CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

MEETING OF NOVEMBER 12-13, 2008
BARSTOW, CALIFORNIA

ITEM: 10

SUBJECT: RESOLUTION AUTHORIZING THE EXECUTIVE OFFICER TO SIGN THE RECORD OF DECISION FOR THE SOUTH BASE, OPERABLE UNIT 2, EDWARDS AIR FORCE BASE, KERN COUNTY

CHRONOLOGY: This is a new item.

ISSUE: Should the Water Board concur with remedial actions proposed by the Air Force for ten sites and authorize the Executive Officer to sign the Record of Decision? The Board is asked to evaluate whether the proposed action complies with State requirements based on information presented with this item.

DISCUSSION: Edwards Air Force Base has submitted a Draft Final Record of Decision for proposed remedial actions for 11 sites at Operable Unit 2, South Base. These sites are located south of the Main Base area and directly west of Rogers Dry Lake. Contaminants, primarily solvents and jet fuel, are in soil and groundwater.

Numerous Interim Corrective Actions have been completed to date. The Air Force proposes the following:

1. No further actions at five sites;
2. Additional soil removal at two sites;
3. In-place closure and detection monitoring at one landfill; and
4. Active in-situ groundwater remediation at three sites.

In-situ aerobic biodegradation and chemical oxidation will used to remediate chlorinated solvents at three sites. The largest groundwater cleanup site has chlorinated solvents and co-mingled jet fuel. At this site a pump, treat, and re-injection system will also be operated to prevent down gradient contaminant movement during cleanup. The landfill and active groundwater cleanup sites will have Land Use Controls where necessary to address risks to human health or the environment.

The Air Force estimates that groundwater cleanup will achieve the primary drinking water standards for pollutants in about 12 years or less at all three sites. The proposed cleanup levels are the upper limits acceptable to the State. The State requires groundwater to be cleaned to background concentrations, or the lowest level technically and economically feasible if background cannot be achieved.

The Air Force demonstrated it is economically or technically infeasible to achieve background (e.g. non-detectable) concentrations of pollutants. Additionally, the Air Force has agreed to conduct additional analyses when cleanup is approaching the primary maximum contaminant level to evaluate if lower concentrations are achievable. The evaluation would be submitted to the agencies for review to determine if lower cleanup levels are appropriate.

The Air Force has estimated the area where contaminants will remain below the primary maximum contaminant and continue to disperse over time. Water Board staff recommends the Board allow this limited groundwater degradation because of the following.

1. Chlorinated solvents will be cleaned to levels below the primary drinking water standard by active cleanup.
2. The area of degraded groundwater will be localized.
3. There are no potential down gradient groundwater users that would be affected.
4. The groundwater gradient is relatively flat with little groundwater movement.
5. The existing naturally occurring groundwater is of marginal quality.

The Air Force does not accept that California State requirements such as the Basin Plan Water Quality Objectives for Secondary drinking water standards, Resolution 68-16, and Resolution 92-49 are requirements for this remedial action from a legal perspective. However, it has complied with these requirements from a technical perspective. The ROD includes "agree-to-disagree" language that preserves each party's legal rights and allows the State to take further action if, in the future, the State finds that the remedy does not comply with California State requirements. Water Board staff has evaluated the proposed remedial action and finds that it complies with State groundwater cleanup requirements.

The Water Board's role is to determine whether State requirements for cleanup are met and decide whether to concur with the Air Force's selected remedy. If the Water Board does not concur with the selected remedy, then specific direction should be provided to staff so that a Dispute Elevation process can be initiated under the Federal Facilities Agreement.

RECOMMENDATION: Adoption of Resolution as proposed.

Enclosures:

1. Proposed Resolution
2. Staff Report

JC/rp BO2008/EAFB OU2 ROD – Green Sheet

ENCLOSURE 1

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

RESOLUTION NO. R6V-2008(PROPOSED)
AUTHORIZING THE EXECUTIVE OFFICER TO SIGN
THE RECORD OF DECISION FOR SOUTH BASE, OPERABLE UNIT 2,
EDWARDS AIR FORCE BASE

Kern County

WHEREAS, the California Regional Water Quality Control Board, Lahontan Region, (Water Board) finds:

1. Edwards Air Force Base (EAFB) submitted a Revised Draft Final Record of Decision (ROD), dated September 19, 2008, for Operable Unit 2 (OU 2), South Base. The ROD describes proposed remedial actions at three sites with groundwater pollution, one old landfill, two sites with additional soil removal, and four sites with no further action.

2. After review of the Revised Draft Final ROD by regulatory agencies, EAFB has proposed changes that were discussed between technical and legal staff from the Air Force, US Environmental Protection Agency, Department of Toxics Substances Control, and the Water Board. These changes will be incorporated into the Final ROD for signature.

3. The Air Force and Water Board "agree-to-disagree" over whether certain State requirements are Applicable or Relevant and Appropriate Requirements for purposes of the remedial action.

4. Water Board staff agrees that the proposed remedial activities will comply with all technical aspects of Water Board applicable or relevant and appropriate requirements and are protective of water quality.

THEREFORE BE IT RESOLVED:

That the Lahontan Water Board authorizes the Executive Officer to:

1. Accept the remedial actions as proposed in the September 19, 2008, Revised Draft Final Record of Decision; and

2. Sign the Final Record of Decision provided that there are no significant changes between the Draft Final and the Final Record of Decision as described in the Water Board staff report with this item.

I, Harold J. Singer, Executive Officer, do herby certify that the foregoing is a full, true, and correct copy of a Resolution adopted by the California Regional Water Control Board, Lahontan Region, on November 12, 2008.

HAROLD J. SINGER
EXECUTIVE OFFICER

BO2008/EAFB ROD2/RESOLUTION

ENCLOSURE 2

STAFF REPORT

RECORD OF DECISION

SOUTH BASE, OPERABLE UNIT 2

EDWARDS AIR FORCE BASE

November 2008

California Regional Water Quality Control Board, Lahontan Region
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STAFF REPORT
EDWARDS AIR FORCE BASE
SOUTH BASE, OPERABLE UNIT 2, RECORD OF DECISION

1. Introduction

This staff report provides information for the California Regional Water Quality Control Board, Lahontan Region (Lahontan Water Board) to consider regarding whether it concurs with a Record of Decision (ROD) for remedial actions at Edwards Air Force Base (EAFB); Operable Unit 2 (OU 2), South Base. The ROD is a decision document prepared to comply with the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Following acceptance of the ROD, the Air Force will prepare work plans to implement the remedies. Table 1, below, summarizes the OU-2 ROD sites.

Water Board staff has reviewed the OU-2 ROD and concludes that the Air Force proposed remedies are in compliance with Water Board requirements as described further in this staff report. Water Board staff recommends the Water Board authorize the Executive Officer to sign the Final OU-2 ROD.

Table 1 – EAFB, OU-2, South Base Sites

Site No.	Site Name	Media Affected	Proposed Remedy
5/14	Site 5/14 Co-mingled Jet Fuel and Solvent Plume	• Soil	• No Further Action
		• Groundwater	• In-Situ Treatment & Land Use Restrictions
		• Vapor	• Land Use Restrictions
76	Old South Base facilities	• Soil	• No Further Action
		• Groundwater	• In-Situ Treatment & Land Use Restrictions
86	Building 300 Engine Test Cell	• Soil	• No Further Action
		• Groundwater	• In-Situ Treatment & Land Use Restrictions
29	Old South Base Landfill	• Soil	• In-Place Closure
		• Groundwater	• Long Term Monitoring
81	Old South Base – North Skeet Range	• Soil	• Excavation & Removal of skeet shards
102	Old South Base – South Skeet Range	• Soil	• Excavation & Removal of skeet shards
78	Old South Base Vehicle Maintenance Area 2	• Soil	• No Further Action
79	Old South Base Vehicle Maintenance Area 2	• Soil	• No Further Action
96	Old South Base Motor Pool	• Soil	• No Further Action
417	South Base Rocket Sled Track	• Soil	• No Further Action
69	Old South Base North Landfill	• Soil	• No Further Action

The staff report describes:

Section 2 – OU-2 sites and proposed actions,
Section 3 – natural groundwater quality and occurrence,
Section 4 – further discussion of sites where additional cleanup or groundwater protection is proposed,
Section 5 – a brief discussion of cleanup actions completed to date,
Section 6 – an evaluation of proposed cleanup levels and the effects of cleanup,
Section 7 – a groundwater degradation analysis,
Section 8 – an evaluation of how the proposed remedies comply with state requirements, and
Sections 9 & 10 – conclusion and recommendation.

2. South Base Sites Information

EAFB is located in the western Mojave Desert. The base, is a test facility dominated by two large dry lakebeds, Rosamond Dry Lake in the southwest corner of the base and Rogers Dry Lake in the center of the base. Figure 1 (attached) shows the base and OU-2 (South Base sites). Groundwater contaminants are primarily chlorinated solvents and compounds related to jet fuel JP-4. South Base was the original 1940's era military installation. In the 1980's the entire South Base was demolished, abandoned, or relocated to make way for a new Main Base runway. Figure 2 shows the individual OU-2 site locations.

The proposed remedies for sites discussed in this ROD can be divided into four categories as follows.

A. *Sites where no further action is proposed.*
Table 2 (attached) describes sites where no further action is proposed at Sites 69, 78, 79, 96 and 417. Interim remediation activities have been completed at these sites and the sites no longer pose a threat to water quality. Therefore, this report provides no further discussion of these sites.

B. *Sites where further soil removal actions are proposed.*
Table 3 (attached) describes two former skeet ranges (Sites 81 and 102) where skeet shard removal is proposed. These sites currently do not pose a water quality threat. Following shard removal, these sites will no longer pose a threat to human health or the environment. Therefore, this report provides no further discussion of these sites.

C. *Sites where groundwater is affected and active cleanup is proposed.*
Table 3 describes three areas (Sites 5/14, 76, and 86) where groundwater is affected, some interim actions are completed, and further groundwater cleanup is proposed. Table 4 (attached) describes alternatives that were evaluated. The proposed remedy is in bold. This staff report provides a further discussion of these sites, contaminants in groundwater, details of

the proposed remedy, and an evaluation of proposed groundwater cleanup levels.

D. *Landfill site where groundwater is not affected and long-term monitoring and closure in place is proposed.*
Table 3 describes a landfill (Site 29) where groundwater is not affected for closure of the landfill long-term groundwater monitoring and a final cover is proposed. Table 4 describes alternatives that were evaluated. The proposed remedy is in bold. This staff report provides a further discussion of this site and details of the proposed remedy.

In addition to the active cleanup proposed, Land Use Controls (LUCs), e.g. access restrictions implemented through the EAFB planning process, will be in place restricting intrusive activities at all sites.

3. OU-2 Groundwater Occurrence and Quality

The OU-2 sites are located on the western margin of Rogers Dry Lake as shown on Figure 2. The area topography is relatively flat. Stormwater runoff from the Main Base area is channeled out to Rogers Dry Lake over the OU-2 area via improved and unimproved drainage channels. The groundwater cleanup sites in OU-2 are located on the distal end of a thin, broad alluvial fan created by Mojave Creek that drains a small watershed northwest of the Main Base. Unconsolidated sediments are composed of about 85 feet of clay, silt, sand, clayey sand, silty sand and gravel over bedrock. The upper 30 feet of bedrock is highly weathered.

There are two primary water bearing zones of concern in this area related to the Lancaster Sub-basin; an Upper Aquifer and a Middle Aquifer. Groundwater in the Upper Aquifer occurs in weathered bedrock and unconsolidated alluvial material over it. The depth to groundwater in the OU-2 area is about 50 feet below ground surface and the groundwater gradient is relatively flat (0.001 feet per foot). The affected aquifer is a heterogeneous system of inter-bedded fine grain units. Contaminants in OU-2 groundwater are limited to the shallow portion (upper 30 feet) of the Upper Aquifer. Well yields for Site 5/14 extraction wells in the Upper Aquifer are relatively low (average about 2.5 gallons per minute) due to low hydraulic conductivity in the upper alluvial and weathered bedrock material.

The Middle Aquifer is the principal drinking water aquifer. In the southeastern portion of OU-2, near Rogers Dry Lake, the underlying bedrock dips sharply downward and contains over 750 feet of alluvial material. The closest Main Base water supply wells are located in the deeper portion of the Middle Aquifer about one mile southwest of the Site 29 landfill and are shown on Figure 2. Groundwater yield from these supply wells ranges from 400 to 750 gallons per minute. The Middle Aquifer has a higher yield than the Upper Aquifer because it has higher hydraulic conductivity and the wells are screened over a longer distance. These wells are screened from 220 to 690 feet below ground surface, deeper than where

contaminants reside, and would not affect contaminant transport over time. The Middle Aquifer is not affected by contaminants from OU-2 sites.

The water quality of selected inorganic naturally occurring constituents in the Upper Aquifer is shown in Table 5, below.

Table 5 - Concentration Range of Selected Natural Inorganic Constituents (mg/L) — with respect to Maximum Contaminant Levels (MCLs)

Constituent	Range	Median	Primary MCL	Secondary MCL
Arsenic	< 0.005 – 0.07	0.014	0.01	None
Chromium, Total	<0.01 – 3.7	0.018	0.05	None
Manganese	0.011 – 1.6	0.12	None	0.05
Chloride	6.5 – 446	118	None	250 – recommended 500 – upper 600 – short term
Sulfate	49.7 – 321	90.4	None	250 – recommended 500 – upper 600 – short term
Total dissolved solids	110 – 1,040	424	None	500 – recommended 1,000 – upper 1,500 – short term

This data show the naturally occurring water quality in the Upper Aquifer is marginal. About one-half of the groundwater samples collected exceeded the arsenic primary maximum contaminant level (MCL) of 0.010 mg/L. Over one-half of the samples exceed the manganese secondary MCL of 0.05 mg/L. Both primary and secondary MCLs are generally met for other inorganic constituents.

4. OU-2 Sites with Further Groundwater Cleanup or Protection Proposed

This section discusses the three sites with further groundwater cleanup proposed and one landfill where a final cover will be installed.

A. Site 76 Groundwater Pollution – Site 76, shown on Figure 3, is the smallest of the three groundwater plumes and contains primarily TCE, although trace concentrations of other organics are present. Table 6 below, provides a summary of current site conditions.

Table 6 – Site 76 Plume (Old South Base Facilities)

Parameter	Result
Plume area (> pMCL)	1.0 acres
Plume area (> background)	1.8 acres
Plume volume (> pMCL)	3.0 acre-feet
Plume volume (> background)	6.0 acre feet
Dissolved TCE mass	0.1 lb
TCE, maximum concentration	29 ug/L

The proposed Site 76 remedy consists of:

a. In-situ chemical oxidation using vertical wells to inject chemical reagents to remediate TCE in about 5 years.
b. Groundwater monitoring to evaluate remedy effectiveness.
c. Land Use Controls.
d. When TCE concentrations approach the primary MCL, evaluate the lowest contaminant levels for all constituents remaining that are technically and economically achievable.

B. ***Site 86 Groundwater Pollution*** – Site 86, shown on Figure 4, also contains primarily TCE, with trace concentrations of other organic constituents. Table 7 below, provides a summary of current site conditions.

Table 7 – Site 86 Plume (Building 300 Engine Test Cell)

Parameter	Result
Plume area (> pMCL)	2.6 acres
Plume area (> background)	4.4 acres
Plume volume (> pMCL)	8.0 acre-feet
Plume volume (> background)	13.0 acre feet
Dissolved TCE mass	0.2 lb
TCE, maximum concentration	83 ug/L

The proposed Site 86 remedy consists of:

a. In-situ aerobic biological degradation using vertical wells to inject air and gaseous nutrients to remediate TCE in about 5 years.
b. Groundwater monitoring to evaluate remedy effectiveness.
c. Land Use Controls.
d. When TCE concentrations approach the primary MCL, evaluate the lowest contaminant levels for all constituents remaining that are technically and economically achievable.

C. ***Sites 5/14 Groundwater Pollution*** – Sites 5/14, shown on Figure 5, is a commingled jet fuel JP-4 and chlorinated solvent plume. It is the largest groundwater plume in OU-2. This site contains dissolved phase jet fuel and other organic compounds, with major constituents listed below. It also contains free phase jet fuel on the water table. Table 8 below, provides a summary of current site conditions.

Table 8 – Site 5/14 Plume (Co-mingled Jet Fuel and Solvent Plume)

Parameter	Result
Plume area (> pMCL)	77.5 acres
Plume area (> background)	100 acres
Plume volume (> pMCL)	234 acre-feet
Plume volume (> background)	302 acre feet
Dissolved TCE mass	63 lb

Parameter	Result
Dissolved JP-4 mass	950 lbs
Free-phase JP-4 volume	71,000 gal
Free-phase JP-4 area	6.5 acres
TCE, maximum concentration	270 ug/L
PCE, maximum concentration	6.9 ug/L
Xylenes, maximum concentration	400,000 ug/L

The proposed Site 5/14 remedy consists of:

a. In-situ aerobic biological degradation using about 60 vertical wells to inject air and gaseous nutrients to remediate floating jet fuel in about 10 years.
b. In-situ chemical oxidation using chemical agent injection using about 10 horizontal wells to remediate dissolved phase chlorinated solvents in about 11 years.
c. Continued operation and maintenance of the existing Site 14 groundwater extraction, treatment and re-injection system to create a hydraulic mound and prevent further plume movement.
d. Land Use Controls.
e. Groundwater monitoring to evaluate remedy effectiveness.
f. When TCE concentrations approach the primary MCL, evaluate the lowest contaminant levels for all constituents remaining that are technically and economically achievable.

D. Site 29 Landfill – Site 29, location shown on Figure 2, is the Old South Base Landfill. Historical groundwater data indicate that a low-concentration solvent release, primarily TCE, occurred. This release has naturally attenuated and a detection monitoring program will be implemented along with landfill closure in-place. Table 9 provides a summary of current site conditions.

Table 9 – Site 29 Status (Old South Base Landfill)

Condition	East Area	West Area
Operation	1950' – 1970's	1930's
Size	20 acres	3 acres
Status	7 cut-and-cover trenches 10 to 15 feet deep. In the mid-1980's, 60,000 cubic yards of South Base demolition debris deposited on top. Fair vegetative re-growth amongst debris	Waste buried, good vegetative re-growth

The Water Board considers Site 29 an existing Class III landfill that is subject to closure, post-closure and monitoring requirements contained in title 27, California Code of Regulations. The proposed remedy consists of:

a. Implement Land Use Controls.
b. Implement groundwater detection monitoring consisting of a sampling event every two years.
c. Improve and maintain storm water drainage controls.

d. Construct subsurface fencing to prevent access by burrowing animals
e. Remove an estimated 60,000 cubic yards of surface debris. Concrete will be stockpiled for future use as a road base. Metals will be recycled.
f. Non-recycled waste will be sent to a landfill.
g. Regrade landfill cover to fill in depressions and prevent ponding.
h. Ensure cover isolates buried waste from stormwater.
i. Apply soil stabilizer and let the site naturally re-vegetate.

Tables 2, 3 and 4 (attached) give additional details on the proposed remedies, actions completed to date, and alternatives evaluated.

5. Interim Actions Completed

As shown in Tables 2 and 3 in the columns titled "Interim Actions Completed", the Air Force has also completed numerous cleanup actions to date, collected soil cleanup confirmation samples, and has continued groundwater monitoring throughout development of the remedies proposed in the ROD. The interim actions have removed leaking underground storage tanks and other piping and infrastructure that were the source of pollutants to groundwater. Further, the soil cleanup actions to date have remediated all contaminated soils to levels that no longer pose a threat to groundwater. Further groundwater cleanup is required only for Sites 76, 86, and 5/14. Closure in place and long-term groundwater monitoring is proposed for Site 29. The Air Force is currently removing about 60,000 cubic yards of debris from the top of the Eastern portion of Site 29.

6. Remedy and Proposed Cleanup Levels

The Air Force proposes to cleanup groundwater only to a primary MCL for those constituents for which a state or federal primary MCL is established. Table 10 below, lists the sites with groundwater pollution and describes the proposed groundwater cleanup goals stated in the OU-2 ROD.

Table 10 – Proposed EAFB OU-2 Groundwater Cleanup Levels

Constituent	Cleanup Levels (ug/L)	Applicable to:		
		Site 76	Site 86	Site 5/14
Benzene	1			X
Carbon tetrachloride	0.5			X
Tetrachloroethene (PCE)	5			X
Trichloroethene (TCE)	5	X	X	X
Ethylbenzene	300			X
Xylenes	1,750			X

The Site 5/14 plume is currently contained by a series of groundwater extraction wells located at its down gradient extent. Groundwater is extracted, treated by granular activated carbon and re-injected to provide hydraulic control of the plume. The proposed maximum effluent concentrations are shown in Table 11,

below, with a treatment goal of non-detectable concentrations for organic constituents. The maximum effluent concentration is one-half of the primary MCLs. Effluent from this system has historically achieved non-detectable concentrations of chlorinated solvents. The Air Force agrees to continue operating the system in the same manner and so it is expected that the system will continue to achieve non-detectable concentrations the majority of time. Water Board staff accepts the proposed levels as satisfying state requirements.

Table 11 – Proposed EAFB OU-2 Treated Water Maximum Concentrations

Constituent	Site 14 Injection Levels (ug/L) [1/2 of primary MCL]
1,2-dichloroethane	0.25
Cis-1,2-dichloroethene	3
Trans-1,2-dichloroethene	5
Tetrachloroethene (PCE)	2.5
Trichloroethene (TCE)	2.5

The proposed in-situ treatment remedies will restore groundwater beneficial uses except for constituents that naturally exceed primary or secondary drinking water standards such as arsenic. Two in-situ treatment methods are proposed: (a) aerobic biological degradation by injecting air and gaseous nutrients to remediate floating jet fuel and (b) chemical oxidation by injecting chemical reagents to remediate dissolved phase chlorinated solvents.

Pilot tests were conducted to evaluate both technologies. Jet fuel remediation will likely use a specific product technology injecting air, methane, nitrous oxide and triethyl phosphate to stimulate bacteria that biodegrade contaminants such as benzene and naphthalene. Potassium permanganate (chemical name $KMNO_4$) will be the likely reagent used for treating chlorinated solvents due to its high oxidation potential. Manganese oxide would be produced and precipitate in the aquifer. Chloride levels would slightly increase as chlorinated solvents are reduced. Manganese and total chromium were the only metals observed to increase, although not substantially, nor to levels that affect groundwater beneficial uses.

Preferential lateral and vertical flow paths exist due to inherent soil heterogeneities created by sediment deposited over time with varying amounts of sand, silt and gravel. Technical staff have consensus that this challenge can be overcome by careful monitoring, and adjusting the reagent concentration and injection timing and placement of injection wells with regard to soil lithology.

7. Degradation Analysis

The Air Force submitted a degradation analysis called a Technical and Economic Feasibility Analysis, dated August 21, 2008. This analysis and subsequent information evaluated: (1) groundwater cleanup to background (non-detectable), (2) groundwater cleanup to the primary MCL, and (3) the degradation remaining

in groundwater after cleanup. Because the Air Force proposes to clean up groundwater only to primary MCLs, groundwater degradation with chlorinated solvents will remain above background (non-detectable), but less than the primary MCL (5 ug/L). Table 12 describes the degree of degradation remaining after cleanup to primary MCLs.

Table 12 – Degradation Analysis Summary

Condition	Site 76	Site 86	Site 5/14
Time to cleanup groundwater to primary MCLs using in-situ treatment	5 yrs	5 yrs	12 yrs
Cost to cleanup groundwater to primary MCLs using in-situ treatment	$501,000	$1,184,000	$13,442,000
Time to cleanup groundwater to background using in-situ treatment	5 yrs	5 yrs	12 yrs
Cost to cleanup groundwater to background using in-situ treatment	$845,000	$2,224,000	$22,751,000
Down gradient migration distance of degraded water plume after cleanup to primary MCLs	780 ft	1,320 ft	1,420 ft
Maximum volume of degraded water after cleanup to primary MCLs	8 acre-ft @ 7 yrs	39 acre-ft @ 12 yrs	587 acre-ft @ 13 yrs
Time to reach background after cleanup to primary MCLs	18 yrs	39 yrs	89 yrs

NOTE: Costs in this table can not be directly compared to costs in Table 4 because the ROD uses a 2005 version of Remedial Action Cost Engineering and Requirements software (RACER) to compare alternative costs. This software is used to evaluate costs for all federal cleanup projects. The Degradation Analysis, which only evaluated cleanup to background or to maximum contaminant levels, used a 2008 version of RACER software.

This analysis indicated that when active cleanup stops (e.g. contaminant concentrations are less than primary MCLs and meet numerical water quality objectives), pollutants will degrade over time through dispersion and diffusion (e.g. dillution) for decades. These estimates are conservative and represent a "worst-case" scenario. The remaining degradation results from the following reasons.

a. In-situ treatment systems will be designed to treat to the primary MCL. Portions of the plume that are at concentrations above background, but less than MCLs, will not be treated and continue to migrate.
b. Sites 76 and 86 have no active hydraulic control to prevent down gradient pollutant movement during active cleanup. Reagent injection will occur at the leading edge of the plume designed to treat to the primary MCL. Concentrations above the primary MCL will not migrate, however concentrations less than the primary MCL will dilute into the aquifer.

c. The Site 5/14 groundwater extraction, treatment, and re-injection system is designed to capture contaminants only to the MCL. Contaminants at concentrations less than the primary MCL may escape full capture.
d. After cleanup, remaining contaminants at concentrations less than the primary MCL would continue to migrate and dilute into the aquifer.

State regulations require cleanup to the lowest concentrations that are technically and economically achievable. The Air Force completed its analysis to determine these levels. The Air Force also agrees to conduct a subsequent analysis at the time attaining primary MCLs is imminent to evaluate all data available at that time to determine if levels lower than primary MCLs are achievable. Water Board staff agrees that primary MCLs are appropriate groundwater cleanup goals to set in the ROD, provided the Air Force completes the additional evaluations as agreed.

8. Analysis With Respect to Water Board Requirements

The ROD describes areas where the Air Force and Water Board "agree-to-disagree" regarding whether some state criteria are Applicable or Relevant and Appropriate Requirements (ARARs) for purposes of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). In order to agree-to-disagree on the ARAR status, there must be technical compliance with the requirement. The remainder of this report focuses on staff's evaluation of the remedy for compliance with state requirements. Based on staff's review, the remedy complies with state requirements from a technical perspective and staff agrees that the proposed remedy is appropriate. Water Board staff and the Air Force have developed "agree-to-disagree" language explaining each party's legal position.

A. Requirement - Section 13304 of the California Water Code

The CA Water Code requires dischargers that have polluted, or threaten to pollute, groundwater to clean it up.

Analysis -
Water Board staff agree that the Air Force's proposed remedies to clean up groundwater at OU-2 satisfies Section 13304.

Status – Agree-to-Disagree

B. Requirement - State Water Board Resolution No. 92-49 (Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304).

This Policy sets forth criteria to be used during an investigation or cleanup of waste and requires that cleanup standards be consistent with State Board Resolution 68-16 (the non-degradation policy). State Board Resolution 92-49, Section III.G, and the Basin Plan require dischargers to cleanup and abate

the effects of discharges in a manner that promotes attainment of background water quality, or the best water quality which is reasonable if background levels cannot be restored. Alternative cleanup levels must, as a minimum, attain water quality objectives and be the lowest levels economically and technologically achievable in accordance with California Code of Regulations (CCR), title 23, section 2550.4. Groundwater cleanup must also attain secondary MCLs.

Analysis -

a. The proposed remedies are expected to reduce chlorinated solvents (such as TCE and PCE) and other constituents (such as benzene) to below the primary MCL in about 12 years. Water Board staff believe this is a reasonable cleanup time. In addition, the expected times that background water quality would be attained for the OU-1 groundwater sites, as shown in Table 12, are reasonable.
b. Water Board staff accepts that, based on current information, it is economically infeasible to attain background concentrations for the primary pollutants of concern.
c. The primary MCL is the upper limit allowed by State criteria, so this is acceptable.
d. A future analysis, to be completed when primary MCLs are about to be reached, will provide information to evaluate if groundwater cleanup levels lower than primary MCLs are technically and economically achievable. This future analysis will be based on data obtained during cleanup. If agreement is reached that lower cleanup concentrations can be achieved, the Air Force would make necessary system modifications to achieve those levels. If agreement is not reached, the FFA includes a dispute resolution process that can be utilized by the Water Board to elevate issues with technical or policy disagreement.
e. Current Air Force policy does not allow remedies that specify cleanup to secondary MCLs. Data from pilot tests indicate that contaminants with a secondary MCL such as naphthalene (a jet fuel constituent) and odor would attain secondary MCLs before TCE reaches its primary MCL (TCE does not have a secondary MCL). Therefore, Water Board staff expects the Air Force will attain secondary MCLs for those contaminants that have a secondary MCL.
f. Water Board staff accepts that the proposed remedies are in technical compliance with Resolution 92-49.

Status - Agree-to-Disagree

C. Requirement - State Water Board Resolution No. 68-16 (Statement of Policy with Respect to Maintaining High Quality of Waters in California).

This resolution provides that no degradation is allowed unless certain conditions are met. The State considers migration of contaminants into areas of high quality groundwater to be a discharge of waste subject to this policy.

For example, when cleanup to primary MCLs is attained at Sites 5/14, 76, and 86, pollutants remaining below the MCL but above background levels will disperse into the aquifer, and Resolution No. 68-16 applies. This policy also applies to the discharge of pollutants from treatment systems, such as the groundwater extraction and treatment system at Site 5/14.

In allowing degradation, the policy requires that the Water Board find that any change in water quality:

- Is consistent with maximum benefit to people of the state;
- Will not unreasonably affect present and anticipated beneficial use of such water; and
- Will not result in water quality less than that prescribed in the policies.
- Further, any activity must result in best practical treatment or control of the discharge to assure that:
  - A pollution or nuisance will not occur; and
  - The highest water quality consistent with maximum benefit to the people of the state will be maintained.

Analysis -

a. Based on available data, cleanup of polluted groundwater as proposed is consistent with maximum benefit to people of the state because it restores the highest beneficial use (Municipal) to water that is now polluted, except for naturally occurring pollutants. The projected cleanup time is reasonable (12 years for Site 5/14 and 5 years for both Sites 76 and 86). In addition, the expected times that background water quality would be attained for the OU-1 groundwater sites, as shown in Table 12, are reasonable. The proposed active cleanup is timely and cost effective when compared to other alternatives and is the least cost for tax-payers.
b. Cleanup of polluted groundwater will not unreasonably affect present and anticipated beneficial use of water because: (1) the Air Force has no current or planned use for such water and (2) when cleanup is completed, contaminants will meet the highest beneficial use (Municipal). There is not expected to be other sources of chlorinated solvents or petroleum contaminants that would use further assimilative capacity in this aquifer in this area.
c. Cleanup of polluted groundwater will not result in water quality less than prescribed in policies such as Resolution 92-49 or the Basin Plan. The subsequent degradation analysis will be based on actual operating data collected over the course of cleanup. This analysis will evaluate whether lower cleanup levels are technically or economically achievable. That analysis should also evaluate whether pollutant concentrations achieve secondary MCLs as expected.
d. Cleanup of polluted groundwater using in-situ treatment methods provides the best practical treatment or control technology to restore groundwater beneficial uses because these methods are cost effective, minimally intrusive, and achieve cleanup levels in a reasonable time frame. Treating

extracted groundwater containing chlorinated solvents with granular activated carbon prior to re-injection is also by best practical treatment or control.

e. Cleanup of polluted groundwater as proposed (leaving some degraded water behind) is to the maximum benefit to people of the state because:
   - Groundwater pollution is eliminated.
   - Groundwater beneficial uses are restored even while remaining contaminants attenuate.
   - Groundwater degradation remaining is only over a limited area.
   - Naturally occurring groundwater quality is marginal and there is sufficient assimilative capacity in the aquifer to absorb the remaining degradation without affecting beneficial uses.
   - No foreseeable groundwater users are affected because the Air Force controls the property and has no groundwater use planned for remaining degraded water.
   - The proposed alternative provides the least cost to taxpayers in comparison to other alternatives evaluated in the Feasibility Study.

Water Board staff concludes that some degradation would result after cleanup, but is justified given the above conditions. Water Board staff accepts that the proposed remedies comply with Resolution 68-16.

Status – Agree-to-Disagree

D. Requirement - Water Quality Control Plan for the Lahontan Region (Basin Plan)

Water Board staff considers the entire Basin Plan to be an ARAR, specifically the following elements for OU-2:

a. Table 2-2, Beneficial Uses for Groundwater of the Lahontan Region, Department of Water Resources Basin (DWR) Basin No. 6-44 (Antelope Valley), which are: Municipal (MUN), Agricultural (AGR), Industrial Service Supply (IND) and Freshwater Replenishment (FRSH).

   Analysis – The ROD acknowledges designated beneficial uses. This is the only portion of the Basin Plan the Air Force considers an ARAR.

b. The Nondegradation Objective, a restatement of Resolution 68-16, as found on page 3-2.

   Analysis – Compliance with non-degradation requirements is discussed in Section 7 (Degradation Analysis) and Section 8.C (Resolution 68-16) above.

Status: Agree-to-Disagree

c. Narrative and numerical groundwater quality objectives listed on page 3-11. These include primary and secondary drinking water standards.

   Analysis - Primary MCLs will be achieved. The subsequent degradation analysis, conducted when the cleanup is approaching primary MCLs, will evaluate whether concentrations less than primary MCLs are technically and economically achievable. This analysis should also evaluate whether secondary MCLs will be attained (primarily jet fuel contaminants such as naphthalene at Site 5/14). This evaluation will be provided to the agencies for review.

   Status – Agree-to-Disagree

d. Region Wide Prohibition 1 listed on pages 4.1-1 – "The discharge of waste which causes violation of any narrative water quality objective...including the non-degradation objective is prohibited."

   Analysis – In-situ cleanup of polluted groundwater at Sites 76, 86, and 5/14 will not cause violation of any narrative objective. A degradation evaluation is provided above.

   Status – Agree-to-Disagree

e. Region Wide Prohibition 2 listed on pages 4.1-1 – "The discharge of waste which causes violation of any numeric water quality objective ...is prohibited."

   Analysis – In-situ cleanup of polluted groundwater at Sites 76 and 86 will be performed in a manner that prevents contaminant exceeding the primary MCL from migrating.

   Status – Agree-to-Disagree

f. Region Wide Prohibition 3 listed on pages 4.1-1 – "Where any numeric or narrative water quality objective ... is already being violated, the discharge of waste which causes further degradation is prohibited."

   Analysis – Source areas that contributed to groundwater pollution have been cleaned up. As previously stated, some groundwater degradation will remain after cleanup to primary MCLs. The Basin Plan, Page 4.1-2, provides an exemption to prohibitions 1 -3 for restoration projects that:

   (1) Eliminate, reduce or, mitigate pollution,
   (2) Have no feasible alternative,
   (3) Minimize land disturbances,

(4) Incorporate Best Management Practices into the project, and
(5) In all other respects, comply with other plans, policies and laws.

These exemption criteria are met because: (1) sources of pollution are currently removed and cleanup eliminates remaining pollution, (2) in-situ treatment is the best practical treatment or control (e.g. best feasible alternative), (3) in-situ cleanup minimizes land disturbances, (4) best management practices include ongoing maintenance and monitoring; and for Site 5/14, hydraulic controls to prevent down gradient migration, and (5) the groundwater cleanup projects comply with state plans and policies., Thus, the cleanup projects qualify for an exemption to the prohibitions because the Basin Plan criteria are met.

Status – Agree-to-Disagree

g. Soil Cleanup Levels listed on pages 4.2-4 and 4.2-5. This narrative criterion requires soils to be cleaned to background or to levels that do not pose a risk to human health or the environment and be protective of groundwater quality objectives.

Analysis - Interim actions completed to date have reduced soil contaminants to levels where they do not pose a threat to groundwater.

Status – Agree-to-Disagree

Water Board staff accepts that the proposed remedies are in technical compliance with Basin Plan requirements.

E. Requirement - Title 27, California Code of Regulations (for landfills)

This regulation specifies landfill closure and post closure maintenance and monitoring requirements, procedures for completing groundwater corrective actions, and criteria for developing groundwater cleanup levels. Water Board staff considers Site 29 to be an "existing" unit. The Air Force considers Site 29 to be a "closed, abandoned, or inactive landfill" – which is a subset of existing units. Requirements applicable to Site 29 include the following.

- Implement groundwater Detection Monitoring Program.
- Develop a Groundwater Quality Protection Standard.
- Provide a final cover that isolates the waste from precipitation as least as well as the prescriptive cover.
- Provide storm water controls to divert and manage run-on and runoff and grading to prevent ponds and erosion.
- Conduct post closure maintenance of the landfill cover system.

Analysis -
The proposed remedy incorporates the above Title 27 elements. The final cover design will be designed and completed in the post-ROD Remedial Design/Remedial Action phase, which will occur within two years following the ROD. The Air Force proposes an alternative to the prescriptive landfill final cover requirements specified in Title 27. This is allowed in Title 27 and is acceptable provided the cover isolates the waste from stormwater infiltration and performs as well as the prescriptive cover would be expected to perform.

Water Board staff accepts that the proposed remedies are in technical compliance with title 27, California Code of Regulations requirements.

Status – Agree-to-Disagree

9. Conclusions

In July 2008, EAFB submitted a Draft Final ROD for OU 2; South Base. Water Board staff has reviewed the ROD and other available data and information. Water Board staff concludes that the proposed actions meet requirements of the Basin Plan, policies and regulations, and State law.

10. Recommendation

The Water Board is party to the EAFB FFA and is now asked to sign the OU-2 ROD if it concurs with the actions proposed by the Air Force. Staff recommends the Board adopt a resolution authorizing the Executive Officer to sign the EAFB OU-2 ROD.

FIGURES: (Attached)

1. Edwards AFB Area Map
2. Edwards AFB South Base Sites
3. OU-2 Site 76
4. OU-2 Site 86
5. OU-2 Sites 5/14

TABLES: (Attached)

2. EAFB, OU-2, South Base Sites – Further Action Proposed
3. EAFB, OU-2, South Base Sites – No Further Action Proposed
4. EAFB, OU-2, South Base Groundwater Sites – Alternatives Evaluated

JC/EAFB OU2 ROD-Staff Report

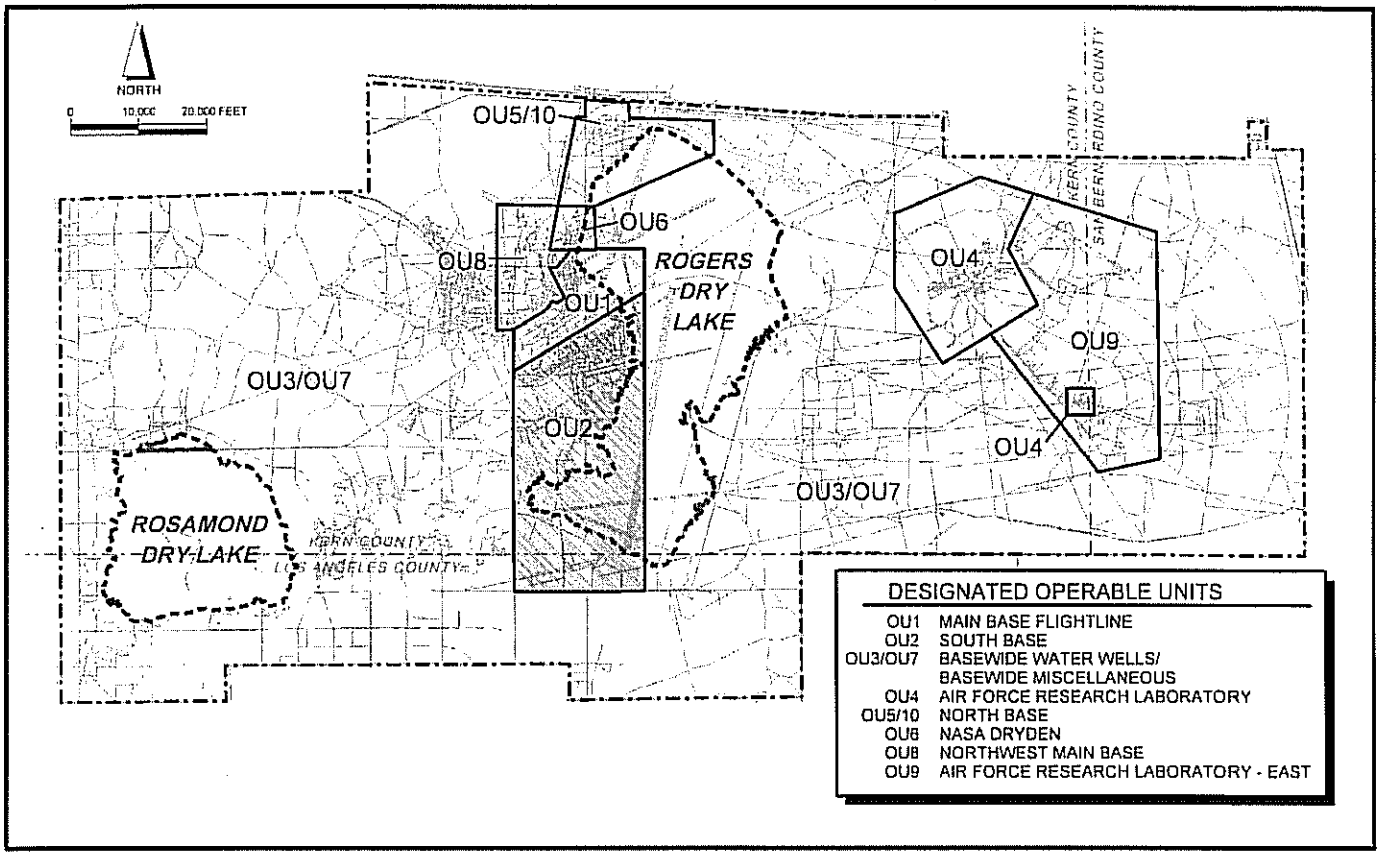

Figure 1 Edwards AFB Area Map

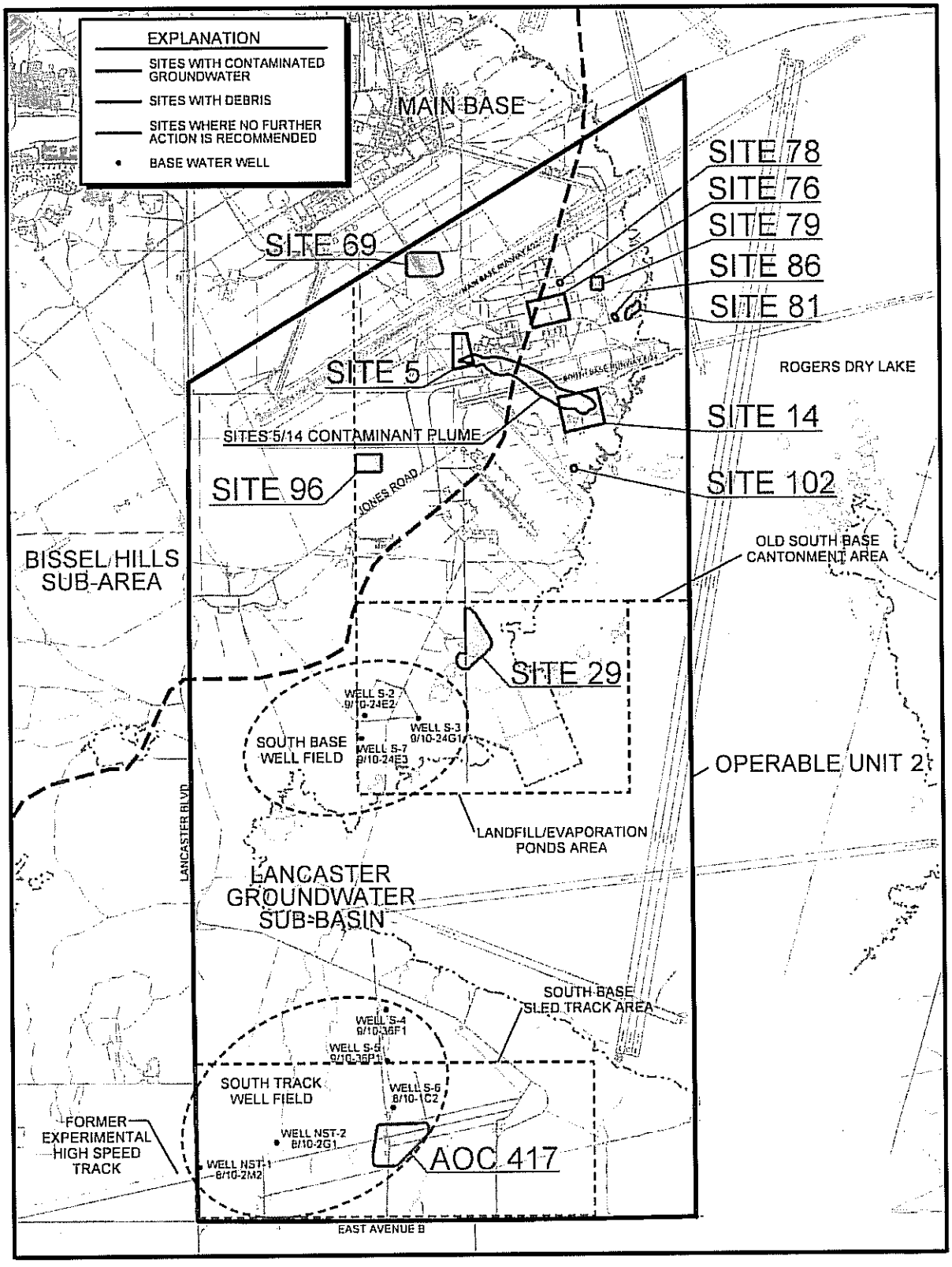

Figure 2 Sites and AOC in the Record of Decision for Operable Unit 2

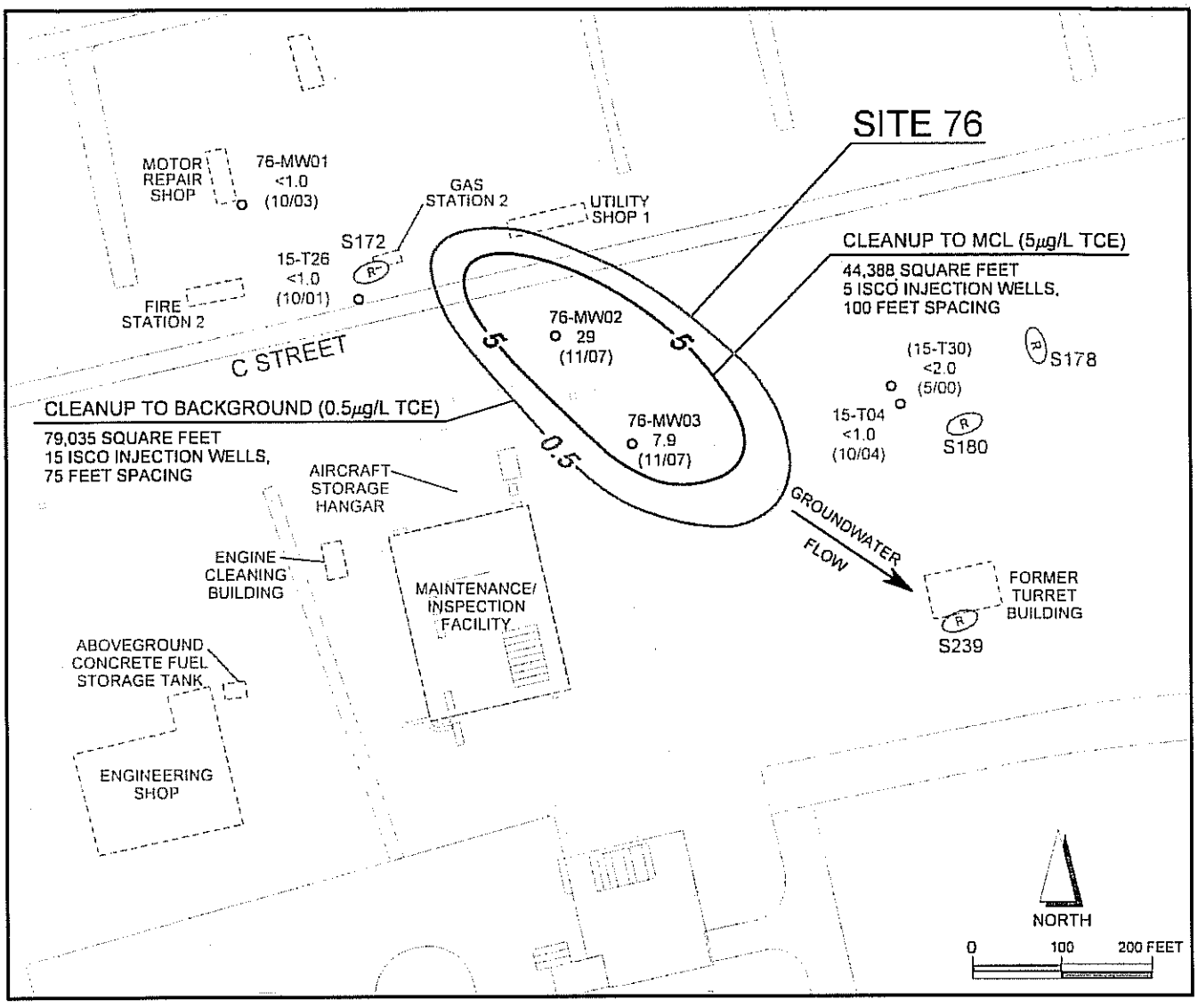

Figure 3 OU2 Site 76

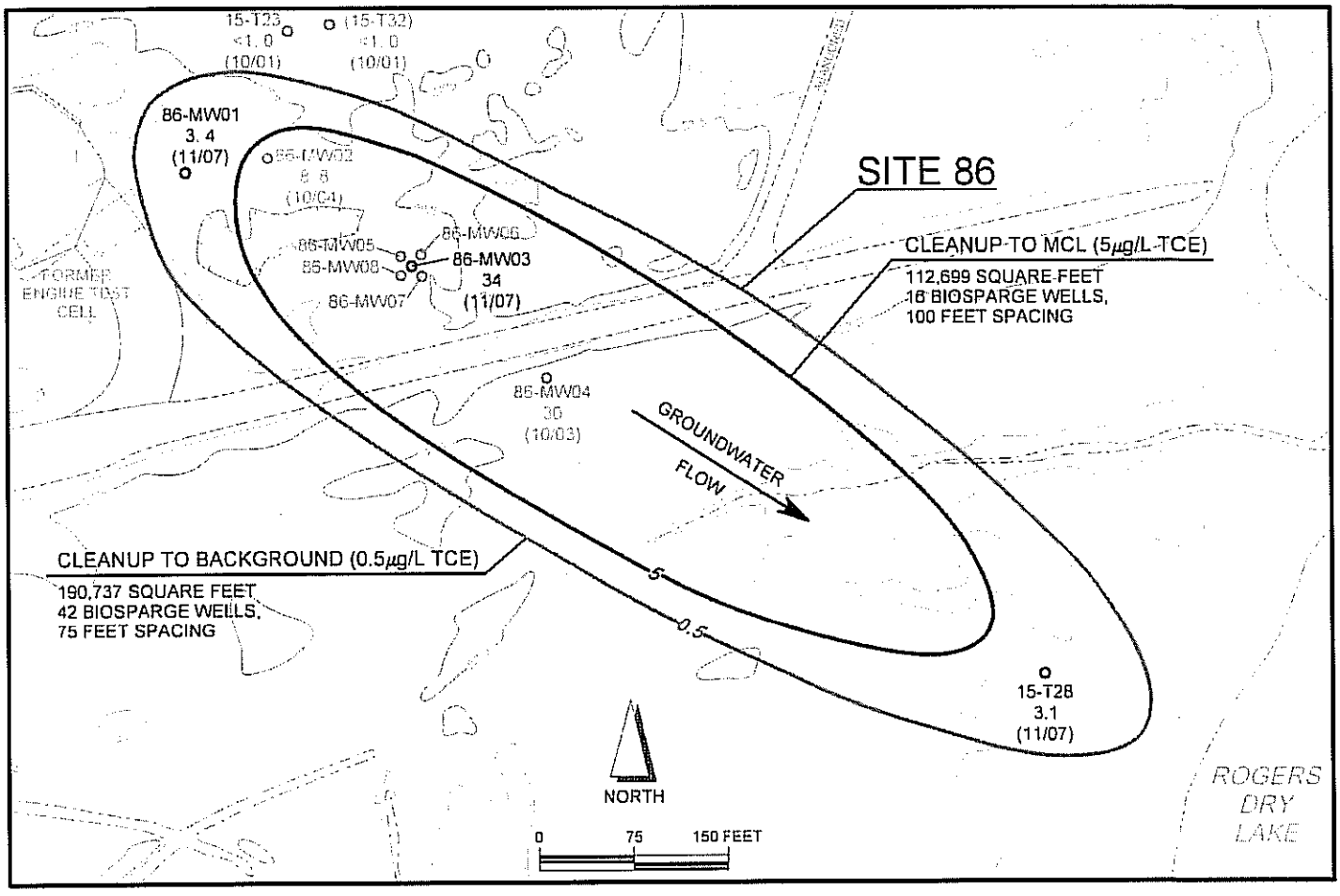

Figure 4 OU2 Site 86

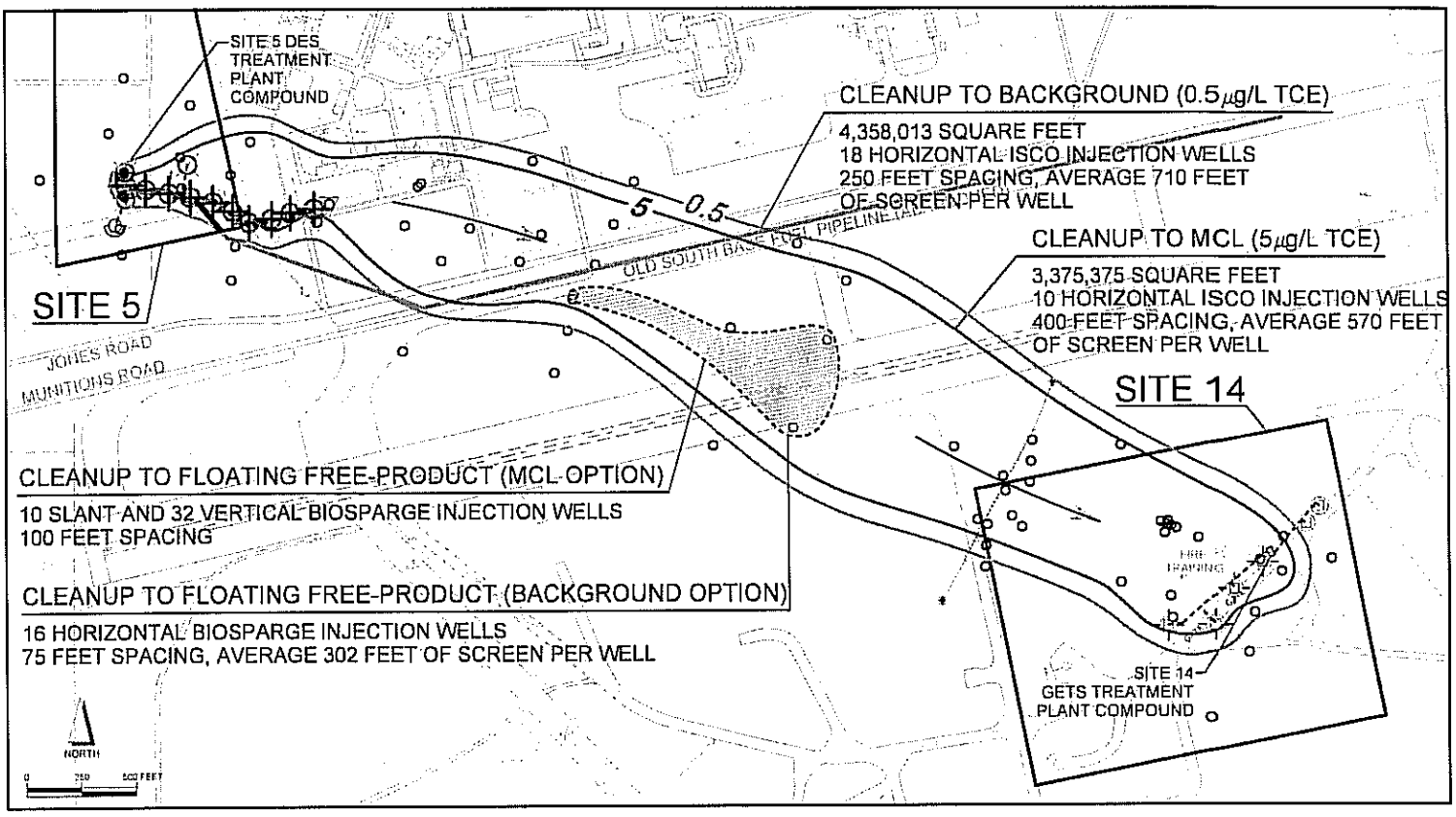

Figure 5 OU2 Sites 5/14

Table 2 – Edwards AFB OU-2 – South Base Sites – No Further Action Proposed

Site	Name	Description	Interim Actions Completed
78	Old South Base Vehicle Maintenance Area 2	1940's era vehicle wash rack, grease pit and sump	o Removed 3 cubic yards of soil, disposed off base o Nonmetallic debris disposed in EAFB Main Base landfill o Metallic debris recycled o Confirmation samples indicate no waste remaining o Backfilled with native soil o No groundwater threats remaining
79	Old South Base Vehicle Maintenance Area 1	1940's era vehicle repair shop, vehicle wash rack, grease pit, sump, former UST (removed), and pump house for former groundwater production well MB-05	o Removed 3 cubic yards of soil, disposed off base o Nonmetallic debris disposed in EAFB Main Base landfill o Metallic debris recycled o Confirmation samples indicate no waste remaining o Backfilled with native soil o No groundwater threats remaining
96	Old South Base Motor Pool	1940's era vehicle maintenance and storage yard, debris disposal pit, burn yard, and scattered refuse.	o Excavated four areas of 85 cubic yards of soil o Mixed with cement to stabilize metals and backfilled onsite o Onsite water well properly destroyed o No groundwater threats remaining
417	South Base Rocket Sled Track	53-acre former experimental high speed track and related facilities, including receiving station, electronics laboratory, photo shop, fabrication shop, supply shop, debris pit, drainage channel, former UST (removed), ASTs, burn area and former groundwater production well 1F1.	o 52 cubic yards of metallic and non-metallic debris excavated and recycled o 280 cubic yards of metals contaminated soil stabilized with concrete and disposed in place o UST removed o Onsite water well properly destroyed o No groundwater threats remaining

10-0029

Table 3 – Edwards AFB OU-2 – South Base Sites – Further Actions Proposed

Site	Name/Description	Interim Actions Completed	Proposed Post-ROD Action
5/14	Sites 5/14 Contaminant Plume – commingled groundwater plumes from former liquid fuels distribution system and former fire fighting training areas with free and dissolved product jet fuel and chlorinated solvents. Area – 77 acres Volume Affected: 234 acre-feet Dissolved JP-4 Mass: 950 lbs Dissolved TCE Mass: 63 lbs Free Phase JP-4 Vol: 71,000 gal Free Phase JP-4 Area: 6.5 acres	o Removed contents of 5 - 50,000 USTs which were backfilled with sand o Removed 22 USTs o Bioventing from 1995 to 1996 at UST Site S191 o Dual phase extraction at Site 5 removing 630, 641 pounds in the vapor phase, 1,035 pounds in the dissolved phase, 7,803 pounds in the free phase o 925 cubic yards of petroleum soil removed from Site 14 o Bioventing from 200 to 2005 at Site 14 o Containment groundwater extraction system at Site 14 removed 22.2 pounds in dissolved phase o Free product recovery of 22 o Air sparging at Site 5 o Free product recovery o Pilot study of reductive dechlorination using edible oil o Pilot study of in situ bioremediation using gaseous injection o Pilot study of in-situ bioremediation using a horizontal well to inject potassium permanganate reagent	Alternative 4 Preferred ▪ In-situ aerobic biological degradation using about 60 gaseous-phase nutrient injection wells to remediate floating jet fuel in about 10 years. ▪ In-situ chemical oxidation using chemical agent injection using about 10 horizontal wells to remediate dissolved phase chlorinated solvents in about 11 years. ▪ Continued Operation and Maintenance of the existing Site 14 groundwater extraction and treatment system to prevent further plume movement. ▪ Carbon treatment of extracted water and re-injection at the toe of the plume to create a hydraulic mound as barrier to flow. ▪ Land Use Controls to prevent human health exposure. ▪ When TCE concentrations approach the primary MCL, evaluate the lowest contaminant levels for all constituents remaining that are technically and economically achievable.
76	Site 76 – Old south Base Assorted Facilities - Dissolved phase chlorinated solvent plume from 1940's era vehicle maintenance area, motor repair shop, engineering shop, maintenance facility, utility shop, gas station, fire station, paint shop, and underground storage tanks. Area – 0.8 acres Volume Affected: 2.4 acre-feet Dissolved TCE Mass: 0.1 lbs	o None	Alternative 4 ▪ In-situ chemical oxidation using vertical wells to inject chemical reagents to remediate TCE in about 5 years. ▪ When TCE concentrations approach the primary MCL, evaluate the lowest contaminant levels for all constituents remaining that are technically and economically achievable.

10-0031

Site	Name/Description	Interim Actions Completed	Proposed Post-ROD Action
86	Site 86 – Building 300 Engine Test Cell - Dissolved phase chlorinated solvent plume from 1940's era engine test cell. Area – 2.8 acres Volume Affected: 8.3 acre-feet Dissolved TCE Mass: 0.5 lbs	o None	Alternative 4 ▪ In-situ aerobic biological degradation using vertical wells to inject air and gaseous nutrients to remediate TCE in about 5 years. ▪ When TCE concentrations approach the primary MCL, evaluate the lowest contaminant levels for all constituents remaining that are technically and economically achievable.
29	Site 29 – South Base Abandoned Sanitary Landfill - includes two former landfills a. Western landfill - 3 acres and operated in the late 1930's b. Eastern landfill – 20.8 acres and operated from the 1950's to the 1970's, Contains household and industrial waste, construction debris, asbestos containing material and possibly unexploded ordinance. Historical groundwater monitoring data indicate that low concentrations of organic solvents, primarily TCE, were detected in groundwater. Presently, all contaminant concentrations are either non-detectable or at trace levels (barely detectable).	o Chain link fence installed around landfill o 645 cubic yards of asbestos containing material removed to an authorized offsite disposal location	Alternative 3 ▪ Implement Land Use Controls ▪ Implement groundwater monitoring consisting of two sampling events every two years ▪ Improve and maintain storm water drainage controls ▪ Construct subsurface fencing to prevent access by burrowing animals ▪ Remove an estimated 60,000 cubic yards of surface debris. Concrete will be stockpiled for future use as a road base. Metals will be recycled. ▪ Non-recycled waste will be sent to a landfill. ▪ Re-grade landfill cover to fill in depressions and prevent ponding. ▪ Apply soil stabilizer and let the site naturally re-vegetate.
81	Site 81 – Old North Base Skeet Range – The site, used in the 1940's and 1950's, contains lead shot and broken clay target fragments.	o None	▪ Manual removal and offsite disposal or recycling of 5 cubic yards of skeet shards.
102	Site 81 – Old North Base Skeet Range – The site, used in the 1940's. Contains lead shot and broken clay target fragments.	o None	▪ Manual removal and offsite disposal or recycling of skeet shards

10-0032

Table 4 – Edwards AFB OU-2 – South Base Sites – Groundwater Alternatives Evaluated
Preferred Alternative in Bold – Escalated Costs Presented

Site	Name	Alternative 1	Alternative 2	Alternative 3	Alternative 4
5/14	Site 5/14 Co-mingled Jet Fuel and Solvent Plume	No Action	▪ Continued Operation and Maintenance of the existing Site 14 groundwater extraction, treatment, and re-injection system to prevent further plume movement. ▪ Land Use Controls to prevent human health exposure. Estimated Cost - $29,500,000 Time to Reach MCLs ~ 100 yrs	▪ Continued Operation and Maintenance of the existing Site 14 groundwater extraction, treatment, and re-injection system to prevent further plume movement. ▪ Installation of approximately 60 vertical dual-phase extraction wells and piping to remove and treat free phase jet fuel. ▪ Land Use Controls to prevent human health exposure. Estimated Cost - $17,600,000 Time to Reach MCLs ~ 50 yrs	**▪ In-situ aerobic biological degradation using about 60 gaseous-phase nutrient injection wells to remediate floating jet fuel in about 10 years.** **▪ In-situ chemical oxidation using chemical agent injection using about 10 horizontal wells to remediate dissolved phase chlorinated solvents in about 11 years.** **▪ Continued Operation and Maintenance of the existing Site 14 groundwater extraction, treatment and re-injection system to prevent further plume movement.** **▪ Carbon treatment of extracted water and re-injection at the toe of the plume to create a hydraulic mound as barrier to flow.** **▪ Land Use Controls to prevent human health exposure.** **Estimated Cost - $7,2800,000** **Time to Reach MCLs ~ 12 yrs**
76	Old South Base Facilities NOTE: Sites 76 & 86 costs are combined.	No Action	▪ Land Use Controls ▪ Long-term groundwater monitoring (annually) ▪ Natural attenuation of solvents Estimated Cost - $9,900,000 Time to Reach MCLs > 100 yrs	▪ Pump polluted groundwater from 4 extraction wells ▪ Treat with carbon ▪ Re-inject into aquifer with 2 wells ▪ Land Use Controls Estimated Cost - $1,300,000 Time to Reach MCLs ~5 yrs	**▪ In-situ chemical oxidation** **▪ Injection of chemical reagent in 5 wells** **▪ Land Use Controls** **Estimated Cost - $550,000** **Time to Reach MCLs ~ 5 yrs**

10-0033

Site	Name	Alternative 1	Alternative 2	Alternative 3	Alternative 4
86	Building 300 Engine Test Cell NOTE: Sites 76 & 86 costs are combined.	No Action	▪ Land Use Controls ▪ Long-term groundwater monitoring (annually) ▪ Natural attenuation of solvents Estimated Cost - $9,900,000 Time to Reach MCLs > 100 yrs	▪ Pump polluted groundwater from 16 extraction wells ▪ Treat with carbon ▪ Re-inject into aquifer with 8 wells ▪ Land Use Controls Estimated Cost - $2,225,000 Time to Reach MCLs ~5 yrs	▪ **In-situ aerobic biological degradation** ▪ **Injection of air and gaseous nutrients in 16 wells** ▪ **Land Use Controls** **Estimated Cost - $1,350,000** **Time to Reach MCLs ~ 5 yrs**
29	Old South Base Landfill	No Action	▪ Land Use Controls ▪ Long-term groundwater monitoring (every other year) ▪ Storm water drainage improvements ▪ Improved fencing ▪ If release detected, implement Evaluation Monitoring Program Estimated Cost - $2,300,000 Estimated Time ~ 30 yrs	▪ **Land Use Controls** ▪ **Long-term groundwater monitoring (every other year)** ▪ **Storm water drainage improvements** ▪ **Improved fencing** ▪ **If release detected, implement Evaluation Monitoring Program** ▪ **Removal of 60,000 cubic yards of surface debris placed in 1980's** ▪ **Improve existing landfill cover to protect groundwater** ▪ **Use soil stabilizer until site naturally revegetates** ▪ **Post-closure landfill cover maintenance** **Estimated Cost - $4,430,000** **Estimated Time ~ 30 yrs**	▪ Land Use Controls ▪ Long-term groundwater monitoring (every other year) ▪ Storm water drainage improvements ▪ Improved fencing ▪ If release detected, implement Evaluation Monitoring Program ▪ Install engineered landfill cover Estimated Cost - $11,000,000 Estimated Time ~ 30 yrs

NOTE: Costs in this table can not be directly compared to costs in Table 12 because the ROD uses a 2005 version of Remedial Action Cost Engineering and Requirements software (RACER) to compare alternative costs. This software is used to evaluate costs for all federal cleanup projects. The Degradation Analysis, which only evaluated cleanup to background or to maximum contaminant levels, used a 2008 version of RACER software.

10-0034