2.10 Summary of Comparative Analysis of Alternatives

In accordance with the NCP, the alternatives for groundwater at Travis AFB were evaluated using the nine (9) criteria described in Section 121(a) and (b) of CERCLA and 40 CFR Section 300.430(e)(9)(i) as cited in NCP Section 300.430(f)(5)(i). These criteria are classified as threshold criteria, balancing criteria, and modifying criteria.

Threshold criteria are standards that an alternative must meet to be eligible for selection as a remedial action. There is little flexibility in meeting the threshold criteria—the alternative must meet them or it is unacceptable. The following are classified as threshold criteria:

- Overall protection of human health and the environment
- Compliance with, or an applicable waiver of ARARs

Balancing criteria weigh the tradeoffs between alternatives. These criteria represent the standards upon which the detailed evaluation and comparative analysis of alternatives are based. In general, a high rating on one (1) criterion can offset a low rating on another balancing criterion. Five (5) of the nine (9) criteria are considered balancing criteria:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying criteria, which may be considered to the extent that information is available during the FFS, but can be fully considered only after public and regulator comments, are as follows:

- Community acceptance
- State/support agency acceptance

The following sections summarize how well each alternative considered for a site satisfies each evaluation criterion and indicates how it compares with the other alternatives under consideration. Relative rankings of the alternatives considered for each site are presented in Tables 2.10-1 through 2.10-20.

2.10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment and/or LUCs.

No Further Action generally does not satisfy this threshold criterion. Overall risks of exposure to COCs are relatively small because groundwater is not currently used, no drinking water wells are threatened, and no buildings are overlying areas posing potential indoor air risks. However, there are no provisions to limit direct contact of humans with groundwater until concentrations of COCs allow for designated beneficial uses of groundwater (domestic, municipal, agricultural, and industrial supply) as well as unlimited

use and unrestricted exposure and indoor air until concentrations of volatile COCs in groundwater posing a potential indoor air risk are at such levels that VOCs emanating from groundwater to indoor air do not pose unacceptable risk to human health (refer to Table 2.8-2). There are no provisions to reduce or monitor reductions in concentrations of COCs and associated risks.

The remaining alternatives include monitoring to provide early warning if drinking water supply wells, agricultural wells, or human receptors are threatened and LUCs to limit direct contact of humans with groundwater until concentrations of COCs allow for designated beneficial uses of groundwater (domestic, municipal, agricultural, and industrial supply) as well as unlimited use and unrestricted exposure and until concentrations of volatile COCs in groundwater posing a potential indoor air risk are at such levels that VOCs emanating from groundwater to indoor air do not pose unacceptable risk to human health. For the off-base plumes originating from Subarea LF007C and Sites FT005 and SS030, Travis AFB's existing access and environmental response easements contain legal restrictions preventing the landowners from engaging in water development or soil disturbing activities that could interfere with cleanup activities. These alternatives have also demonstrated the capacity to reduce concentrations of COCs and associated risks.

2.10.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and NCP Section 300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations, which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA Section 121(d)(4).

The alternatives have common ARARs under CERCLA Section 121(d)(2) associated with groundwater performance monitoring, cleanup levels, and LUCs. Federal MCLs are a relevant and appropriate requirement for groundwater except when there is no federal MCL for a COC or the state MCL for that COC is more stringent than the federal MCL. Groundwater does not currently meet MCLs for VOCs (primarily TCE) and organochlorine pesticides (primarily alpha-chlordane). ARARs for Travis AFB groundwater are included as Appendix C – Summary of ARARs and TBCs.

As demonstrated by the IRAs and current monitoring data, COCs in groundwater have decreased over time, have achieved the MCLs at Subarea LF007B (additional monitoring is required) and Site SS041, and have the potential to achieve the MCLs at the remaining sites. Because no provisions exist to monitor and confirm compliance with ARARs, No Further Action does not satisfy this threshold criterion. Therefore, the No Further Action alternative is not considered further in the comparative analysis of alternatives.

At Sites FT004 and LF006, Subareas LF007B and LF007D, and Sites LF008, ST027B, SD031, SD033, SS035, and SD043, a continuing source is absent, and natural attenuation processes have already reduced COCs, indicating that the sites are suitable for MNA (Alternative 2). COCs at Subarea LF007B are less than MCLs and at Site LF006 are less than or near MCLs. At Subarea LF007B, although current monitoring data already indicate COC concentrations less than MCLs, monitoring will continue at least 2 more years to meet regulatory agencies' requirements to confirm that cleanup levels have been achieved. Current concentrations of TCE at Site LF006 are 7.1 µg/L, compared with the cleanup level of 5 µg/L. The existing

well networks are adequate to monitor natural attenuation processes and compliance with ARARs.

At Site LF008, Alternative 3 – GET, also evaluated for the site, has a lower potential of achieving the MCLs and complying with chemical-specific ARARs than Alternative 2. After 7.5 years of GET, no significant change in pesticide concentrations was evident (see Section 2.2.5.6). A rebound study was initiated, and results indicate that the COCs are not dissolved in groundwater but rather sorbed to the fine soil particles suspended in the groundwater.

Alternative 3 – GET has a high potential of achieving the MCLs and complying with chemical-specific ARARs at Site FT005, Subarea LF007C, and Sites SS029 and SS030. Although decreasing COC concentration trends over the course of the rebound study initiated in 2007 and a receding plume may indicate that Alternative 2 – MNA may effectively achieve MCLs at Site FT005, recently observed increases in the concentrations of COCs at some wells indicate that GET may be more likely to achieve MCLs. At Subarea LF007C and Site SS030, only GET was evaluated because COCs have migrated beyond the Base boundary, and hydraulic capture of the plume is required. Optimization measures were conducted at Subarea LF007C and Site SS030 in 2011-2012, which improved mass removal rates (see Section 2.2.2). At Site SS029, only GET was evaluated because COCs are near the southern Base boundary, and it is required to hydraulically capture the plume. A supplemental study was conducted at Site SS029 in 2012 to evaluate optimization of the GET system (see Section 2.2.6).

At Subarea LF007C, Alternative 3 – GET must also comply with location-specific ARARs regarding the operation and optimization of the GET system within a well established vernal pool. Operational constraints with the GET system have been resolved with the USFWS.

At Sites SS015, SS016, SD036, SD037, and DP039, COC concentrations indicate the presence of DNAPLs; therefore, reductions in COCs dissolved in groundwater and achieving cleanup levels may be more difficult with Alternative 2 – MNA compared with Alternative 5 – EVO and EA evaluated for Site SS015, with Alternative 3 – GET compared with Alternative 4 – Bioreactor and GET evaluated for Site SS016, Alternative 3 – GET compared with Alternative 5 – EVO and EA evaluated for Sites SD036 and SD037, and Alternative 3 – GET compared with Alternative 6 – Bioreactor, Phytoremediation, EVO PRB, and EA evaluated for Site DP039. Alternatives 4, 5, and 6 provide for additional treatment of the highest residual concentrations of COCs in groundwater. EVO injections conducted at Sites SS015, SD036, SD037, and DP039 have successfully demonstrated the viability of in situ ERD treatment processes, and performance monitoring results indicate contaminants are being successfully degraded (see Section 2.2.3.2).

At Site SD034, Alternative 3 – GET and Alternative 7 – Passive Skimming and EA are equally expected to achieve the MCLs and comply with chemical-specific ARARs because they would remove Stoddard solvent (LNAPL), containing dissolved COCs, floating on the groundwater table.

2.10.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

Each of the groundwater alternatives has the potential to provide long-term and permanent remedies that will meet cleanup levels and allow for designated beneficial uses of groundwater (domestic, municipal, agricultural, and industrial supply) as well as unlimited use and unrestricted exposure to groundwater and indoor air at buildings overlying groundwater plumes at Sites FT004, SS015, SS016, SS029, SD033, SD034, SS035, SD036, SD037, and DP039. If residual TPH is present at one (1) or more sites after RAOs are achieved, then those sites will be transferred from CERCLA to the POCO program. Travis AFB has previously accomplished this type of program transfer (e.g., Site ST032 [ERP to POCO] and Site ST027B [POCO to ERP]) by preparing a technical memorandum/ report that provides the technical basis for the transfer of site administration. This technical memorandum will then be reviewed and approved by the regulatory agencies. After obtaining concurrence, Travis AFB will then take the necessary administrative actions to transfer the site from the ERP to the POCO program. This transfer will also be documented in subsequent five-year review reports.

At Sites SS015, SS016, SD036, SD037, and DP039, COC concentrations indicate the presence of DNAPLs. As discussed with the previous criterion, treatment of the highest residual concentrations of COCs in groundwater with EVO, a bioreactor, and/or phytoremediation (Alternatives 4, 5, and 6) is more likely to provide a long-term and permanent remedy compared with MNA (Alternative 2) or GET (Alternative 3).

At Site FT005, as discussed with the previous criterion, GET (Alternative 3) is more likely to provide a long-term and permanent remedy compared with MNA (Alternative 2).

At Site LF008, as discussed with the previous criterion, MNA (Alternative 2) is more likely to provide a long-term and permanent remedy compared with treatment with GET (Alternative 3).

2.10.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy. The NCP prefers remedial actions where treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, irreversibly reduce contaminant mobility, or reduce total volume of contaminated media.

Alternative 2 – MNA does not directly result in the reduction of toxicity, mobility, or volume of COCs in groundwater through treatment. Naturally occurring physical, chemical, and biological processes will be monitored at each site as reductions are achieved. Only MNA was evaluated for Site LF006, Subareas LF007B and LF007D, and Site ST027B because no active IRAs were implemented at these sites, and natural attenuation processes have been demonstrated at these sites to effectively reduce the toxicity and volume of COCs in groundwater by MNA assessments and studies (see Section 2.2.5). For Site SS035, only MNA

was evaluated because while GET was operational during the period of interim remediation, COC concentrations in the area beyond the influence of the GET system declined, and the plume was receding (see Section 2.2.5.9).

Alternatives 3, 4, 5, 6, and 7 include treatment as components of the remedies.

Alternative 3 – GET and Alternative 4 – Bioreactor and GET involve the off-base transfer and treatment/recycling of activated carbon that is laden with contaminants adsorbed from extracted groundwater. For Site FT005, Subarea LF007C, and Sites SS029 and SS030, Alternative 3 – GET uses onsite LGAC treatment of groundwater extracted from plumes with low-level threat wastes to provide permanent reductions in the toxicity and volume of contaminants. Spent carbon containing adsorbed contaminants is then regenerated by an EPA-approved off-base vendor. At Site FT005, Subarea LF007C, and Sites SS029 and SS030, only GET was evaluated because it will hydraulically capture the plumes that have either migrated beyond the Base boundary (Site FT005, Subarea LF007C, and Site SS030) or are near the southern Base boundary (Site SS029).

For Sites FT004, FT005, LF008, SD031, and SD043, which included treatment with GET as an IRA, both Alternatives 2 and 3 were evaluated. At Site LF008, after 7.5 years of GET, no significant change in pesticide concentrations was evident (see Section 2.2.5.6). Rebound study results indicate that the COCs are not dissolved in groundwater but rather sorbed to the fine soil particles suspended in the groundwater. Because Alternative 3 will not reduce the toxicity, mobility, or volume of COCs, Alternative 2 better satisfies this criterion for Site LF008. For Sites FT004, FT005, SD031, and SD043, because Alternative 3 includes treatment, it better satisfies this criterion.

Alternative 4 – EVO and GET (Site SS016); Alternative 5 – EVO and EA (Sites SS015, SD036, and SD037); and Alternative 6 – Bioreactor, Phytoremediation, EVO PRB, and EA (Site DP039) provide for in situ treatment of the principal threat wastes and the highest concentration portions of the site plumes to permanently reduce the toxicity and volume of contaminants.

Alternative 7 – Passive Skimming and EA provides for physical removal of the free-phase Stoddard solvent (LNAPL containing dissolved COCs) principal threat waste that poses an ongoing source of contamination to the underlying groundwater at Site SD034. Removal of the Stoddard solvent will result in a reduction of the volume of COCs dissolving into the groundwater from the Stoddard solvent source material. The Stoddard solvent removed by passive skimming will be treated or recycled by an EPA-approved off-base vendor. Site SD034 is the only site with free-phase Stoddard solvent contamination and the only site for which Alternative 7 is applicable. Alternatives 3 and 7 were evaluated for Site SD034.

2.10.5 Short-term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved. Estimates of the times required to achieve chemical-specific ARARs at each site are provided in Tables 2.9-2 through 2.9-21. Sustainable remediation, including key sustainability metrics (i.e., carbon dioxide generation and energy consumption), are also considered.

Each of the alternatives includes monitoring to provide early warning if drinking water supply wells, agricultural wells, or human receptors are threatened and LUCs to limit direct contact of humans with groundwater and inhalation of VOCs in indoor air. For the off-base plumes originating from Site FT005, Subarea LF007C, and Site SS030, Travis AFB's existing access and environmental response easements contain legal restrictions preventing the landowners from engaging in water development or soil disturbing activities that could interfere with cleanup activities.

Activities associated with the alternatives pose minimal risk to workers, the community, and the environment, as most of the construction activities have already been conducted. Minimal materials and resources are used for Alternatives 2, 3, 6, and 7.

The total RTFs for the alternatives were estimated from approximately 5 years for Alternative 2 – MNA to greater than 100 years for Alternative 4, which is dependent on site conditions.

For Sites FT004 and SD031, remediation timeframes for both Alternatives 2 and 3 evaluated for these sites are similar (35 years for Site FT004 and 15 years for Site SD031). However, within these diffuse and low concentration plumes, the effectiveness of the GET system has decreased, as demonstrated by contaminant rebound studies conducted during the period of interim remediation. In addition, there are lower energy requirements and less GHG emission for Alternative 2 compared with Alternative 3; therefore, Alternative 2 better satisfies this criterion.

For Sites FT005 and LF008, the remediation timeframes for Alternative 2 – MNA compared with Alternative 3 – GET is estimated to take longer (Site FT005 – 43 compared with 10 years, Site LF008 – greater than 100 years compared with 100 to 110 years). However, there are lower energy requirements and less GHG emission associated with Alternative 2. Therefore, both alternatives equally satisfy this criterion. The longer remediation timeframe for Site LF008 is because COCs are not dissolved in groundwater but rather sorbed to the fine soil particles suspended in the groundwater (see Section 2.2.5.6).

For Sites SS015, SS016, SD036, SD037, and DP039, Alternatives 4 – Bioreactor and GET; 5 – EVO and EA; and 6 – Bioreactor, Phytoremediation, EVO PRB, and EA provide for additional treatment of the highest residual concentrations of COCs in groundwater, reducing remediation timeframes to 58 to 70 years compared with remediation timeframes from 91 years to greater than 100 years under Alternative 2 – MNA or Alternative 3 – GET. Alternatives 4, 5, and 6 better satisfy this criterion.

For Site SD034, Alternative 3 – GET compared with Alternative 7 – Passive Skimming is estimated to take longer (91 compared with 60 years), and there are lower energy requirements and less GHG emission associated with Alternative 7. Therefore, Alternative 7 better satisfies this criterion. The longer remediation timeframe for Site SD034 is based on the presence of Stoddard solvent (LNAPL), containing dissolved COCs, floating on the groundwater table.

For Sites SD033 and SD043, the remediation timeframe for Alternative 3 – GET compared with Alternative 2 – MNA is estimated to take longer (91 compared with 60 years). Sites SD033 and SD043 are component sites within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including all the

commingled plumes originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043. Treatment of the higher concentration portions of the WIOU plume within Sites SD036 and SD037 using Alternative 5 – EVO and EA will reduce the influx of contaminants into the remaining portions of the WIOU plume. This reduced influx of contamination will enhance the natural attenuation capacity of the aquifer to remediate contamination and will result in a shorter cleanup time. The physical, chemical, and biological processes of attenuation are the same under alternatives with MNA or EA components. The distinction between these alternatives is that no treatment of the higher concentration portion of a site plume is conducted under MNA, while EA is associated with site-specific treatment of those higher concentration portions of a plume.

Within these diffuse and low concentration plumes, the effectiveness of the GET system has decreased, as demonstrated by contaminant rebound studies conducted during the period of interim remediation. In addition, there are lower energy requirements and less GHG emission associated with Alternative 2. Therefore, Alternative 2 better satisfies this criterion.

2.10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternatives 2 through 7 can be implemented using conventional and available equipment. Groundwater monitoring can easily continue under the existing GRIP, and LUCs are currently enforced as a component of the existing interim remedies. Alternatives 3 and 7, which include GET or skimming, are more difficult to implement compared with other alternatives that consist of MNA (Alternative 2) or in situ treatment (Alternatives 4, 5, and 6) because they include ongoing O&M and discharge of treated groundwater or recycling of removed Stoddard solvent.

GET systems (Alternative 3) have already been constructed at Subarea LF007C and Sites SS029 and SS030. The ex situ treatment process of LGAC associated with Alternative 3 is proven and reliable, and replacement system components are readily available. No difficulties associated with additional future construction or operations are anticipated. Extracted groundwater is already being successfully treated and discharged at the CGWTP.

A bioreactor and GET system (Alternative 4) have already been constructed at Site SS016 and a bioreactor at Site DP039 (Alternative 6). O&M will be minimal for bioreactors included with Alternatives 4 and 6, which consist of occasional dosing of the bioreactor and pump maintenance. Compared with ex situ treatment, in situ treatment is relatively easy to implement. Site SS016 is located within an area of active military airfield operations, and site access is restricted. The majority of the plume underlies active military aircraft parking ramps, taxiways, and runways. If necessary in the future, potential expansion of the GET system or construction would be difficult.

These alternatives are also administratively implementable. The regulatory agencies are already providing oversight of the ongoing groundwater IRAs and would continue to do so.

2.10.7 Cost

The estimated capital, O&M, and present value costs for the alternatives evaluated for each site are provided in Appendix D – Remedy Cost Estimates and include Tables D-1 through D-29.

Each alternative includes similar costs for implementing LUCs to restrict human exposure to contamination and to ensure that no activities will adversely affect implementation of the selected remedy. Examples of LUC costs are fence repairs and sign replacement, when needed. For the off-base plumes at Subarea LF007C and Sites FT005 and SS030, the cost for purchase of an additional easement is included. These easements contain legal restrictions preventing the landowners from engaging in water development or soil disturbing activities that could interfere with cleanup activities. In accordance with the Base General Plan, future buildings constructed in proximity of a groundwater plume may require installation of a vapor barrier and passive venting system. These vapor intrusion mitigation measures will result in additional building costs, but are not cost components of the remedial alternatives.

Cost estimates do not include capital costs for components constructed during the groundwater IRAs. These components include existing monitoring, injection, and extraction wells; GET systems; and bioreactors.

In general, costs for implementing Alternative 2 – MNA are less than costs for ex situ treatment with Alternative 3 – GET at Sites FT004, SD031, SD033, SD043 and in situ treatment with Alternative 5 – EVO and EA at Sites SS015, SD036, and SD037. For Site DP039, costs for Alternative 3 – GET are less than Alternative 6 – Bioreactor, Phytoremediation, EVO PRB, and EA. Costs for ex situ treatment with Alternative 4 – GET and Bioreactor at Site SS016 and Alternative 7 – Skimming and EA at Site SD034 are higher compared with Alternative 3 – GET because of higher annual O&M costs. For Site FT005, the cost of Alternative 2 – MNA is moderately greater than Alternative 3 – GET because the time required to achieve cleanup is approximately four (4) times greater, and a longer period of monitoring is needed. For Site LF008, the cost of Alternative 2 – MNA is moderately greater than Alternative 3 – GET because of greater long-term O&M costs.

2.10.8 State/Support Agency Acceptance

The California DTSC, San Francisco Bay Regional Water Board, and EPA have expressed their support for the following remedies selected for groundwater at each site at Travis AFB:

- Site SS041: Alternative 1 – No Further Action
- Sites FT004 and LF006, Subareas LF007B and LF007D, and Sites LF008, ST027B, SD031, SD033, SS035, and SD043: Alternative 2 – MNA
- Site FT005, Subarea LF007C, and Sites SS029 and SS030: Alternative 3 – GET
- Site SS016: Alternative 4 – Bioreactor and GET
- Sites SS015, SD036 and SD037: Alternative 5 – EVO and EA
- Site DP039: Alternative 6 – Bioreactor, Phytoremediation, EVO PRB, and EA
- Site SD034: Alternative 7 – Passive Skimming and EA

2.10.9 Community Acceptance

During the public comment period, the community expressed its support for the following remedies selected for groundwater at each site at Travis AFB:

- Site SS041: Alternative 1 – No Further Action
- Sites FT004 and LF006, Subareas LF007B and LF007D, and Sites LF008, ST027B, SD031, SD033, SS035, and SD043: Alternative 2 – MNA
- Site FT005, Subarea LF007C, and Sites SS029 and SS030: Alternative 3 – GET
- Site SS016: Alternative 4 – Bioreactor and GET
- Sites SS015, SD036 and SD037: Alternative 5 – EVO and EA
- Site DP039: Alternative 6 – Bioreactor, Phytoremediation, EVO PRB, and EA
- Site SD034: Alternative 7 – Passive Skimming and EA

Travis AFB received comments during the public meeting on October 18, 2012, regarding clarification of the preferred alternatives described therein. Three (3) verbal comments were received at the public meeting and are discussed in the Responsiveness Summary (see Section 3).

TABLE 2.10-1
Summary of Comparative Analysis of Each Alternative – Site FT004
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative	
Criterion	**2 – MNA**	**3 – GET**
Overall Protection of Human Health and the Environment	●	●
Compliance with ARARs	●	●
Long-term Effectiveness and Permanence	●	●
Reduction of Toxicity, Mobility, and Volume	◒	●
Short-term Effectiveness	●	◒
Implementability	●	◒
Cost ($)	59,641	163,538*

* Cost estimate for the existing IRA, which includes GET and MNA components.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-2
Summary of Comparative Analysis of Each Alternative – Site FT005
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative	
Criterion	**2 – MNA**	**3 – GET**
Overall Protection of Human Health and the Environment	●	●
Compliance with ARARs	◒	●
Long-term Effectiveness and Permanence	◒	●
Reduction of Toxicity, Mobility, and Volume	◒	●
Short-term Effectiveness	◒	◒
Implementability	●	◒
Cost ($)	101,633	94,273*

* Cost estimate for the existing IRA.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-3
Summary of Comparative Analysis of Each Alternative – Site LF006
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative
Criterion	**2 – MNA**
Overall Protection of Human Health and the Environment	●
Compliance with ARARs	●
Long-term Effectiveness and Permanence	●
Reduction of Toxicity, Mobility, and Volume	●
Short-term Effectiveness	●
Implementability	●
Cost ($)	11,909*

* Cost estimate for the existing IRA.

Note:

● = Alternative that best satisfies the criterion.

TABLE 2.10-4
Summary of Comparative Analysis of Each Alternative – Subarea LF007B
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative
Criterion	**2 – MNA**
Overall Protection of Human Health and the Environment	●
Compliance with ARARs	●
Long-term Effectiveness and Permanence	●
Reduction of Toxicity, Mobility, and Volume	●
Short-term Effectiveness	●
Implementability	●
Cost ($)	817*

* Annual O&M cost estimate for the existing IRA.

Note:

● = Alternative that best satisfies the criterion.

TABLE 2.10-5
Summary of Comparative Analysis of Each Alternative – Subarea LF007C
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative
Criterion	**3 – GET**
Overall Protection of Human Health and the Environment	●
Compliance with ARARs	●
Long-term Effectiveness and Permanence	●
Reduction of Toxicity, Mobility, and Volume	●
Short-term Effectiveness	●
Implementability	●
Cost ($)	432,334*

* Cost estimate for the existing IRA.

Note:

● = Alternative that best satisfies the criterion.

TABLE 2.10-6
Summary of Comparative Analysis of Each Alternative – Subarea LF007D
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative
Criterion	**2 – MNA**
Overall Protection of Human Health and the Environment	●
Compliance with ARARs	●
Long-term Effectiveness and Permanence	●
Reduction of Toxicity, Mobility, and Volume	●
Short-term Effectiveness	●
Implementability	●
Cost ($)	18,139*

* Cost estimate for the existing IRA.

Note:

● = Alternative that best satisfies the criterion.

TABLE 2.10-7
Summary of Comparative Analysis of Each Alternative – Site LF008
Groundwater Record of Decision, Travis Air Force Base, California

Criterion	Alternative	
	2 – MNA	**3 – GET**
Overall Protection of Human Health and the Environment	●	●
Compliance with ARARs	●	◒
Long-term Effectiveness and Permanence	●	◒
Reduction of Toxicity, Mobility, and Volume	●	◒
Short-term Effectiveness	●	◒
Implementability	●	◒
Cost ($)	46,182	35,545*

* Cost estimate for the existing IRA.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-8
Summary of Comparative Analysis of Each Alternative – Site SS015
Groundwater Record of Decision, Travis Air Force Base, California

Criterion	Alternative	
	2 – MNA	**5 – EVO and EA**
Overall Protection of Human Health and the Environment	◒	●
Compliance with ARARs	◒	●
Long-term Effectiveness and Permanence	◒	●
Reduction of Toxicity, Mobility, and Volume	◒	●
Short-term Effectiveness	●	◒
Implementability	◒	●
Cost ($)	55,137*	358,474

* Cost estimate for the existing IRA.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-9
Summary of Comparative Analysis of Each Alternative – Site SS016
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative	
Criterion	**3 – GET**	**4 – Bioreactor and GET**
Overall Protection of Human Health and the Environment	◒	●
Compliance with ARARs	◒	●
Long-term Effectiveness and Permanence	◒	●
Reduction of Toxicity, Mobility, and Volume	◒	●
Short-term Effectiveness	◒	●
Implementability	◒	●
Cost ($)	761,718*	1,116,162

* Cost estimate for the existing IRA.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-10
Summary of Comparative Analysis of Each Alternative – Site ST027B
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative
Criterion	**2 – MNA**
Overall Protection of Human Health and the Environment	●
Compliance with ARARs	●
Long-term Effectiveness and Permanence	●
Reduction of Toxicity, Mobility, and Volume	●
Short-term Effectiveness	●
Implementability	●
Cost ($)	49,996*

* Cost estimate for the existing IRA.

Note:

● = Alternative that best satisfies the criterion.

TABLE 2.10-11
Summary of Comparative Analysis of Each Alternative – Site SS029
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative
Criterion	**3 – GET**
Overall Protection of Human Health and the Environment	●
Compliance with ARARs	●
Long-term Effectiveness and Permanence	●
Reduction of Toxicity, Mobility, and Volume	●
Short-term Effectiveness	●
Implementability	●
Cost ($)	339,851*

* Cost estimate for the existing IRA.

Notes:

● = Alternative that best satisfies the criterion.

TABLE 2.10-12
Summary of Comparative Analysis of Each Alternative – Site SS030
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative
Criterion	**3 – GET**
Overall Protection of Human Health and the Environment	●
Compliance with ARARs	●
Long-term Effectiveness and Permanence	●
Reduction of Toxicity, Mobility, and Volume	●
Short-term Effectiveness	●
Implementability	●
Cost ($)	294,390*

* Cost estimate for the existing IRA.

Notes:

● = Alternative that best satisfies the criterion.

TABLE 2.10-13
Summary of Comparative Analysis of Each Alternative – Site SD031
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative	
Criterion	**2 – MNA**	**3 – GET**
Overall Protection of Human Health and the Environment	●	●
Compliance with ARARs	●	●
Long-term Effectiveness and Permanence	●	●
Reduction of Toxicity, Mobility, and Volume	◒	●
Short-term Effectiveness	●	◒
Implementability	●	◒
Cost ($)	30,480	42,103*

* Cost estimate for the existing IRA, which includes GET and MNA components.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-14
Summary of Comparative Analysis of Each Alternative – Site SD033
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative	
Criterion	**2 – MNA**	**3 – GET**
Overall Protection of Human Health and the Environment	●	●
Compliance with ARARs	●	●
Long-term Effectiveness and Permanence	●	●
Reduction of Toxicity, Mobility, and Volume	◒	●
Short-term Effectiveness	●	◒
Implementability	●	◒
Cost ($)	42,082	65,778*

* Cost estimate for the existing IRA, which includes GET and MNA components.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-15
Summary of Comparative Analysis of Each Alternative – Site SD034
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative	
Criterion	**3 – GET**	**7 – Passive Skimming and EA**
Overall Protection of Human Health and the Environment	●	●
Compliance with ARARs	●	●
Long-term Effectiveness and Permanence	●	●
Reduction of Toxicity, Mobility, and Volume	●	◒
Short-term Effectiveness	◒	●
Implementability	●	●
Cost ($)	108,288*	80,639

* Cost estimate for the existing IRA, which includes GET, Passive Skimming, and MNA components.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-16
Summary of Comparative Analysis of Each Alternative – Site SS035
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative
Criterion	**2 – MNA**
Overall Protection of Human Health and the Environment	●
Compliance with ARARs	●
Long-term Effectiveness and Permanence	●
Reduction of Toxicity, Mobility, and Volume	●
Short-term Effectiveness	●
Implementability	●
Cost ($)	2,537*

* IRGs have been achieved at this site; 2 years of monitoring will be completed prior to evaluating the site for closure.

Notes:

● = Alternative that best satisfies the criterion.

TABLE 2.10-17
Summary of Comparative Analysis of Each Alternative – Site SD036
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative	
Criterion	**3 – GET**	**5 – EVO and EA**
Overall Protection of Human Health and the Environment	●	●
Compliance with ARARs	◒	●
Long-term Effectiveness and Permanence	◒	●
Reduction of Toxicity, Mobility, and Volume	◒	●
Short-term Effectiveness	◒	●
Implementability	◒	●
Cost ($)	100,106*	759,875

* Cost estimate for the existing IRA, which includes GET and MNA components.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-18
Summary of Comparative Analysis of Each Alternative – Site SD037
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative	
Criterion	**3 – GET**	**5 – EVO and EA**
Overall Protection of Human Health and the Environment	●	●
Compliance with ARARs	◒	●
Long-term Effectiveness and Permanence	◒	●
Reduction of Toxicity, Mobility, and Volume	◒	●
Short-term Effectiveness	◒	●
Implementability	◒	●
Cost ($)	275,751*	1,298,581

* Cost estimate for the existing IRA, which includes GET and MNA components.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-19
Summary of Comparative Analysis of Each Alternative – Site DP039
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative	
Criterion	**3 – GET**	**6 – Bioreactor, Phytoremediation, EVO PRB, and EA**
Overall Protection of Human Health and the Environment	●	●
Compliance with ARARs	◒	●
Long-term Effectiveness and Permanence	◒	●
Reduction of Toxicity, Mobility, and Volume	◒	●
Short-term Effectiveness	◒	●
Implementability	◒	●
Cost ($)	73,680*	1,177,618

* Cost estimate for the existing IRA, which includes GET and MNA components.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

TABLE 2.10-20
Summary of Comparative Analysis of Each Alternative – Site SD043
Groundwater Record of Decision, Travis Air Force Base, California

	Alternative	
Criterion	**2 – MNA**	**3 – GET**
Overall Protection of Human Health and the Environment	●	●
Compliance with ARARs	●	●
Long-term Effectiveness and Permanence	●	●
Reduction of Toxicity, Mobility, and Volume	◒	●
Short-term Effectiveness	●	◒
Implementability	●	◒
Cost ($)	26,273	38,121*

* Cost estimate for the existing IRA, which includes GET and MNA components.

Notes:

● = Alternative that best satisfies the criterion.
◒ = Alternative that moderately satisfies the criterion.

2.11 Principal Threat Wastes

The NCP expects that treatment that reduces the toxicity, mobility, or volume of the principal threat wastes will be used to the extent practicable. The principal threat concept refers to the source materials at a CERCLA site considered to be highly toxic or highly mobile that generally cannot be reliably controlled in place or present an unacceptable risk to human health or the environment should exposure occur. A source material is material that contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or that acts as a source for direct exposure.

For Sites SS015, SS016, SD036, SD037, and DP039, portions of the plumes contain high contaminant concentrations, and residual DNAPL is likely present. At Sites SS015, SD036, and SD037, EVO will treat the portion of the plume with residual DNAPL and the highest concentrations of COCs. At Site SS016, a bioreactor will treat a portion of the plume with residual DNAPL and the highest concentrations of COCs. At Site DP039, the combination of a bioreactor, phytoremediation, and an EVO PRB will treat the portions of the plume with residual DNAPL and the highest concentrations of COCs.

For Site SD034, free-phase Stoddard solvent (LNAPL), containing dissolved COCs, is floating on the groundwater table and poses an ongoing source of contamination to the underlying groundwater. Passive skimming will physically remove the free-phase product to address this principal threat waste.

The remaining contaminants in groundwater do not constitute principal threat wastes as defined by CERCLA.