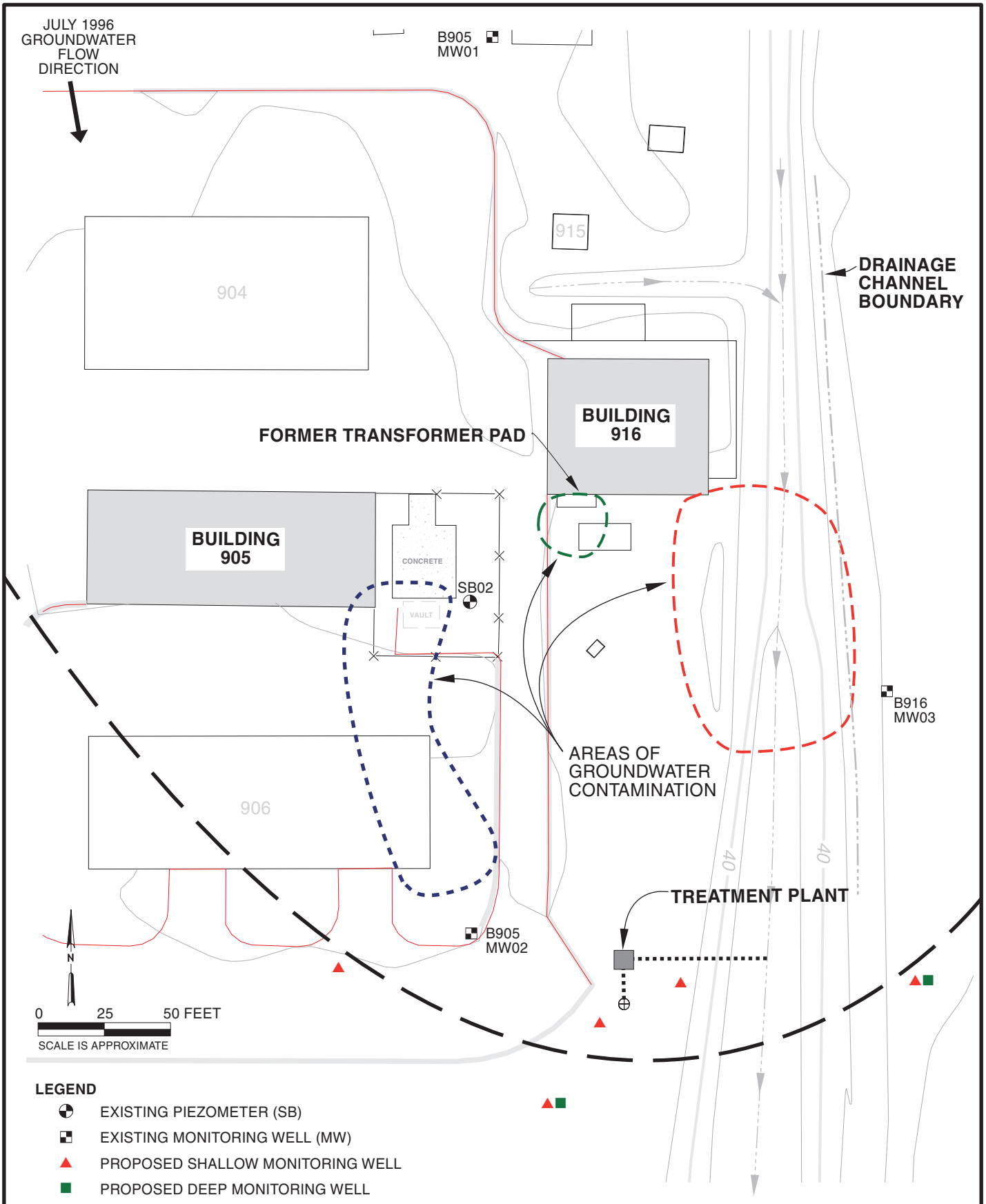

FIGURE 5-4
ALTERNATIVE G3 — CONTAINMENT/TREATMENT /DISCHARGE CONCEPTUAL DESIGN AT BUILDINGS 905/916
WEST/ANNEXES/BASEWIDE OPERABLE UNIT (WABOU)
WABOU GROUNDWATER IROD
TRAVIS AIR FORCE BASE, CALIFORNIA

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The NEWIOU Groundwater RD/RA Plan uses the Treated Groundwater Use Plan to strategize the specific use of treated groundwater and to estimate irrigation and industrial needs for the Base. This Plan also contains a decision matrix that outlines the rationale and method for treated groundwater discharge at Travis AFB. The WABOU addendum to this Plan will follow this approach.

The volumes of treated groundwater discharged to Union Creek will be estimated and measured during the RD/RA phase to ensure there are no adverse impacts to Union Creek. Groundwater extraction and treatment will take place in phases, which will gradually increase the amount of treated water available for use. By 1999, Travis AFB might extract and treat approximately 413 gallons per minute (gpm) from both NEWIOU and WABOU groundwater sites. The Treated Groundwater Use Plan presents the assumptions used to derive this rate.

Before the treated water reaches Union Creek, it is sampled and analyzed to verify that it meets appropriate water quality standards. The Air Force will meet the discharge requirements for treated groundwater as presented in Section 6.0. Additional NPDES substantive requirements for sampling, monitoring, and reporting will be established for each new discharge. These requirements will be based on the descriptions of treatment units with schematic drawings and design criteria, operation and maintenance procedures, results of chemical analyses of untreated groundwater (influent) at each site, projected maximum concentrations, projected flow rates, topographic maps showing exact locations of proposed discharges, and other appropriate data. These NPDES substantive requirements will be presented in each site-specific WABOU RD/RA work plan. Discharges of treated water to Union Creek are subject to approval by the SFBRWQCB.

5.6 Land Use Restrictions

The Air Force has land use restrictions in place at the four WABOU groundwater sites. These administrative actions restrict the use of onbase groundwater from these contaminated sites. Travis AFB does not currently use its onbase groundwater for drinking water. These actions also restrict soil excavation and other subsurface work where the excavation worker will encounter contaminated groundwater or vapors. These subsurface activities are only allowed after environmental and worker safety control measures are in place. Travis AFB uses its digging permit program to coordinate, and if necessary, restrict contractor and Base personnel access to contaminated areas. In addition, Travis AFB will amend its General Plan to document additional land use restrictions, once the final remedial actions are selected in the basewide groundwater ROD. A detailed description of the existing land use restrictions at the four WABOU groundwater sites will be included in the addendum to the NEWIOU Groundwater RD/RA Plan.

Groundwater beneath Travis AFB is not used to provide potable water to the Base; so the Air Force does not need a contingency plan to replace the onbase water supply.

5.7 Groundwater Monitoring

Groundwater monitoring will be used at all WABOU groundwater sites to document the effectiveness of the interim actions. The details of the groundwater monitoring strategy at each site, such as monitoring well locations and sampling interval, will be presented in the site-specific RD/RA work plans. Groundwater monitoring of each treatment system will be

initiated during the RA and will be transferred to the Travis AFB Groundwater Sampling and Analysis Program (GSAP) after a period of at least one year.

5.8 Statutory Determinations

This section discusses the applicability and compliance of the following statutory determinations:

- Protectiveness
- Applicable or Relevant and Appropriate Requirements
- Cost-Effectiveness
- Use of Permanent Solutions, Alternative Treatment, or Resource Recovery Technologies
- Preference for Treatment as a Principal Element
- State and Community Acceptance

5.8.1 Protectiveness

These selected remedies are protective of human health and the environment in the short term and are designed to increase protection until the final basewide groundwater ROD is signed. They achieve protection by removing source areas of contamination that can cause the degradation of the local groundwater for a long time. They also prevent the migration of contaminated groundwater beyond the current plume boundaries.

5.8.2 Applicable or Relevant and Appropriate Requirements

The selected remedies comply with state and federal ARARs. The groundwater ARARs are presented in Section 6.0.

5.8.3 Cost-Effectiveness

The technologies selected in implementing the groundwater remedial actions at each site are the most cost-effective technologies that can meet the WABOU Remedial Action Objectives. The details of the technology selection are presented in Appendix C of the WABOU FS.

5.8.4 Use of Permanent Solutions, Alternative Treatment, or Resource Recovery Technologies

The selected remedies utilize permanent solutions to the potential threats posed by groundwater contamination at each site to the maximum extent practicable. The use of innovative technologies such as DPE is designed to remove large quantities of contaminant mass before they are able to dissolve into the local groundwater. Standard pump-and-treat systems will be used to prevent plume migration and remove dissolved contamination. MNA of dissolved chlorinated solvents is an innovative and cost-effective treatment strategy that may be capable of remediating contaminated groundwater.

5.8.5 Preference for Treatment as a Principal Element

Each remedy will effectively use active treatment to address the principal potential threats posed by contaminated groundwater. The evaluation of MNA, an in-situ treatment technology, is included as a component of the selected alternative for Building 755. The Air Force will use the groundwater treatment systems at each WABOU site to maximize contaminant

removal from the groundwater to the extent practicable. The Air Force will also determine whether MNA is an appropriate treatment technology for Building 755.

5.8.6 State and Community Acceptance

The State of California (DTSC and SFBRWQCB) concurs with the Air Force and the U.S. EPA in the selection of the interim actions described in this section for the WABOU groundwater sites.

Based on the comments received during the April 8, 1998 to May 8, 1998, public comment period, the public has no preference of alternatives. The public comments received and the Air Force response is provided in Part III (Responsiveness Summary).

5.9 RD/RA Implementation and Schedule

The Air Force will implement the RD/RA in accordance with this IROD. In accordance with the Travis AFB FFA, the Air Force will present a schedule for completing and submitting the site-specific RD/RA work plans and RDs to the regulatory agencies within 21 days of signing the WABOU Groundwater IROD.

The WABOU RD/RA schedule is based on the Travis AFB IRP Priority Model. This model is a planning tool used by Travis AFB to prioritize funding and schedule remedial actions for IRP sites. Factors considered in this model include human health risk, offbase migration, ecological risk, public interest, MNA, mass of contaminants, groundwater concentration, capital cost, project execution, and projected funding levels.

Previously the Air Force created a NEWIOU Groundwater Remedial Design/Remedial Action Plan to describe the overall rationale for treatment and discharge of extracted groundwater for all NEWIOU groundwater sites. It also included the NEWIOU RD/RA schedule and a decision matrix for selecting the treatment technologies at each NEWIOU site. The Air Force will add an addendum to this work plan to include a detailed description of the treatment and discharge of extracted groundwater for the WABOU sites. The addendum will also include the WABOU RD/RA schedule. The Air Force will provide an opportunity for public participation during the Remedial Design phase.

Previously, the Air Force created a NAAP to provide the methodology used to evaluate the potential use of MNA at NEWIOU sites. The Air Force will add an addendum to the NAAP to include a description of the approach to be used for the evaluation of the MNA component of Alternative G5 at Building 755.

In addition to the addendum to the Groundwater NEWIOU RD/RA Plan, the Air Force will prepare a site-specific RD/RA work plan for each WABOU groundwater site. The site-specific RD/RA work plans will present the placement of monitoring wells, groundwater monitoring protocols and frequency, and procedures to determine whether plume migration above water quality objectives is occurring. The regulatory agencies will review each of the site-specific WABOU RD/RA work plans. If a contingency action is necessary to control migration, the Air Force will request funding and implement a contingency action as soon as funding becomes available.

If the RD investigation reveals an interaction between groundwater and a preferential pathway, then an appropriate remedial action will be proposed for the site and documented in an amendment to this Groundwater IROD. There is no potential for contaminated

groundwater to migrate along storm and sanitary sewer lines, based on a comparison of the highest measured level of the local water table with the location and depth of the local sanitary and storm sewer lines the WABOU. However, if future data collection suggests that contaminated groundwater has migrated to an area where interaction with preferential pathways is likely, the Air Force will investigate the potential interaction during the RD. At locations where the Air Force has verified the migration of contaminated groundwater to the storm sewer or Union Creek, the Air Force will expand the interim remedial action to control migration. The Air Force will continue to monitor the effectiveness of its interim actions to ensure that plume migration is controlled.

The Air Force will implement interim groundwater remedial actions as described in this WABOU Groundwater IROD. The Air Force will monitor all sites and will measure the change in contaminant concentrations. The Air Force will utilize the monitoring results to evaluate the potential for using the MNA component of Alternative G5 at Building 755. The Air Force and regulatory agencies will periodically review the analytical and performance data from these actions to verify their effectiveness and the need for additional action(s). The Air Force and regulatory agencies will hold a formal program review after the IROD is signed and after sufficient analytical and performance data have been collected. The purpose of the program review will be to determine the final basewide remedial actions and cleanup levels that are technically and economically feasible for each groundwater site at Travis AFB.

5.10 Documentation of Significant Changes

There have not been any significant changes to the selected remedies since the Air Force submitted the WABOU Groundwater Proposed Plan for public comment on April 8, 1998.