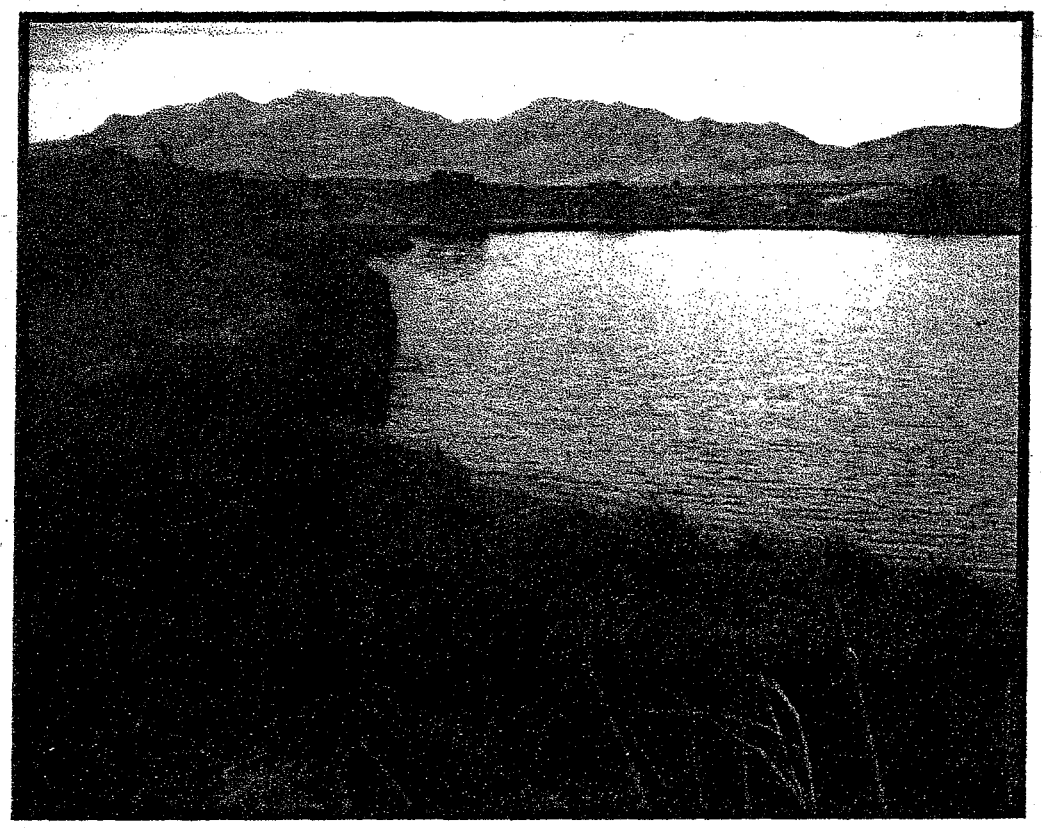
Environmental Assessment for Artificial Aquifer Recharge and Treated Effluent Reuse Management, Fort Huachuca, AZ

Environmental Assessment

US Army Garrison
Fort Huachuca

Environmental and
Natural Resources
Division

July, 2000



HOW THIS ENVIRONMENTAL ASSESSMENT IS ORGANIZED

The EXECUTIVE SUMMARY briefly describes the Proposed Action and alternatives. Direct and indirect impacts are summarized and compared, and cumulative impacts are briefly described.

SECTION 1 INTRODUCTION discusses the purpose and need for the Proposed Action, the regulatory background surrounding this project, and the scope of this Environmental Assessment.

SECTION 2 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES discusses the Proposed Action and alternatives addressed in this Environmental Assessment.

SECTION 3 AFFECTED ENVIRONMENT describes the existing environment within the Region of Influence.

SECTION 4 ENVIRONMENTAL CONSEQUENCES provides a comparison of environmental consequences associated with the Proposed Action alternatives. Mitigation measures are also addressed in this section.

SECTION 5 CUMULATIVE IMPACT ANALYSIS provides a discussion of anticipated contributions to other past, present and reasonably foreseeable activities in the region.

SECTION 6 FINDINGS AND CONCLUSIONS provides a summary of anticipated environmental impacts.

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ARTIFICIAL AQUIFER RECHARGE AND TREATED-EFFLUENT REUSE MANAGEMENT, FORT HUACHUCA, ARIZONA

ENVIRONMENTAL ASSESSMENT

JULY 2000

Directorate of Installation Support
U.S. Army Garrison, Fort Huachuca, Arizona

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Contract #DABT63-99-D-0028, T.O. 15

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ARTIFICIAL AQUIFER RECHARGE AND TREATED-EFFLUENT REUSE MANAGEMENT, FORT HUACHUCA, ARIZONA

ENVIRONMENTAL ASSESSMENT

LEAD AGENCY: Department of the Army

TITLE OF THE PROPOSED ACTION: Artificial Aquifer Recharge and Treated-Effluent Reuse Management

AFFECTED JURISDICTION: Cochise County, Arizona

PREPARED BY: Directorate of Installation Support, U.S. Army Garrison, Fort Huachuca

REVIEWED BY: Commander, U.S. Army Garrison, Fort Huachuca

APPROVED BY: Commander, U.S. Army Intelligence Center & Fort Huachuca

ABSTRACT: To continue the reduction in consumptive water use at Fort Huachuca, improve watershed health on the East and West Ranges, and prevent excess sediment transport from the East and West Ranges into riparian areas, the Army has determined a need to improve four aspects of the Fort's water management program:

1. Expansion of the Fort's treated-effluent reuse distribution pipelines in the cantonment area.
2. Upgrades to Wastewater Treatment Plant #2 in the cantonment area.
3. Implementation of Artificial Aquifer Recharge projects on the East Range.
4. Improvements to erosion control and stormwater management on the East and West Ranges.

This Environmental Assessment analyzes the Proposed Action (to include those items listed above) and two alternatives. The Enhanced Existing Facilities (Alternative A) consists of modifying existing Treated-Effluent Basins #2, #3 and #4 and implementing some erosion control and stormwater management projects on the East Range, West Range and cantonment area. The No-Action (Alternative C) consists of not approving any of the activities described herein. An additional alternative (Injections Wells: Alternative B) was determined not to be feasible from an engineering and economic perspective and is therefore not evaluated in the document.

REVIEW COMMENT DEADLINE: Public comments must be received within 30 days from the publishing date of this document. Public comments may be provided to: Commander, USAIC&FH, ATTN: ATZS-ISB (AAREA), Fort Huachuca, Arizona 85613-6000. Comments may also be faxed to (520)533-3043.

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EXECUTIVE SUMMARY

For several years, Fort Huachuca has been studying the feasibility of reducing its consumptive water use through treated-effluent reuse, Artificial Aquifer Recharge (AAR) and stormwater management practices. Studies indicate that these practices may be feasible and cost effective (GHLN 1995, SAIC 1997, GSA 2000). To achieve this water-use reduction, Fort Huachuca is proposing a variety of activities to increase the efficiency of treated-effluent reuse and AAR on the installation. Potential environmental impacts from these activities, currently proposed for implementation between fiscal year (FY) 2001 and FY 2010, are evaluated in this Environmental Assessment (EA).

This EA was prepared in compliance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA, and AR 200-2, Environmental Effects of Army Actions (USA 1988).

Proposed Action

The Proposed Action involves upgrades and expansions to the water management capabilities on Fort Huachuca by:

- Expanding the treated-effluent reuse distribution system within the cantonment area,
- Upgrading the Wastewater Treatment Plant (WWTP) #2 within the cantonment area,
- Implementing AAR capabilities on the East Range, and
- Constructing erosion control and stormwater management improvements on the East and West Ranges.

In addition, the possible future inclusion of treated effluent from nearby civilian communities or enterprises for treatment at the Fort WWTP #2 is considered.

Environmental Consequences of the Proposed Action

Implementation of the Proposed Action will have a direct positive impact on soils and water resources and an indirect positive impact on the overall habitat for local biological resources. In addition, upgrades to WWTP #2 will improve the quality of these resources on the Fort. Adverse impacts on land use, socioeconomics, environmental justice, public safety, children's safety, electrical utilities, and hazardous materials will be none to minor. Cultural resources, air quality, and transportation could potentially be affected by implementation of the Proposed Action, but

activities will be managed to keep any impact below the threshold of significance. Over the long term East Range rehabilitation projects will improve the overall condition of the range and site-specific revegetation will restore conditions along the basin perimeters. Table ES-1 presents a summary of anticipated impacts. Overall, it is anticipated that the Proposed Action will have no significant impact on the human environment.

Other Alternatives Considered

Enhanced Existing Facilities (Alternative A) consists of upgrading the WWTP #2 in the cantonment area and minor re-engineering of the Treated-Effluent Basins #2, #3, and #4 on the East Range. In addition, this alternative includes some erosion control and stormwater management components on the East Range and within the cantonment area. The Enhanced Existing Facilities Alternative will have a reduced direct positive impact on soils and water resources and the overall habitat for biological resources. Impacts on land use, socioeconomics, environmental justice, public safety, children's safety, electrical utilities, and hazardous materials will be none to minor. Cultural resources, air quality, and transportation could potentially be affected, but activities will be managed to keep any impact below the threshold of significance.

No-Action (Alternative C) reflects a continuation of baseline conditions at Fort Huachuca. Under this alternative, improvements to the treated-effluent reuse distribution system, treated-effluent basins, and erosion control and stormwater management will not occur. The level of treated-effluent water in the existing basins on the East Range will likely remain similar to current conditions. Local and regional transportation may be affected due to erosion currently undercutting the perimeter road and Highway 90. Further, the benefits of replenishing the groundwater supply at an accelerated rate may not occur under the No-Action Alternative.

Because both action alternatives include the repair and reversal of significant soil erosion and resulting damages to vegetation and wildlife habitat (as well as infrastructure) on the East Range, the No-Action alternative would lead to a continuation of these problematic conditions. Under the No-Action Alternative, the Fort would not receive the additional aquifer recharge associated with the two action alternatives.

Management Methods Included in the Proposed Action

Special considerations for protection of the environment will be enacted during activities associated with the Proposed Action. These methods are described throughout Section 4.0 of this EA and are included to ensure that impacts to various resources are kept below the level of significance.

Cumulative Impacts

Cumulatively, neither the Proposed Action, the Enhanced Existing Facilities Alternative, nor the No-Action Alternative would not contribute to any significant impact on the human environment. The anticipated decrease in net consumptive water use at Fort Huachuca under the Proposed Section will contribute in a positive way to cumulative impacts.

Findings and Conclusions

It is the conclusion of this analysis that neither the Proposed Action nor any of the alternatives constitute a major federal action with significant impact on the human environment, and a Finding of No Significant Impact for the Proposed Action should be issued to complete the documentation.

Table ES-1: Summary of Anticipated Impacts

Resource Area	Proposed Action	Alternative A	No-Action Alternative	Management Methods Included in Proposed Action
Geology / Soils	No impacts to geology anticipated. Potential for erosion of loose soil and stockpiles due to surface water/wind; reduced erosion on East and West Ranges.	No impacts to geology anticipated. Potential for erosion of loose soil due to surface water/ wind; reduced erosion on East and West Ranges	Existing soil erosion conditions would continue to progress.	Use of BMPs to reduce and reverse erosion.
Water Resources	Potential for erosion of stormwater diversion channel, dirt roads, and wash beds; increased AAR.	Potential for erosion of dirt roads, wash beds, and existing infiltration basins; downstream sediment transport; some increase in AAR.	Potential for significant erosion of roads, wash beds, and existing infiltration basins; downstream sediment transport.	Manage sediment transport with BMPs.
Air Quality	PM_{10} emissions from construction and stockpiles.	PM_{10} emissions from construction.	No impacts anticipated.	Use of dust abatement measures.
Biological	Some loss of vegetation and wildlife habitat; some wildlife disturbance; potential to disturb agave stands; may affect some listed species, but not significantly. Improved riparian habitat.	Some loss of vegetation and wildlife habitat; some wildlife disturbance; potential to disturb agave stands; may affect some listed species, but not significantly.	Loss of long-term benefit from AAR recharge and improved range conditions.	Post-construction revegetation and careful monitoring and avoidance of agave stands; no nighttime construction activities.
Cultural Resources	Potential to disturb subsurface cultural resources during construction.	Potential to disturb subsurface cultural resources during construction.	No impacts anticipated.	Survey prior to construction; halt all activities if cultural resources are discovered.
Transportation	Minor traffic delays; periodic road closures on the East Range during construction; improved road conditions.	Periodic road closures on the East Range during construction; improved road conditions.	Erosion may under-cut the Perimeter Road and Highway 90. May cause other problems on East Range.	Provision of alternate routes; erosion and control measures.
Utilities	Decreased potable water use; improved quality of treated effluent for reuse/ recharge.	Decreased potable water use; improved quality of treated effluent for reuse/ recharge.	No reduction in potable water use.	None
Hazardous Materials and Wastes	Fuel storage and potential for fuel spills.	Fuel storage and potential for fuel spills.	No impacts anticipated.	Storage and spill plan filed prior to use/storage of fuels.

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1.0 INTRODUCTION

For several years, Fort Huachuca has been studying the feasibility of reducing net water use through treated-effluent reuse, artificial aquifer recharge (AAR), and stormwater management practices. Studies indicate that these practices may be feasible and cost effective (GHLN 1995, SAIC 1997, GSA 2000). To achieve this water-use reduction, Fort Huachuca is proposing a variety of activities to increase the efficiency of treated-effluent reuse and AAR on the installation. Potential environmental impacts from these activities, currently proposed for implementation between fiscal year (FY) 2001 and FY 2010, are evaluated in this Environmental Assessment (EA).

1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose for the Proposed Action is to reduce net consumptive water use, improve watershed health on the East and West Ranges, and prevent excess sediment transport from the East and West Ranges into riparian habitats. These objectives would be achieved by implementing or enhancing existing treated-effluent reuse, AAR, and erosion control and stormwater management at Fort Huachuca. In addition, possible future inclusion of treated effluent from nearby civilian communities or enterprises for treatment at the Fort's Wastewater Treatment Plant (WWTP) #2 and reuse/recharge on the installation is being considered.

Several of the Proposed Action activities have been under analysis by Fort Huachuca for several years as part of its water and natural resources management program. The Army is also committed to identify and implement additional ways to reduce consumptive water use and improve range conditions across the installation in partial fulfillment of a recent U.S. Fish and Wildlife Service Biological Opinion (USFWS 1999), prepared under the Section 7 consultation process of the Endangered Species Act (ESA). Implementation of the Proposed Action will also contribute to goals identified in the Biological Opinion and will lead to reductions in net consumptive water use at Fort Huachuca.

1.2 REGULATORY BACKGROUND

The National Environmental Policy Act (NEPA) requires that agencies of the federal government implement an environmental impact analysis program in order to evaluate "...major federal actions significantly affecting the quality of the human environment." Under NEPA, an action

becomes a "major federal action significantly affecting the quality of the human environment" by virtue of the magnitude of its impact in various media areas. An environmental assessment documents the analysis to determine whether the implementation of a project will, by virtue of its impact, have significant impact on the human environment, and therefore whether it is a "major federal action significantly affecting the quality of the human environment." For example, a small project with significant impact could be a "major federal action significantly affecting the quality of the human environment" while a $20 million dollar building remodeling project may not be because it could have minimal impact on the environment.

Army Regulation (AR) 200-2 implements the NEPA process for Army commands and installations. The Regulation states that "... all Army decision making that may have an impact on the human environment will use a systematic, interdisciplinary approach that ensures the integrated use of natural and social sciences, planning and the environmental design arts..." (USA 1988, Section 2-1). This EA was prepared in compliance with the NEPA (Public Law 91-190, 42 U.S.C. 4321-4347, as amended), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508), and AR 200-2, Environmental Effects of Army Actions (USA 1988). This EA is tiered off the Final Environmental Impact Statement (FEIS) for the Approval of Land Use and Real Estate Investment Strategies in Support of Real Property Master Planning, May 1999, prepared by the Environmental and Natural Resources Division (ENRD), Directorate of Installation Support (DIS), U.S. Army Garrison, Fort Huachuca, Arizona. The FEIS authorized steps leading to the implementation of this project. This EA is one of the steps.

The concept of tiering, introduced in 40 CFR 1502.20, states: "Whenever a broad environmental impact statement [or assessment] has been prepared (such as a program or policy statement) and a subsequent statement or environmental assessment is then prepared on an action or policy (such as a site specific action), the subsequent statement or environmental assessment need only summarize the issues discussed in the broader statement and incorporate discussions from the broader statement by reference and shall concentrate on the issues specific to the subsequent action."

The process of tiering refers to the covering of general issues in a broad document (i.e., the FEIS), with further focused documents (i.e., this EA) used to address more specific decisions

incorporating detailed, action-specific information. Similarly, AR 200-2, Section 6c encourages the use of tiering to eliminate repetitive discussions so that focus may remain on the central issue. As a result, descriptions of some baseline resource areas may be abbreviated if the action has been determined to have little or no impact on that resource area. The reader is invited to refer to the above-mentioned FEIS for additional information.

This EA was also developed to cover the Proposed Action in its entirety. Although components of the Proposed Action may seem unrelated, together they contribute to a process for sustainable watershed management that includes maintenance of groundwater levels, reversal of stream entrenchment and reduction of erosion and sedimentation in stream flow delivered to riparian habitat.

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

In accordance with NEPA and AR 200-2, the Army has prepared this EA to assess the potential environmental impacts resulting from a variety of proposed activities to expand water reuse and recharge capabilities at Fort Huachuca. All of the proposed activities will occur within the East Range, West Range, or cantonment (urbanized) area of Fort Huachuca. A complete description of these activities is provided in Section 2 of this document.

Upon completion of the preliminary environmental screening for this EA, the Army determined that this EA would evaluate the potential impacts on the human environment by focusing on the following environmental resources:

- Geology and Soils (Sections 3.1, 4.1)
- Water Resources (Sections 3.2, 4.2)
- Air Quality (Sections 3.3, 4.3)
- Biological Resources (Sections 3.4, 4.4)
- Cultural Resources (Sections 3.5, 4.5)
- Transportation (Sections 3.6, 4.6)
- Utilities (Sections 3.7, 4.7)
- Hazardous Materials and Wastes (Sections 3.8, 4.8)

In addition to evaluation for potential direct and indirect impact on the above resources, the proposed activities were also evaluated from the perspective of cumulative impacts on the environment (described in Section 5 of this document).

1.4 PUBLIC OUTREACH

CEQ and AR-200-2 regulations that implement NEPA recommend an early and open process for the preparation of an EA. In keeping with an open decision-making process, the Army has made

this EA available to agencies and the general public for review and comment. A Notification of Availability (NOA) was published in the *Sierra Vista Herald and Huachuca Scout* newspapers. Initial distribution of this EA included agencies and individuals that had previously expressed interest in activities at Fort Huachuca. This distribution list is provided in Section 7, *Distribution List.*

For further information regarding this EA or the Proposed Action, contact: Public Affairs Office, U.S. Army Garrison, ATTN: ATZS-PA, Fort Huachuca, Arizona 85613-6000, telephone: (520)533-2922 or 533-1985. To obtain copies of the EA, contact Ms. Ledbetter at (520) 533-3120 or write to: U.S.A.I.C. & F.H., ATTN: ATZS-ISB (AAREA), Fort Huachuca, Arizona 85613-6000.

The public is invited to comment on this EA during the 30-day public comment period. Comments postmarked after that date will be considered to the extent practicable. Questions and comments may be addressed to either of the addresses provided above.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Under NEPA, the proponent for an action is responsible for considering all reasonable alternatives for achieving a goal or implementing a project or program. For this EA, three action scenarios were evaluated to provide Fort Huachuca with expanded water reuse and AAR capabilities. The evaluations were based on the ability of each scenario to support the larger water reuse and AAR programs as contemplated by the U.S. Army at Fort Huachuca. As a result, a preferred alternative was selected and is presented as the Proposed Action. The other two action scenarios were considered less effective in providing mission requirements but would improve current capabilities at a lower funding level, should funding for full implementation of the preferred action not be available. The three action scenarios are:

- **Proposed Action (Full Facilities):** Construction of new facilities and upgrade of existing facilities for treated-effluent reuse management, upgrades to WWTP #2, reengineering and construction of state-of-the-art AAR facilities on the East Range, construction of other small AAR facilities, and erosion control and stormwater management improvements.
- **Alternative A (Enhanced Existing Facilities):** Minor reengineering of East Range Treated-Effluent Basins #2, #3 and #4. This would not include construction of additional facilities, no expansion of treated-effluent distribution system, and no WWTP#2 upgrades. Erosion control and stormwater management projects will be carried out, but to a lesser extent than under the Proposed Action.
- **Alternative B (Injection Wells):** Use of Class I injection wells with backflushing basins on the East Range, with associated upgrades to WWTP #2.

Under CEQ regulations, a proponent must also evaluate the No-Action scenario – presented as **Alternative C** in this document. This scenario represents a baseline continuation of current water management activities and associated facilities at Fort Huachuca.

Figure 2.0-1 presents a map of Fort Huachuca as a point of reference for the location of activities proposed in this EA.

2.1 PROPOSED ACTION—FULL FACILITIES

The Proposed Action involves upgrades and expansions to water management capabilities on Fort Huachuca by:

- Expanding the treated-effluent reuse distribution system within the cantonment area.
- Upgrading the WWTP #2 within the cantonment area.
- Implementing AAR capabilities on the East Range.
- Constructing erosion control and stormwater management improvements on the East and West Ranges.

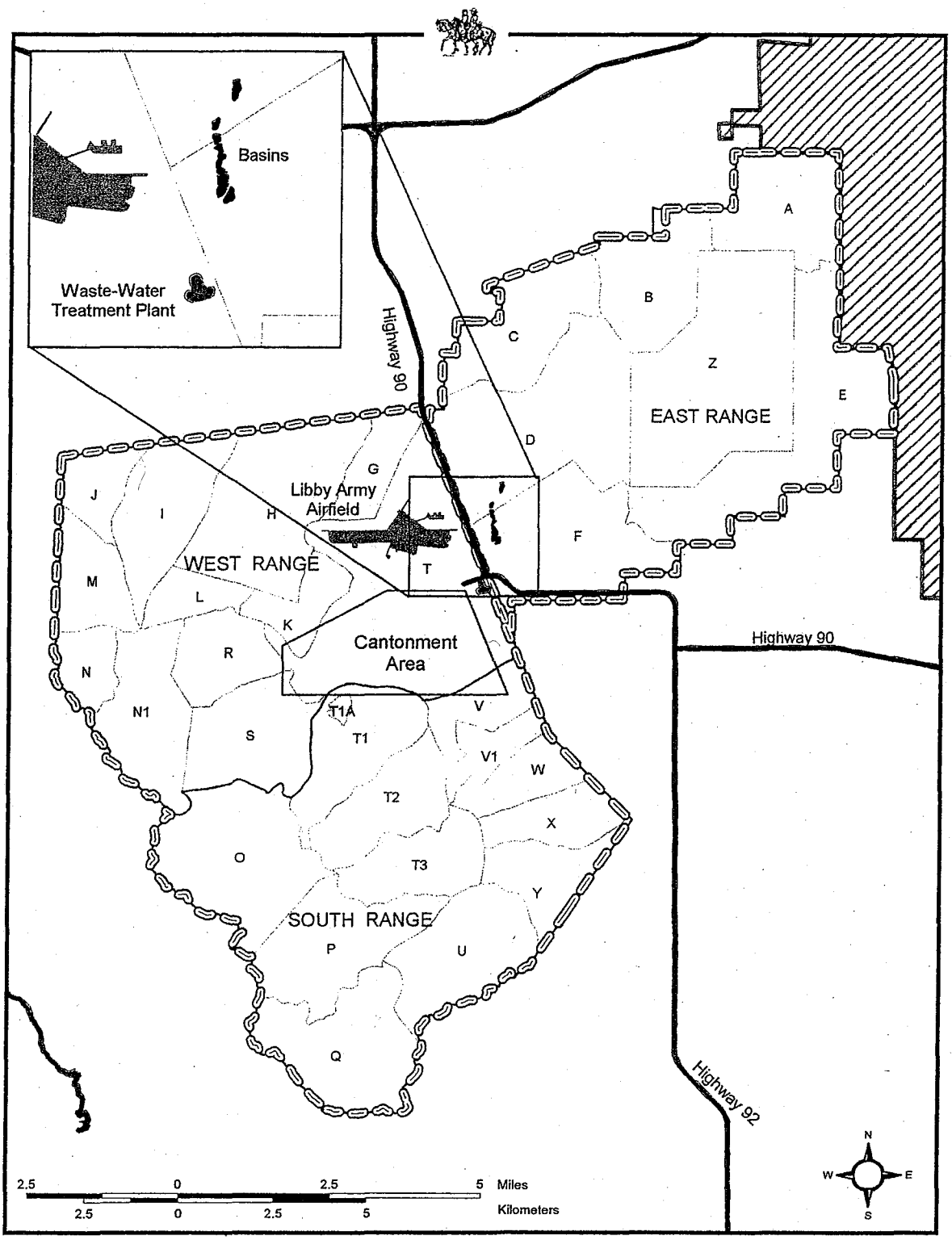

FIGURE 2.0-1

Fort Huachuca

Major Roads
Fort Huachuca
Training Areas
San Pedro Riparian NCA

In addition, the possible future inclusion of treated-effluent from nearby civilian communities or enterprises for treatment at WWTP #2 is considered. Each of the Proposed Action components is described in more detail below.

2.1.1 Treated-Effluent Reuse Distribution System Expansion

The existing treated-effluent reuse distribution system consists of a network of reuse pipelines, storage tanks and basins, and the WWTP #2, all located in the cantonment area and East Range (Figure 2.1-1). The proposed enhancements to this system include:

- Extending the existing reuse pipelines.
- Expanding the capacity of and improving the reuse facilities at Chaffee Parade Ground and installation ball fields to provide more efficient irrigation.
- Replacing the feeder line to the golf course.
- Replacing some current potable water irrigation with non-potable water.
- Returning unconsumed treated effluent to the East Range recharge facility.
- Installing heat exchange technology for cooling and heating in lieu of current consumptive uses at major consuming facilities along the reuse route.

Under the Proposed Action, the treated-effluent reuse system will be expanded to include the Military Intelligence Village, Thunderbird Village, Greely Hall, and Riley Barracks within the cantonment area. Through these enhancements treated effluent will replace some current potable water use. New reuse pipelines will be placed within existing roadways or utility rights-of-way. It is estimated that these activities will disturb approximately 5 acres (2 ha) of land.

2.1.2 Upgrade to WWTP #2

The WWTP #2 is part of the treated-effluent reuse distribution system described above. A new secondary treatment process and an upgrade to the digester are proposed to improve the quality of the final treated effluent. These new facilities will occupy approximately 2 acres (0.8 ha) adjacent to the WWTP #2.

2.1.3 Implementation of AAR Capabilities

AAR methods are being considered for improved infiltration into the aquifer using shallow-spreading basins (Figure 2.1-2). This involves directing water to the basins for infiltration into the vadose zone. To reach necessary soil types to facilitate infiltration, basin depth is anticipated to be between 2 ft and 10 ft (0.6 m and 3 m), but deeper excavation may be required. The reconstructed basins will allow for wet-dry cycles within the basins.

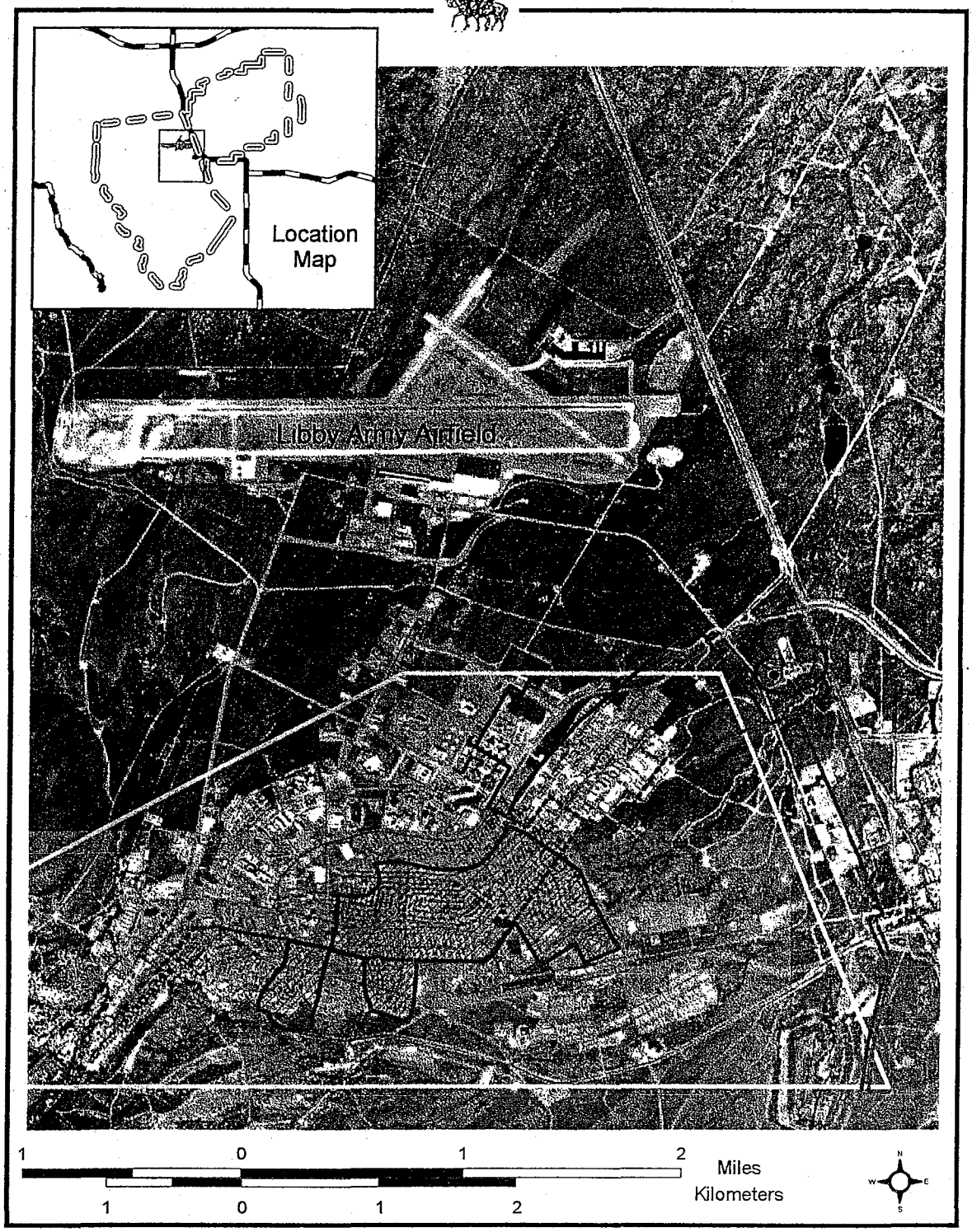

FIGURE 2.1-1

Proposed Treated-Effluent Distribution System Expansion

Proposed Treated-Effluent Pipelines
Existing Treated-Effluent Pipelines
Cantonment Area
Major Reuse Irrigation Areas
Waste Water Treatment Plant

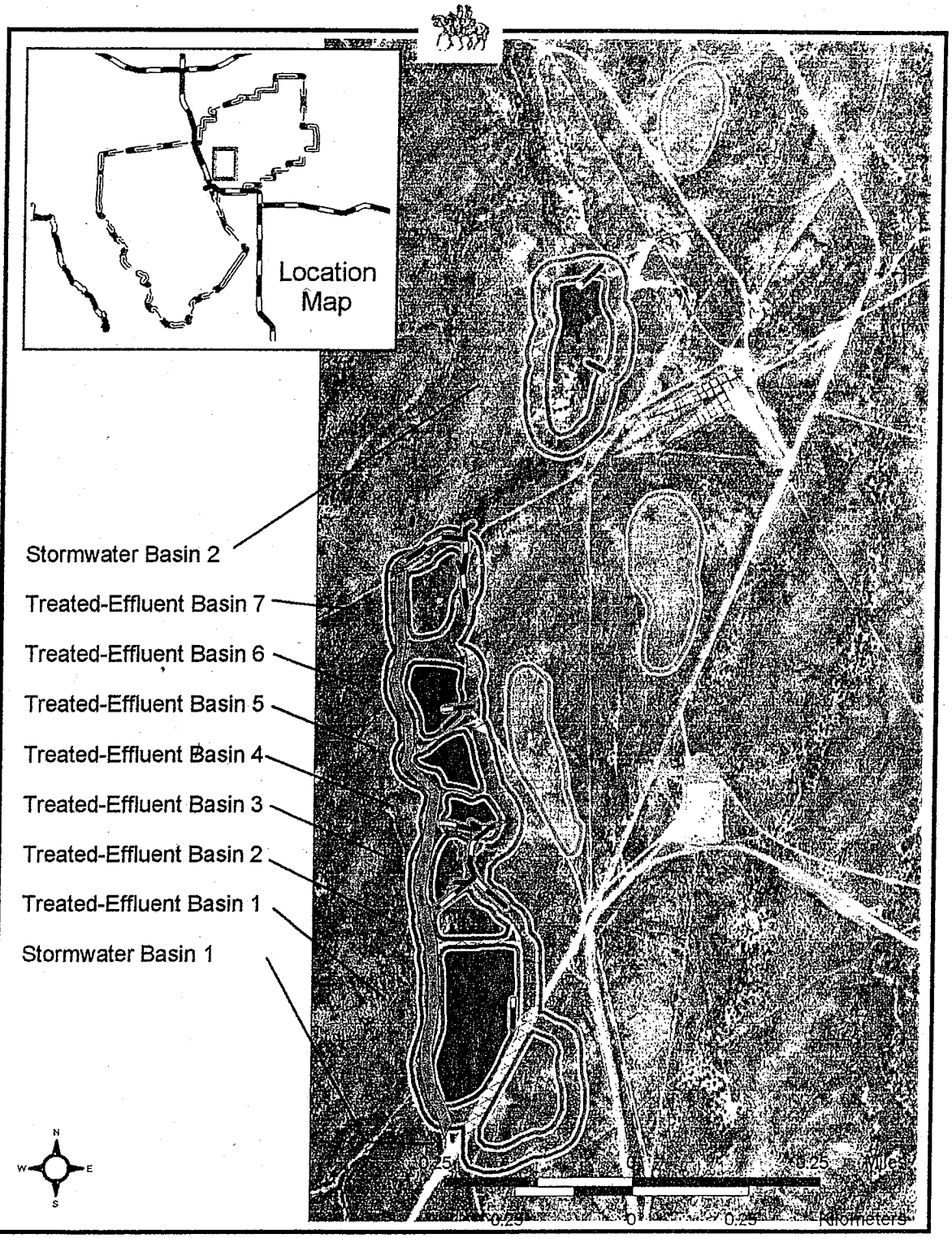

FIGURE 2.1-2

Artificial Aquifer Recharge Basins

- Road Improvements
- Stormwater Diversion Channel
- Basins
- Areas of Temporary Disturbance
- Proposed Stockpile Areas

Effluent treated to the tertiary level will be gravity fed or pumped into the basins from the WWTP #2. To inhibit the growth of algae, which reduces infiltration rates, these treated-effluent basins will be permitted to dry out every 5 to 10 days. During initial construction, the existing basins will be tilled, and all vegetation will be removed from the sides and bottom. Occasional maintenance will involve the removal of sediment and minerals that collect over time as a result of the wet-dry cycle. Although each facility is different, anticipated maintenance will occur every 12 to 24 months.

To prevent stormwater from entering the treated-effluent basins and potentially flushing diluted treated effluent from the basins, an open diversion channel will be built to convey stormwater along the western side of the basins. The approximately 35 ft-wide (11 m) channel will include riprap and/or native vegetation to protect against erosion. Concrete drop structures will also be used to allow the actual channel slope to remain relatively flat. This will reduce the velocity of water flow and erosion potential. To further reduce erosion, engineered aprons will be used where tributary washes enter the channel. Approximately 0.25-mile north (downstream) of the treated-effluent basins, stormwater will discharge from the open channel into a series of stormwater infiltration basins. The treated-effluent basins are considered off-channel basins; off-channel basins are less susceptible to flooding during storm events than their in-channel counterparts. Approximately 105 acres (42 ha) are included within the proposed AAR footprint.

Minor additions to the infrastructure of the Fort will be required to support these proposed AAR activities. Approximately one mile of additional dirt roads amongst and between the treated-effluent basins will be constructed to provide access around and into each basin

A small utility building will be required to support the infiltration basin facility. This structure will be located on the south side of Treated-Effluent Basin #2 and will consist of a concrete foundation and a one-story metal superstructure. The estimated footprint is 10 ft by 10 ft (3 m by 3 m) and an area of approximately 20 ft by 20 ft (6 m by 6 m) will be permanently disturbed as a result of this construction. In addition, Huachuca City's sewage disposal basins, located along the northwestern edge of Training Area C on the East Range, are being considered for possible inclusion in the Fort Huachuca AAR program.

The piping of treated effluent from the Huachuca City basin to the East Range recharge facilities is also analyzed as part of the Proposed Action, should this option eventually be considered

advantageous to all parties concerned. This will require trenching for pipelines and a booster station to support delivery of the treated effluent uphill to the facility, as well as some additional treatment. This EA address the addition of "off fort" effluent being treated at WWTP#2. Because no pipeline route has been proposed to date, further analysis will tier off of this EA to cover trenching and pipeline installation associated with this activity. Analysis of this option is not intended to construe that formal negotiations or commitments of any kind have been made by any of the parties potentially concerned.

Soils stockpiled from the AAR construction area may be transported to any of three proposed stockpile areas for both temporary and long-term storage. Approximately one half of the 400,000 cubic yards (306,000 cubic m) of excavated soils may be redistributed on the East and West Ranges as part of erosion control and stormwater management improvements within the next one to two years. For example, this soil may be used to backfill the highly entrenched dry wash (locally known as an arroyo) at the upper Graveyard Gulch basin site (Figure 2.1-3 and Figure 2.1-4). Other sites on the East Range would use additional soil for surface recontouring and revegetation. The remaining 200,000 cubic yards (153,000 cubic m) of excavated soils will remain at the stockpiles until further uses are found. Approximately 20 acres (8 ha) will be used to accommodate the stockpiling of soil excavated during construction.

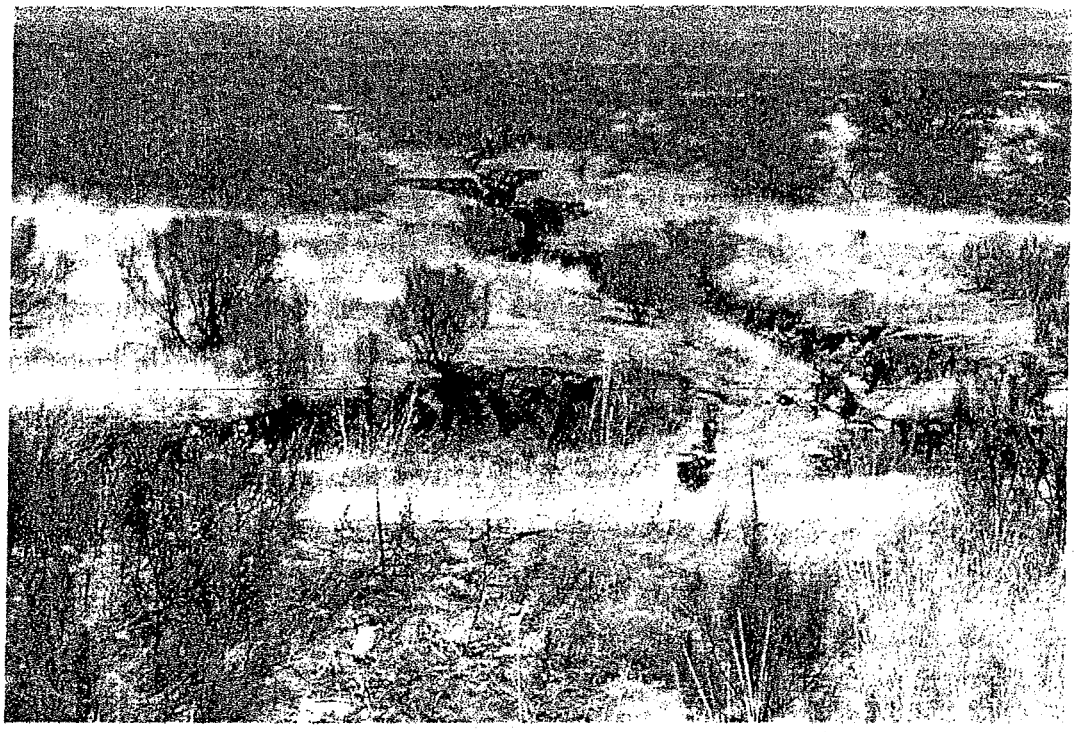

Figure 2.1-3. Arroyo at Upper Graveyard Gulch Basin Site (View from Highway 90)

Figure 2.1-4. Arroyo at Upper Graveyard Gulch Basin Site (View toward Highway 90)

2.1.4 Erosion Control and Stormwater Management Improvements

Several methods, or combination of methods, to manage erosion and stormwater and thereby improve watershed conditions are considered in order to accomplish the following objectives:

- Reduce or reverse the entrenchment of streambeds.
- Reduce the movement of sediment.
- Aid in the infiltration of stormwater by allowing it to remain in the channel longer.
- Protect water recharge mechanisms such as in-stream basins from inundation.

These methods (summarized in Table 2.1-1) include combinations of surface stabilization, runoff control and conveyance, outlet protection, sediment traps and barriers, stream protection and stormwater detention, infiltration, and distribution systems. A more detailed description of each method is presented in Appendix A. Figure 2.1-5 shows the proposed erosion control and stormwater management areas. It is anticipated that these activities will disturb approximately 75 acres (30 ha). One specific project, accounting for 50 (20 ha) of the 75 acres of this disturbance, is discussed below.

Table 2.1-1. Erosion Control and Stormwater Management Methods

Category	Methods
Surface Stabilization	Riprap Surface Roughening/contouring Revegetation Geotextiles Vegetated Filter Strip
Runoff Control and Conveyance Measures	Grass-Lined Channel Hardened Channel Riprap Channel Runoff Diversion
Outlet Protection	Level Spreader Outlet Stabilization Structure
Sediment Traps and Barriers	Brush Barrier Check Dam/Rock Wire Gabion Sediment Basin Sediment Fence/Straw Bale Barrier
Stream Protection	Grade Stabilization Structure Stream bank Stabilization Temporary Stream Crossing
Stormwater Detention and Infiltration Basins	Infiltration Basins Dry-wells Rooftop Collection

Upper Graveyard Gulch Stormwater Detention Basin

Construction of a 50-acre (20.2 ha) stormwater detention basin on the south edge of Training Area F is proposed. (Figure 2.1-6). Currently, stormwater enters the East Range from the large culvert under SR 90 Business Bypass (mile marker 319) and has caused significant erosion in Graveyard Gulch (see Figure 2.1-4).

Under the Proposed Action, stormwater would be detained in the proposed detention basin and conveyed downstream at a lower rate and velocity than the rate upon entering the basin. This reduces the water's tendency to cause erosion that contributes to the creation of gullies. Typically, this type of basin is constructed below existing ground level with a flat bottom. The depth is anticipated to be between 2 ft and 10 ft (0.6 m and 3 m), but may be deeper if necessary to reach acceptable soil types. During initial construction, all vegetation at the site would be removed and the area would be tilled and recontoured. The sides of the basin and any disturbed areas outside of the basin would be revegetated. Occasional maintenance may involve the removal of sediment and minerals that collect over time. The existing eroded gully would be backfilled and compacted. The perimeter road would be reconstructed. Low flows into the basin may be metered and conveyed to the revegetation areas for natural irrigation.

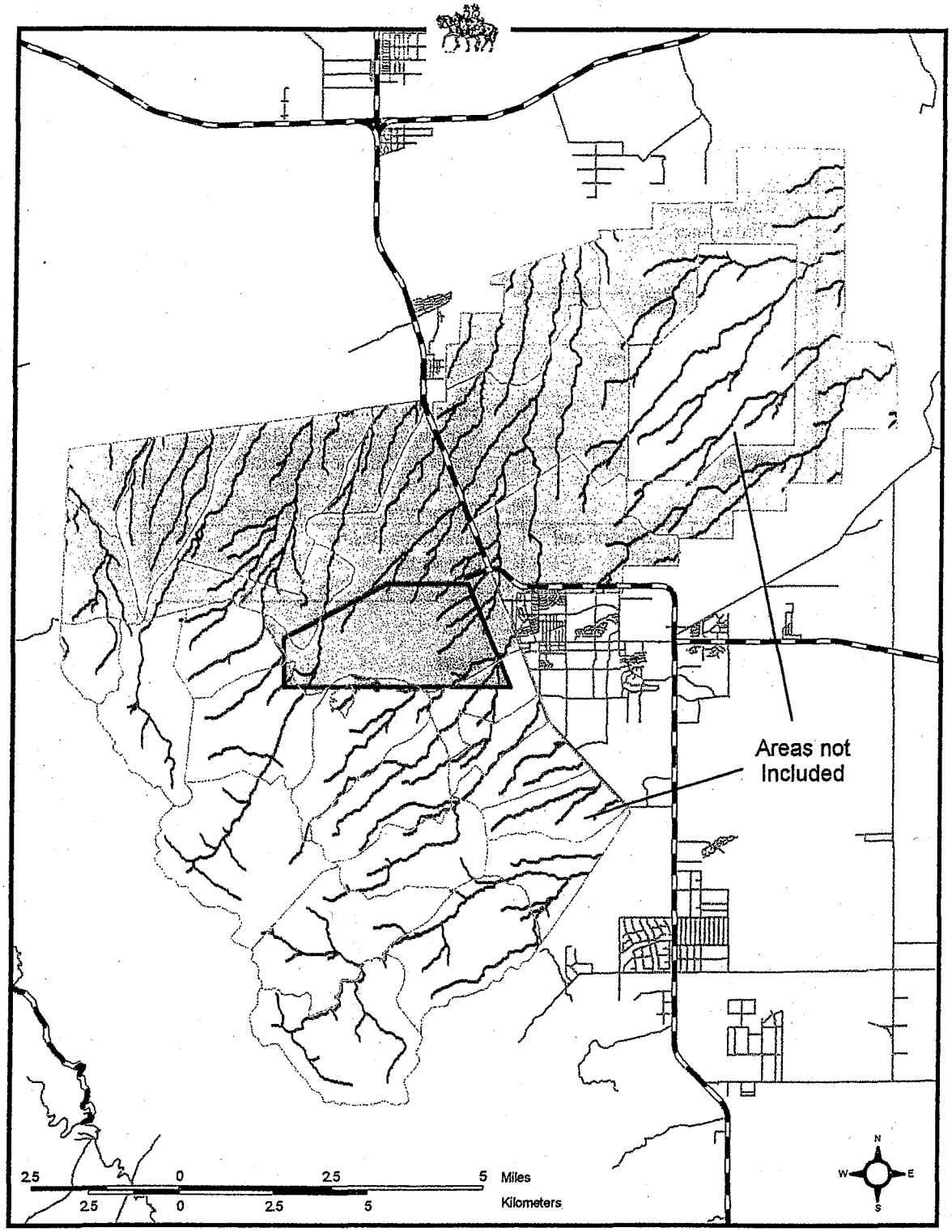

FIGURE 2.1-5

Proposed Erosion Control and Stormwater Management Areas

ManagementArea
Cantonment Area
Training Areas
State Highway
Local Roads
Water

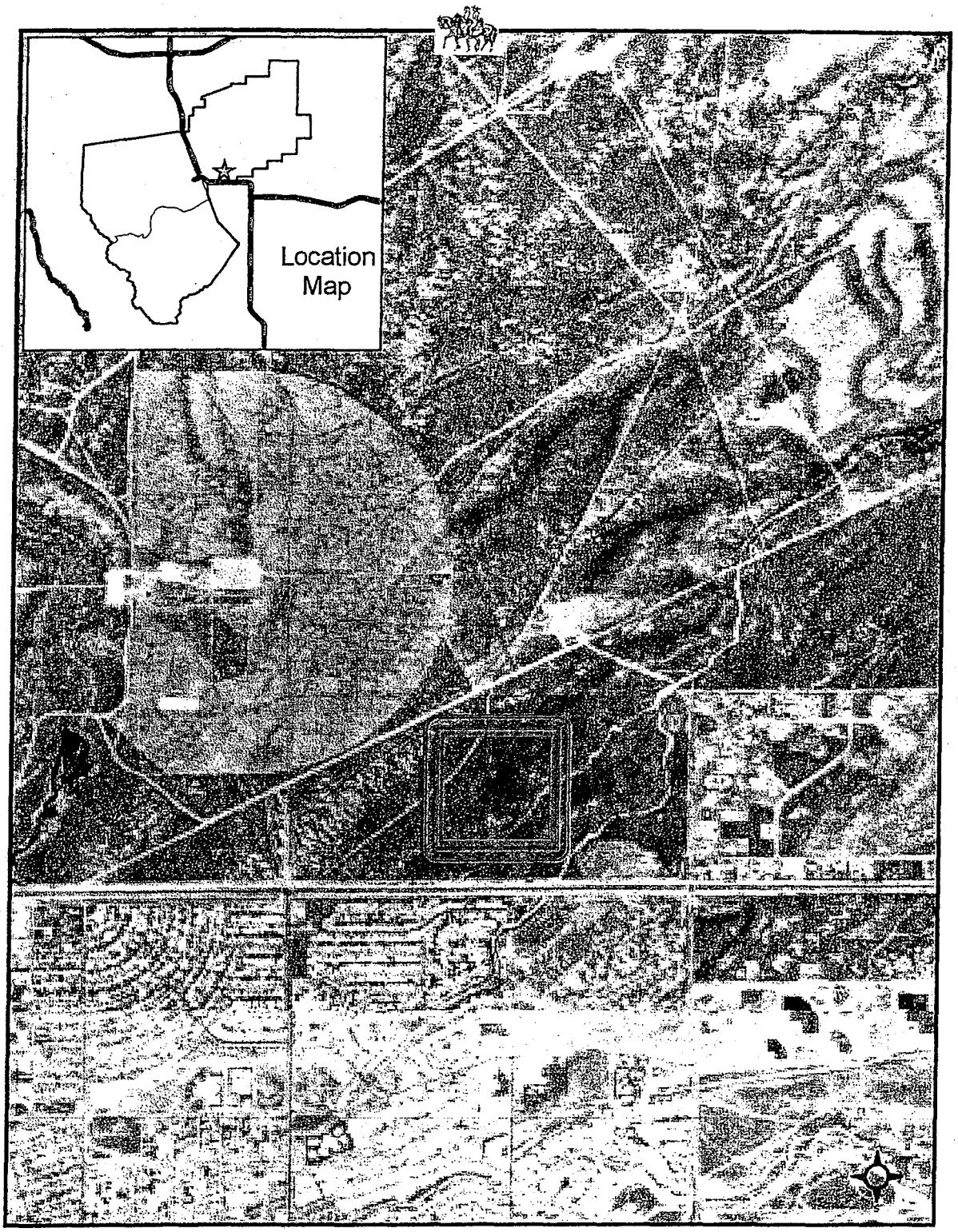

FIGURE 2.1-6

**Proposed Graveyard Gulch
Stormwater Drainage Basin**

Stormwater Drainage Basin
Temporary Area of Disturbance

2.2 ALTERNATIVE A—ENHANCED EXISTING FACILITIES

Under Alternative A no new AAR facilities will be built and the reuse distribution pipelines will not be expanded. Minor reengineering of the existing East Range Treated-Effluent Basins #2, #3, and #4 will convert them to recharge basins and improve infiltration efficiency. The reengineering includes removal of vegetation and accumulated sediments on the bottom and sides of the basins, stabilization of the banks, addition of monitoring equipment, and minor trenching to accommodate installation of additional pipelines and manual valves between the basins. The stormwater diversion channel and the utility building will not be constructed, and the dirt road network will not be extended.

Erosion control and stormwater management projects will be carried out on the East and West Ranges, but to a lesser extent than under the Proposed Action. These projects will not include any outlet protection or stormwater detention or infiltration basins.

2.3 ALTERNATIVE B—INJECTION WELLS

This alternative evaluates the possibility of using Class I injection wells with backflushing basins on the East Range. Class I injection wells connect directly with the groundwater table and provide a conduit through which treated effluent may be deposited into the groundwater without filtering through the vadose zone. Using a high-pressure pump, treated water is forced into the well and subsequently into the groundwater. With the water injected directly into the groundwater system, this method of recharge minimizes evaporative losses.

In function, the injection well accepts the treated effluent and conducts it into the ground. Over time, deposits of fine sediment and algae growth develop in the area immediately adjacent to the perforated section of the well, causing it to become clogged and reducing the efficiency of the well to pump water into the groundwater system. The rate at which clogging occurs depends upon the sediment and nutrient load of the treated effluent. To reduce the amount of clogging, the well requires regular maintenance in the form of backflushing, done by reversing the pump and moving water from the groundwater to the surface. Pumping the water from the subsurface removes algae and fine sediments from the area surrounding the perforated interval. The water containing the algae and fine sediment is placed in a backflushing basin. A backflushing basin is similar to a treated-effluent basin in that it holds the water until it either evaporates or infiltrates. Such a basin also requires regular maintenance to remove deposits left from the backflushing process.

2.4 NO ACTION (ALTERNATIVE C)

Under the No-Action Alternative, the existing water management program at Fort Huachuca will continue as is, with no increase in facilities. None of the existing facilities will be upgraded. This alternative represents the continuation of baseline environmental conditions with respect to treated effluent and urban runoff management at Fort Huachuca.

2.5 ALTERNATIVES CONSIDERED BUT REJECTED

After evaluating the Injection Well Alternative (Alternative B), it was determined that injection wells are not a reasonable approach to meeting Fort Huachuca's AAR goals. Although this method of recharge minimizes evaporative losses, there are many inherent problems with injection wells and the engineering suitability of potential sites on Fort Huachuca.

Constructing and maintaining injection wells is also cost prohibitive. In an effort to minimize well clogging due to algae growth, the treated effluent requires additional treatment to meet a more stringent chemical standard than is required for treated-effluent basins and other methods of recharge. This additional treatment increases the total cost of operating the well. Similarly, the extensive maintenance required to operate an injection well is costly. Evaluation of available areas on the East Range indicated that although injection well recharge is possible, the engineering and logical parameters are marginal. To transfer the available amount of treated effluent would require multiple injection well systems, thus increasing the upfront costs, maintenance costs, and potential for irreversible clogging within a system. For all of these reasons, this alternative was rejected and is not further discussed in this document.

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3.0 AFFECTED ENVIRONMENT

The affected environment descriptions presented in this section provide the context for understanding the environmental consequences described in Section 4 of this EA. As such, they serve as a baseline for comparing changes to existing environmental conditions caused by implementation of the Proposed Action and alternatives. The region of influence (ROI) studied will be defined for each resource area affected by the Proposed Action and alternatives. The general ROI includes Fort Huachuca and surrounding environs (Figure 3.0-1).

3.1 GEOLOGY AND SOILS

Geology and soils affected by the various activities in this EA are within the boundaries of Fort Huachuca, with the potential for some effect to adjacent areas downstream along the Babocomari and San Pedro Rivers. Based on this, the ROI includes the entire Fort and adjacent portions of the Babocomari and San Pedro River floodplains.

3.1.1 Geology

The geology of the area between the San Pedro River and the Huachuca Mountains is complex. The remnants of a volcano, active from about 66 to 73 million years ago, are exposed in the beds of the Babocomari and San Pedro Rivers and in the numerous rocky hills extending from the town of Tombstone to the northern part of Fort Huachuca's East Range. Weathering and erosion have obscured most of the original crater. Beneath the relatively young alluvium of the Babocomari and San Pedro Rivers lies an undulating surface of hard volcanic rock (Cochise County 1993). Geophysical studies confirm the presence of this volcanic body at the approximate confluence of the Babocomari and San Pedro Rivers. As part of recent and continuing studies, Wynn and Gettings (1997) have identified a volcanic center. They report that parts of the Tombstone Caldera underlie the eastern margins of Fort Huachuca.

Degradation processes formed a pediment composed of eroded volcanic detritus and entrained material that was scoured from the original mountain slopes. The minerals in the detritus dissolved and re-crystallized over time, thereby cementing the once loose and porous mix into a nearly impermeable mantle that encircles much of the northern and eastern flanks of the Huachuca Mountains. This formation is identified as the Pantano (Brown et al. 1966) or Tertiary - Conglomerate.

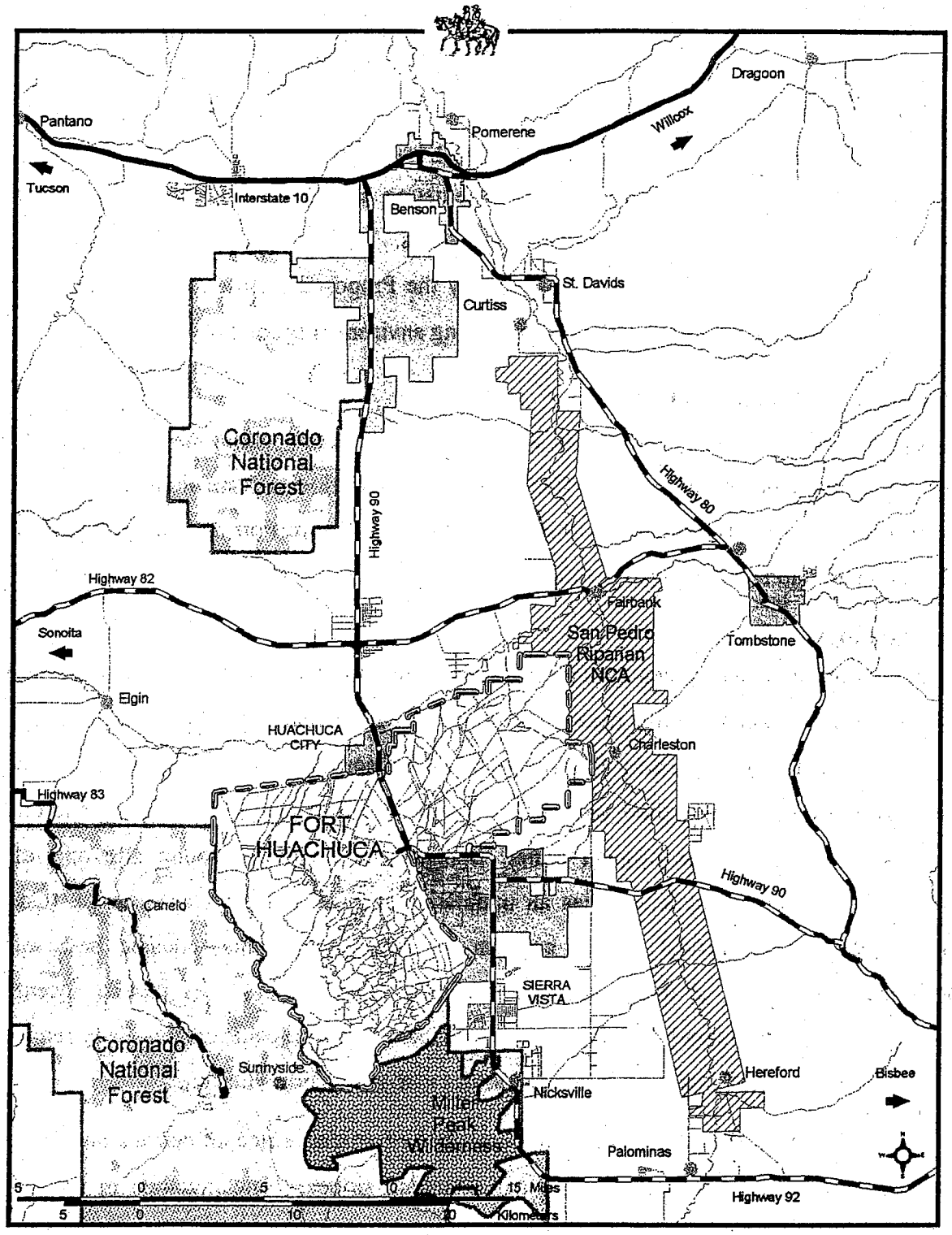

FIGURE 3.0-1

Fort Huachuca & Surrounding Areas

- Town
- Municipal Boundary
- San Pedro Riparian NCA
- Wilderness Area
- National Forest
- Interstate Highway
- State Highway
- Local Road
- Major Watercourses
- Fort Huachuca

The Upper San Pedro Basin (USPB) is underlain by several hundred feet of consolidated and unconsolidated sedimentary deposits, most of which can transmit groundwater. These deposits are not uniform and range from a thickness of more than 1,000-ft (301 m) in the south, where basin and range type faulting have produced a deep graben structure, to just below ground surface in other areas (BLM 1989). Along the northeast portion of the Fort, deep structural faults and at least one volcanic body bisect the valley-fill deposits. The principal regional hydrostratigraphic features are the upper and lower units of unconsolidated basin fill and the overlying floodplain alluvium. Together, these units comprise the regional and local aquifers.

3.1.2 Soil Properties and Conditions

Located along the mountain front of the Huachuca Mountains, the Fort has a diverse assortment of soils. The physical and chemical properties of the soils influence existing plant communities as well as land use and management. Soils that influence land use and management include gravely or rocky soils; soils with hard pans; and deep, droughty, sandy soils. Soil management is a significant operational consideration at Fort Huachuca.

The Soil Survey of Fort Huachuca (Natural Resources Conservation Service, 1997) classifies the different types of soils found on the installation into hydrologic groups (B, C, and D) based upon infiltration capacity and ability to transmit water. The survey also identifies their locations (Figure 3.1-1) and potential uses

Group "B" soils have moderate infiltration rates when thoroughly wetted and chiefly have moderately fine to moderately coarse textures. These soils have a moderate rate of transmission. Group "C" soils have slow water transmission rates and moderate-to-slow infiltration rates when thoroughly wetted. Both "B" and "C" soil types promote higher amounts of runoff and streamflow from storm events. Group "D" soils have extremely low water transmission rates and very slow infiltration rates when saturated. This is usually caused by a high percentage of clay and the existence of claypans or clay layers near the surface, or where shallow soils overlie nearly impervious bedrock near the surface.

Almost one-quarter of the post has deep red clay soils with slow permeability, typical of Group "D" soils. These soils tend drain poorly, become very slippery when wet, and are susceptible to compaction. Soil stability is affected by slope and vegetation density.

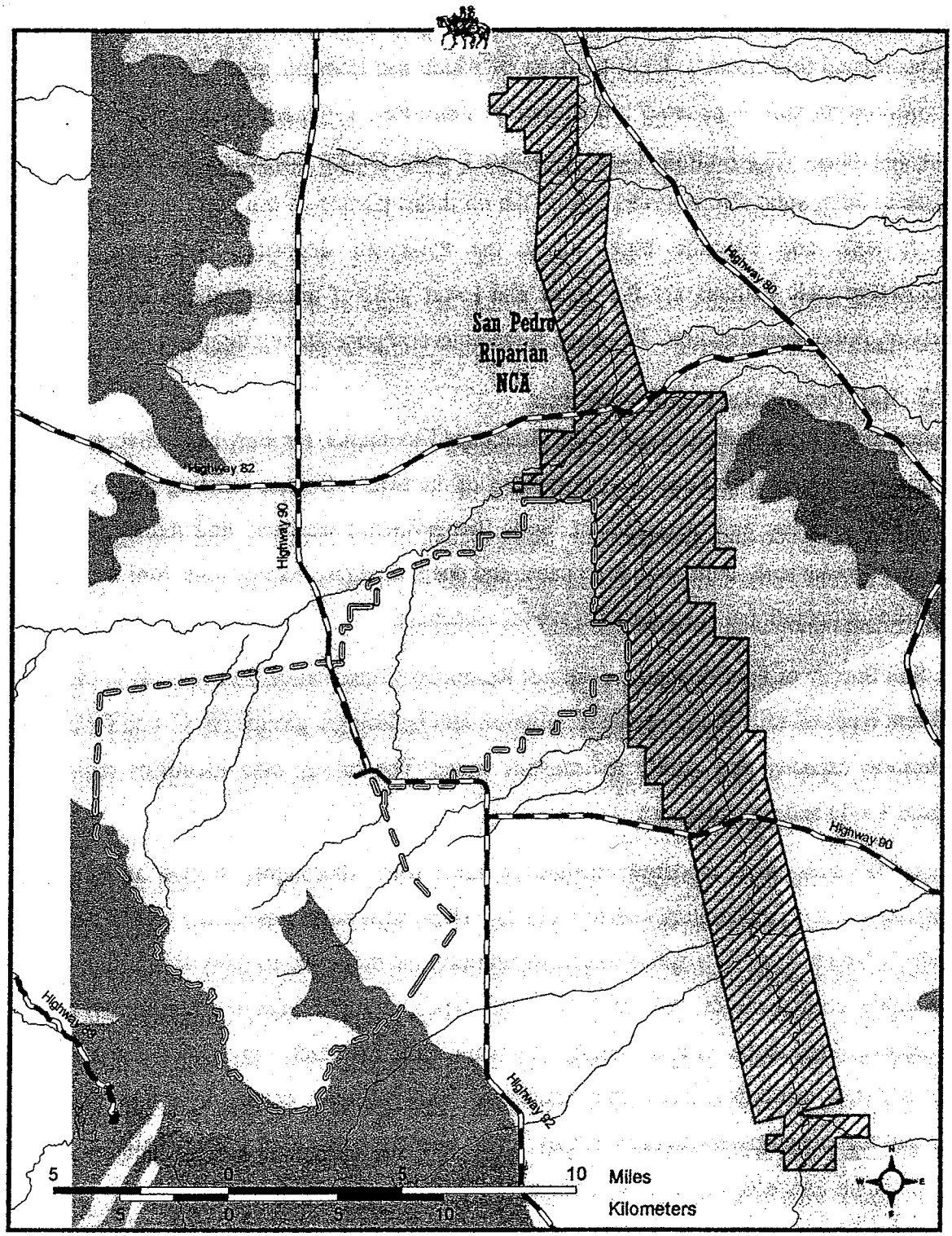

FIGURE 3.1-1

NRCS Soil Groups

NRCS Soil Group
B
C
D

Major Roads
Fort Huachuca
Major Watercourses
San Pedro Riparian NCA

Steep slopes mean that stormwater runoff moves at higher velocities with associated higher potential for erosion. Low nutrient soil value results in lower vegetation density (less vegetation cover), and less vegetation increases susceptibility to erosion. Rills and gullies are prevalent and further decrease the surface area on which vegetation can establish itself.

Many of the soils on the hilly and mountainous areas on the South and West Ranges are shallow. Roughly 30 percent of the soils are less than 2 ft deep (0.6 m) over bedrock. The soils tend to be droughty with a low available water capacity and are susceptible to erosion. The soils of the cantonment area consist of alluvial fan soils (White House complex, Lanque soil, Courtland-Sasabe-Diaspar complex, Blacktail-Pyeatt complex, Blakeney soil, and Combate soil) (Svetlic 1994).

Several different soil groups characterize the East Range. The soils are derived from alluvium transported from the mountain front to the west. The high sodium and gypsum makes them subject to gully erosion and piping and causes them to be very corrosive to concrete and steel. Weathering of the parent material proceeds through the more advanced stages of soil development as one moves downslope from the mountain front east towards the San Pedro River. The existing soil disturbance across the East Range is attributed to the physical setting of the range and the functional uses of the area, as described below.

Roads—Significant rilling and gullying associated with roadway drainage is present in some locations. There is little provision to control water drainage from the roads anywhere on the East Range. The severity of the erosion from stormwater runoff depends on the soil type and steepness of the slopes where the roads are located. Soils low in nutrients do not support much vegetation, a major factor in soil stabilization. Roads constructed vertically down hill slopes experience more erosion than roads that traverse the hill slope. Stormwater runoff from the roads with steeper slopes moves at a higher velocity and therefore has more potential for erosion than the typical slower moving water of a slope-traversing road.

Drainage improvements and local development—The pattern of erosion present on the East Range is associated with local development upslope of the range. Local development has caused historic sheet flow to be concentrated and delivered to the East Range at a few, select locations. Two factors cause increased erosion: (1) concentrated flow has a higher velocity from channalization thereby increasing the water's ability to carry sediment and (2) a lack of sediment

in the runoff since some of the stormwater is originating from developed areas. Runoff has a natural appetite for sediment, and when this clear water runoff reaches the relatively natural landscape of the East Range, substantial erosion occurs. The most dramatic example of this form of erosion occurs at Upper Graveyard Gulch. Roadways and channels collect stormwater runoff from several square miles of developed areas in Sierra Vista. The water is delivered to the East Range in a 10-ft wide by 5-ft high (3 m x 1.5 m) concrete box culvert under SR 90 Business Bypass, near mile marker 319 (see Figure 2.1-6). Over time, clear water released from the culvert has eroded an arroyo nearly one mile long. The headcut of the arroyo has undermined the East Range perimeter road (temporarily reinforced with grouted riprap), and now sits at the toe of the road prism of Highway 90. If not abated, subsequent flows will likely undermine the box culvert beneath the highway, ultimately leading to the failure of the perimeter road and the highway. Likewise, development upslope of the East Range and to the east is using the same pattern of drainage infrastructure. There are already indications that similar erosion problems are occurring. In the absence of abatement measures, this erosion will progress over time.

3.2 WATER RESOURCES

Because groundwater and surface water flows influence large areas, water resources are evaluated at a regional level. The Upper San Pedro Basin (USPB) watershed comprises the ROI for water resources in this EA, with specific reference to the Sierra Vista subwatershed.

3.2.1 Surface Water Resources

Fort Huachuca lies in the Babocomari and the Garden Canyon watersheds, as defined by the NRCS. Combined, these watersheds represent a 539 sq mi (1,396 sq km) drainage area, making up 31.7 percent of the USPB (ENRD 1997). The San Pedro River is about three-quarters of a mile from the eastern boundary of the East Range (Figure 3.2-1), and the Babocomari River is within one-half mile of the installation's northern boundary.

There are a number of ephemeral surface water features on Fort Huachuca. They include arroyos and continuous and discontinuous gullies. The streams are usually dry and only flow in response to significant precipitation events. Ephemeral streams on the installation are typically narrow channels with a sand and gravel layer at the bottom. Some of these channels are entrenched. The channels conduct runoff to larger drainage systems.

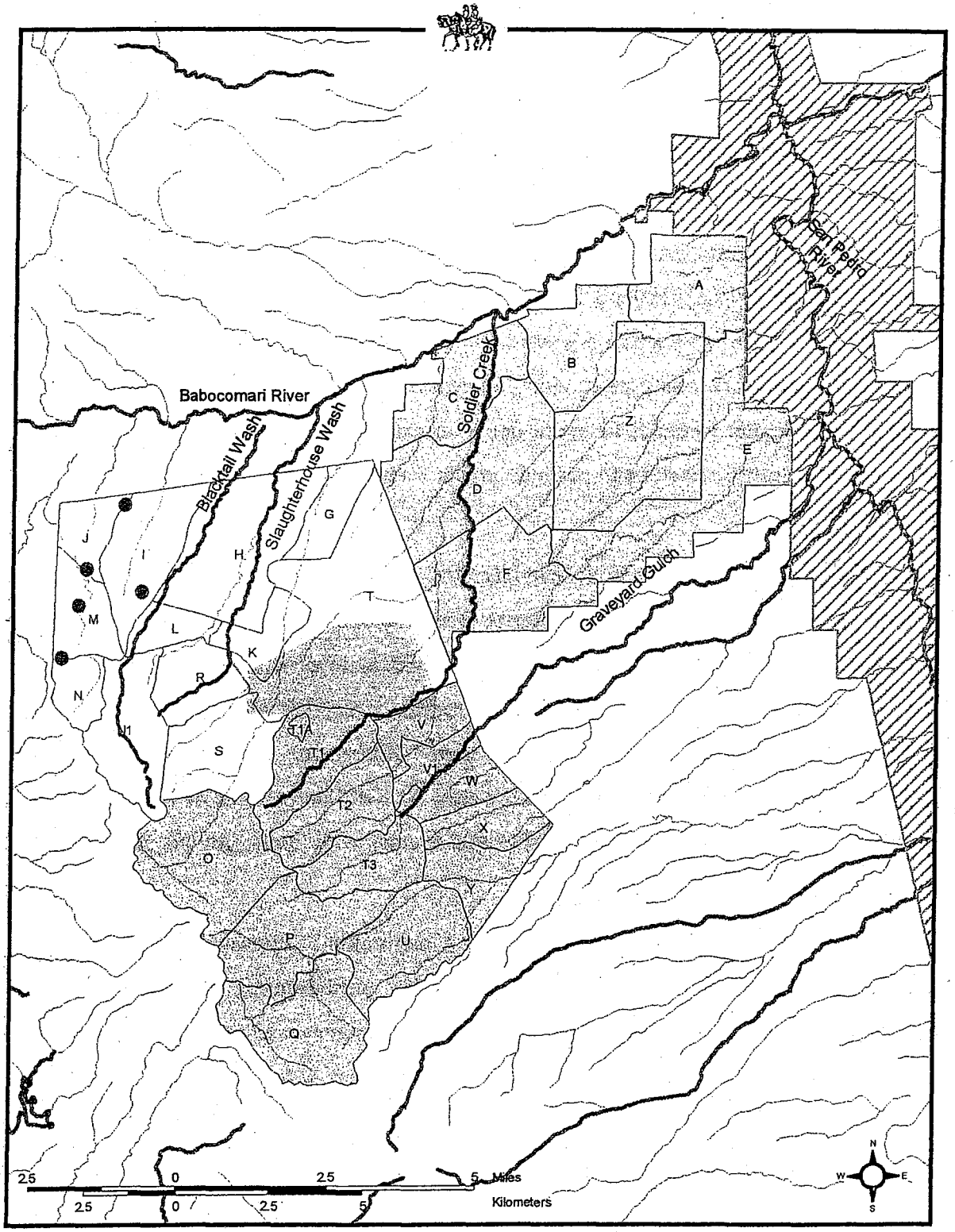

FIGURE 3.2-1

Fort Huachuca
Water Resources

- Cantonment Area
- South Range
- West Range
- East Range
- San Pedro River NCA
- Training Areas
- Watercourses
- Selected Ponds

Local surface water is generated as storm runoff, snowmelt, and springs discharging into the stream channels of Garden and Huachuca Canyons. Other canyons located within the boundaries of Fort Huachuca yield little water except for during short periods following precipitation events. Springs provide the primary source of perennial surface water within the Fort. Potable springs are located in Garden and Huachuca Canyons.

Fort Huachuca has approximately 4.5 miles (7.2 km) of perennial streams, of which Garden Canyon has 3.5 miles (5.6 km) and Huachuca Canyon has 0.75 miles (1.2 km) of perennial stream segments. Minor lengths of perennial reaches also occur in McClure and Blacktail Canyons. Wetlands are associated with the perennial streams, springs and ponds on the installation. Inadvertent wetlands have developed in association with plugged drainage culverts. Other wetlands have developed around ponds, sewage lagoons, and erosion control impoundments

The East Range of Fort Huachuca is relatively flat with a gentle slope southwest to northeast, towards the San Pedro River. The West Range slopes upwards to the north from the Huachuca Mountains. The cantonment area is relatively flat, with a slope of approximately two percent. Mountains with slopes of 50 degrees or more succeed foothills with steep slopes (up to 35 degrees rise) to the west of the cantonment area. Ephemeral streambeds flow out of the mountains and across the cantonment area towards the San Pedro River or Babocomari Creek. These beds are deeply incised from flash-flood events, with rock, gravel, sand, and debris scattered throughout the channels.

The existing treated-effluent basins are located in a longitudinal depression that also functions as a corridor for discharge of natural stormwater. The northernmost basin is isolated from immediate stormwater runoff. Runoff from the western tributary wash flows into the subsequent recharge basins and then cascades through the basin system before resuming its normal flow path. There is some deposition of sediment, as flows from the western tributary enter the second, uppermost recharge basin. Water velocities are low enough to keep the water from becoming highly erosive, as there is little evidence of erosion in the wash channel downstream of the recharge basin system.

The eastern tributary wash has been truncated by an access road, essentially isolating it from the uppermost recharge basin. The road is not designed to withstand a particular design frequency

storm (such as a 100-year flood). There is no evidence of water overflowing the road and no obvious erosion along the side slopes of the road. Further, vegetation along the sides of the road prism does not show any signs of disturbance. Grasses are particularly sensitive to even minor water flows, yet they show no evidence of any water flow. It appears that the area upstream of the road has been able to accommodate storm flows thus far.

The side slopes of the major ravine exhibit little evidence of rilling or gullying. There are several dirt access roads leading to the existing recharge basins, which are perpendicular to the ravine. These roads exhibit gullying along the sides as a the result of concentrated stormwater runoff on the road, which lack provisions for drainage. Downstream from the existing recharge basins, the wash channel appears to be stable as there is no evidence of significant channel entrenchment or aggradation; vegetation along the channel banks is well established.

3.2.2 Groundwater Resources

Most of the geologic information in this section is summarized from a hydrogeologic investigation of the Huachuca Mountains near the Fort conducted by the U.S. Geological Survey (USGS) (Brown, et al. 1966).

The Huachuca Mountains consist of faulted granite, carbonate rocks, conglomerate, and claystone beds. Groundwater generally moves downward through interconnected fractures and caverns following local topography. Springs occur in canyons where downward flow is interrupted by impermeable rocks such as cemented sandstone, siltstone, mudstone, granite, or intrusive dikes.

Groundwater generally flows northeasterly from the east face of the Huachuca Mountains. The San Pedro Basin groundwater is recharged by infiltration through canyon stream channels where runoff collects from side slopes and from alluvial fan slopes along the mountain front. Although some storm runoff recharges the groundwater basin, most of the infiltrated water is eventually lost to the transpiration of plants. Springs in the Huachuca Mountains are recharged by infiltration of water that is captured by fractures in the carbonate rocks.

Besides the regional aquifer, at least one local perched aquifer exists along the pediment of the Huachuca Mountains in a zone where the alluvium of the basin fill is underlain at shallow depths by bedrock. A perched aquifer is an isolated pocket of water that occurs above the regional water table. The perched aquifer extends from the area of Carr Canyon toward the Fort Huachuca

military reservation boundary and extends northeasterly toward the San Pedro River (Harshbarger and Associates 1974). The Arizona Department of Water Resources (ADWR) estimates the capacity of the aquifer at 31.8 million ac-ft (10,361,235 gallons).

Groundwater quality and availability are of particular importance at Fort Huachuca. All potable water is pumped from groundwater supply wells. Regional agricultural operators and the adjacent communities of Sierra Vista and Huachuca City also rely entirely on groundwater for irrigation, potable water and other consumptive uses.

Two cones of depression, one at the Fort Huachuca-Huachuca City well field, the other in the area of Fort Huachuca-Sierra Vista, have been created by groundwater withdrawal. Groundwater declines have lead to significant soil subsidence in other parts of the United States, however, at the Fort the geology and soils are considered at relatively low risk for subsidence.

Fort Huachuca withdrew an average of 2,814 ac-ft (917 MG) of water from the aquifer from 1989 to 1999 (ENRD 2000). Water table elevations at Fort Huachuca decreased 40 to 50 ft (12 to 15 m) in the period between 1940 and 1985. Groundwater levels continued to decline at a rate of 1 to 2 ft (0.3 to 0.6 m) per year. This was primarily a result of withdrawal rates that exceeded recharge rates until the late 1980's when water management surfaced as an issue. Since that time, water consumption has declined by as much as 1,300 ac-ft (423 MG) due to successful water management on the installation. Numerous conservation, reuse, and recharge programs, such as this program, are either on going or in the planning phase.

Generally, the chemical quality of the groundwater obtained by Fort Huachuca and other users in the USPB is good and is considered suitable for domestic uses. However, in several areas (St. David and Benson), fluoride and sulfate concentrations at or above drinking water standards have been noted. Groundwater on the installation is treated with chlorine.

3.3 AIR QUALITY

An air pollutant is any contaminant present in the atmosphere in sufficient quantities to be detrimental to the public's well being, human health, plant or animal life, or property. Criteria air pollutants are defined as those pollutants for which the federal government has established air quality standards or criteria for outdoor concentrations in order to protect public health. The air quality of a region is evaluated on the basis of Ambient Air Quality Standards (AAQS) for five criteria air pollutants: particulate matter smaller than 10 microns (μm) in diameter (PM_{10}); Sulfur

dioxide (SO_x); ozone (O_3); carbon monoxide (CO); and nitrogen dioxide (NO_x). The directly emitted criteria air pollutants are CO, NO_x, SO_x and suspended particulate matter (PM_{10}). Ozone is a secondary air pollutant resulting from photochemical reactions involving nitrogen oxides (NO_x) and reactive organic gases (ROG).

In 1990, the Arizona Department of Environmental Quality (ADEQ) adopted the National AAQS as the Arizona AAQS. The Arizona State Implementation Plan (SIP), which is a detailed description of the programs Arizona uses to carry out its responsibilities under the Clean Air Act, includes the Arizona Air Pollution Control Laws and the Arizona Air Pollution Control Regulations under Arizona Administrative Rules and Regulations. The State of Arizona has adopted both National Primary and Secondary Standards for criteria air pollutants (Table 3.3-1).

Table 3.3-1. National Primary and Secondary Ambient Air Quality Standards

		STANDARDS	
POLLUTANT	AVERAGING TIME	PRIMARY	SECONDARY
Ozone	1 Hour	0.12 ppm; (235 $\mu g/m^3$)	Same as primary standard
Carbon Monoxide	8 Hours	9.5 ppm; (10 $\mu g/m^3$)	-
	1 Hour	35 ppm; (40 $\mu g/m^3$)	-
Nitrogen Dioxide	Annual	0.053 ppm; (100 $\mu g/m^3$)	Same as primary standard
Sulfur Dioxide	Annual	0.03 ppm; (80 $\mu g/m^3$)	-
	24 Hours	0.14 ppm; (365 $\mu g/m^3$)	-
	3 Hours	-	1,300 $\mu g/m^3$; (0.5 ppm)
Particulate Suspended Matter (PM_{10})	24 Hours	150 $\mu g/m^3$	Same as primary standard
	Annual Arithmetic Mean	50 $\mu g/m^3$	
Lead	Calendar Quarter	1.5 $\mu g/m^3$	Same as primary standard

Source: 40 CFR Part 50

Air quality standards and regulations are expressed either as pollutant concentration or as the annual emission rate. Concentrations are expressed in either micrograms per cubic meter ($\mu g/m3$) or parts per million (ppm) by volume. National Primary Standards define the levels of air quality necessary to protect the public health and welfare from known or anticipated adverse effects of a pollutant with an adequate margin of safety.

This section identifies current ambient air quality conditions and policies affecting the Fort Huachuca area, located in the Southeast Arizona Air Quality Control region. This region encompasses the counties of Cochise, Graham, and Santa Cruz. Local air quality standards fall under the jurisdiction of the U.S. Environmental Protection Agency (EPA) and are regulated by the National AAQS as directed by the Clean Air Act of 1971 and the ADEQ.

3.3.1 Ambient Air Quality

General ambient air quality conditions are affected by pollutants emitted at a site as well as those emitted upwind and moved by wind and air currents into the site area. The air quality for Fort Huachuca and the immediate vicinity is of primary concern in this EA. Given the remote location of the Fort, upwind emissions play a minimal role in the air quality of the region. Therefore, the ROI for air quality is limited to the Fort, with considerations directed toward how the activities evaluated would influence downwind air quality.

The superior air quality in the vicinity of Fort Huachuca is related to favorable wind patterns and a lack of typical major sources of air pollution such as heavy industry and fossil fuel power plants. Sources of air pollutants in the area include aircraft (military and private), private and military vehicles, and gas heating emissions. Because of these favorable conditions, Fort Huachuca is within an area of air quality attainment for criteria air pollutants.

Available monitoring data indicates that air quality in the Fort Huachuca area meets AAQS for criteria air pollutants, and has met the standards since the inception of monitoring programs. Since Sierra Vista monitoring stations are close to Fort Huachuca, these data provide applicable characterization of Fort Huachuca air quality. Monitoring programs for CO and O_3 were conducted in Sierra Vista between 1977 and 1983 by the ADEQ. The routine CO and O_3 monitoring program in Sierra Vista ended in 1984 and with the justification that CO and O_3 concentrations would continue to decrease through year 2000. CO results primarily from automobile emissions and O_3 from photochemical reactions involving hydrocarbons.

ADEQ also monitored total suspended particulate (TSP) in Sierra Vista between 1974 and 1988. The TSP measurements include particles in the PM_{10} size range and PM_{10} levels can be calculated from TSP values. The Arizona Office of Air Quality Control monitors PM_{10} because particles in the PM_{10} size range are respirable, thus influencing human health. Calculated PM_{10} levels for the Sierra Vista area were well below 50 $\mu g/m^3$, the compliance standard.

No data are available on sulfur and nitrogen oxides. Vehicle engines and industrial processes are the major sources of these pollutants. Potential industrial sources of sulfur dioxides in the region are mainly copper smelters. Sources of these pollutants on the Fort are vehicle and aircraft engines, diesel generators, boilers, military ordnance and other heating equipment. Fuels and ordnance are typically low in sulfur and would not contribute measurable amounts of sulfur and nitrogen dioxides to the region.

3.3.2 Climate

The climate at Fort Huachuca is as varied as its topography, ranging from hot, dry valley bottoms to cool, moist mountain peaks. The principal meteorological station is located at LAAF, elevation 4,664 ft (1,422 m) above mean sea level (MSL), and the electronic proving ground (EPG) maintains other stations on the Fort. Average minimum and maximum daily air temperatures at the LAAF station are 35°F (2°C) in January and 90°F (32°C) in June (ENRD 1995). Average annual precipitation at the Fort is 15 inches (38 cm). The intensity and frequency of storms varies greatly from one year to the next, so that the seasonal precipitation is normally much below or above the long-term average value. Roughly, one tenth of the winter precipitation falls as snow, but rarely stays on the ground for more than a day or two.

The Huachuca Mountains receive an average annual precipitation that exceeds 30 inches (76 cm) per year (ADWR 1988). Precipitation has a bimodal distribution, with approximately 60 percent of the total falling during the summer "monsoon" season, and roughly 30 percent occurring during winter months. Spring and fall are typically dry (Sellers and Hill 1974). Maximum "monsoonal" precipitation falls on the southeast (windward) side of the Huachuca Mountains (ADWR 1988).

3.4 BIOLOGICAL RESOURCES

The ROI for biological resources encompasses the entire Fort with the exception of the South Range. Although direct effects on vegetation will be limited to those areas on Fort Huachuca where proposed construction or erosion control would occur, potential indirect effects could occur across the East and West Ranges and on adjacent portions of the San Pedro Riparian NCA. A brief discussion of the NCA is included as the potential exists for activities to either indirectly or directly affect the water level and/or quality of habitat within the NCA.

3.4.1 Fort Huachuca Vegetation

Twelve vegetation types have been mapped on Fort Huachuca (Figure 3.4-1). The following discussion describes the vegetation found on the East and West Ranges and the cantonment area.

East Range—The major plant community occurring on the East Range is shrublands of the Chihuahuan desert scrub type (Brown 1994). Elevations for this habitat type range from 4,000 to 4,400 ft (1,220 to 1,341 m). The desert scrub community was historically desert grassland, subsequently altered by livestock overgrazing prior to government ownership.

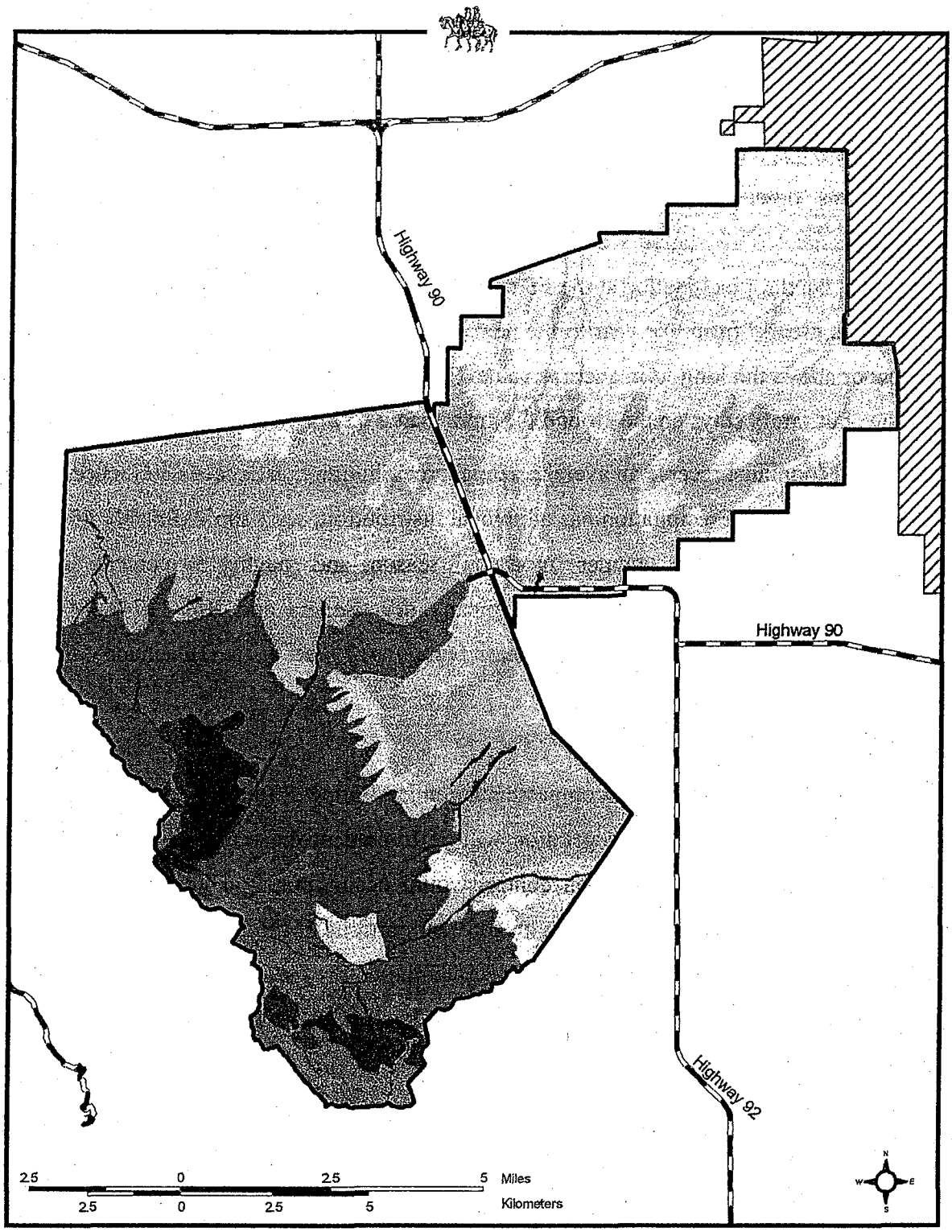

FIGURE 3.4-1

Fort Huachuca Vegetation

- Deciduous Woodland
- Mahogany Woodland
- Mesquite Woodland
- Mesquite-Grass Savanna
- Mixed Woodland
- Oak Woodland
- Oak-Grass Savanna
- Open Grassland
- Pine Woodland
- Pinyon-Juniper Woodland
- Shrub-Grassland
- Shrubland
- Urban and Built-Up Land

Since 1960, when the Army fenced the East Range, the area has been improving, but bushy and non-native species have largely replaced the natural desert grassland. Lehmann lovegrass (*Eragrostis lehmanniana*) an introduced, invasive annual grass indicative of disturbance, is abundant within most vegetation associations on the East Range.

West Range—Up-slope from the basin scrub lands, between 4,400 to 5,100 ft (1,341 to 1,524 m), vegetation transitions into semi-desert grassland habitat. This is the predominant assemblage found on the lower elevations of this range. A savanna-like character occurs at the foothills of the mountains and develops into true woodlands at higher elevations. Vegetation includes open grassland on the lower elevation portions in the north and east, transitioning through oak-grass savanna to oak and mixed woodlands in the south and west. Deciduous riparian vegetation is found near Antelope Pond and Blacktail, Slaughterhouse, and Huachuca Creek washes. Disturbed areas include paved and unpaved roads, parking areas, a concrete helipad, power lines, a pipeline, several buildings and antenna installations, and UAV runways.

Perennial streams are found at higher elevations, with maple, ash, walnut, sycamore, and cottonwood trees along the banks. At lower elevations, cottonwood, willow, and sycamore trees usually line intermittent streams.

The vegetation in the cantonment area has changed from the original conditions. The presence of roads, a large variety of buildings, residential housing and a variety of other structures, and landscaping with lawns and exotic plant species has replaced nearly all native plant communities. The areas of native vegetation that do remain are small and fragmented. Desert landscaping is common in administrative and common areas, with mowed lawns and grassy strips between residential buildings. Several large grassy areas are maintained; two are parade fields. One of these, Chaffee Parade Grounds is watered with treated effluent. Other planted areas within the cantonment area include trees and shrubs that are maintained by the Post Forester.

3.4.2 San Pedro Riparian NCA Vegetation

The upper San Pedro River is characterized by a relatively broad floodplain that meanders through the San Pedro River Valley. The NCA consists of cottonwood-willow and herbaceous associations near the river channel, with mesquite bosque on the higher terraces. Pond and marshland communities, saltceder (*Tamarix chinensis)* four-wing saltbush (*Atriplex canescens),* and sacaton (*Sporobolus wrightii*) associations exist in the riparian zone of the river. The upper

San Pedro River flows perennially from approximately Hereford to about four miles north of the Charleston Stream Gage. The Babocomari River, which drains portions of the Mustang, Huachuca, Whetstone Mountains, and Canelo Hills is the largest tributary, enters the San Pedro River just south of Fairbank. O'Donnel Creek, Ramsey Canyon, and Miller Canyon are other important tributaries [ASL Hydrologic and Environmental Services (ASL) 1994].

The San Pedro watershed is home to one of the largest surviving expanses of southwestern cottonwood-willow riparian forest, serving as an important corridor for millions of migratory birds. Each year, millions of songbirds migrate from their wintering grounds in Mexico and Central America to their summer breeding habitats in Canada and northern United States. To successfully cross the desert landscapes of northern Mexico and the southwestern United States, migrating songbirds congregate and travel along a small number of north-south oriented corridors where they are able to find food, water and shelter.

3.4.3 Fort Huachuca Wildlife

The biotic diversity on the Fort is similar to habitats outside installation boundaries. A large diversity of birds, mammals, reptiles, amphibians, and invertebrates can also be found on Fort Huachuca. Although direct effects on wildlife will be limited to those areas on Fort Huachuca where proposed construction or erosion control would occur, potential indirect effects could occur across the East and West Ranges and on adjacent portions of the San Pedro Riparian NCA.

More than 175 species of butterfly have been observed, collected, and positively identified in Garden and Sawmill Canyons on the Fort (Hessil, pers. comm., 2000). Among the butterfly species known to have very limited ranges are the Huachuca giant skipper, occurring in the Huachuca Mountains and having a dependent relationship with an agave species; and the orange-headed roadside skipper, found only in the Huachuca and Chiricahua Mountains (Williamson, pers. comm., 1996).

Fort Huachuca also supports a very diverse population of mammals. Large mammals found on post include Coues white-tailed deer (*Odocoileus virginianus*), desert mule deer (*O. hemionus*), pronghorn antelope (*Antilocapra americana*), collared peccary or javelina (*Tassayu tajacu*), mountain lion (*Felis concolor*), and black bear (*Ursus americanus*). At least 14 species of bats occur on the installation; many of which are candidate species for federal listing. Despite development and other human activity, many species of wildlife are present within the cantonment area.

Bird species commonly observed on the installation include mourning doves (*Zenaida macroura*), ruby-crowned kinglet (*Regulus calendula*), Gila woodpecker (*Melanerpes uropygialis*), turkey vulture (*Cathartes aura*), and several species of quail, flycatchers, and hummingbirds. The wide range of habitats available on the installation contributes to a variety of birds including a cross-section of upland, grassland, woodland, and wetland species too numerous to mention.

Field visits evaluated wildlife at the existing treated-effluent basins on the East Range. The following species were observed: red-winged black bird (*Agelaius phoeniceus*) (nesting), barn swallow (*Hirundo rustica*), northern rough-winged swallow (*Stelgidopteryx serripennis*), ruddy duck (*Oxyura jamaicensis*), mallard (*Anas platyrhynchos*), American coot (*Fulica americana*), killdeer (*Charadrius vociferus*), snowy egret (*Egretta thula*), phainopepla (*Phainopepla nitens*) (nesting), white-winged dove (*Z. asiatica*), mourning dove (*Z. macroura*), brown-headed cowbird (*Molothrus ater*), turkey vulture (*C. aura*), and white-tail deer (*O. viriginianus*).

Five ponds (approximately 4 acres [1.6 ha], shown in Figure 3.2-1, are located within or adjacent to the ROI on the West Range (Table 3.4-1). One of these ponds (Sycamore II) is stocked with trout when water conditions are favorable.

Table 3.4-1. Ponds on West Range

Pond	Game Management Area	Size (sq ac)	Depth	Stocked
Sycamore II	J	1.75	7'	Yes
Hidden	I	0.75	2.5'	No
Antelope	I	1.5	2	No
Laundry Ridge	K	--	--	No
Kino	M	--	--	No

3.4.3.1 Federally-listed Threatened, Endangered, and Candidate Species

The United States Fish and Wildlife Service (USFWS) has regulatory responsibility for implementation and enforcement of the Endangered Species Act of 1973 (ESA), as amended. It classifies species as endangered, threatened, proposed (threatened or endangered), or candidate according to guidelines within the ESA.

The Fort Huachuca Programmatic Biological Opinion issued by the USFWS, dated October 27, 1999 (as discussed in Section 1.1), covered all the federally-listed species known to exist or that

could potentially exist on Fort Huachuca and in the San Pedro Riparian NCA. Information from this BO and other recent environmental analyses were used to generate Table 3.4-2 which addresses 26 species, including 17 endangered and 9 threatened. The table was developed as a basis for summarizing the potential occurrences of these species in areas to be affected by the Proposed Action. Information for the table was gathered by analyzing the range, distribution, abundance, and habitat parameters for each species through a review of recovery plans, listing packages, scientific literature, and consultation with endangered species biologists.

Figure 3.4-2 shows the generalized areas where known populations of federally-listed species occur on the installation and the San Pedro Riparian NCA. Specific species information on the 26 that could occur in the ROI, along with a discussion of potential effects on the species by the proposed action, are included in the Biological Evaluation presented as Appendix B to this EA

3.4.3.2 Other Species and Habitats of Concern

Areas within the San Pedro Riparian NCA are designated as Critical Habitat for four federally-listed species: the southwestern willow flycatcher, Huachuca water umbel, spikedace (fish) and the Loach minnow (fish). Neither of the fish are known or expected in the area. However, the San Pedro Riparian NCA is an important recovery habitat for both fish species.

Areas of Fort Huachuca have been designated as critical habitat for the Huachuca water umbel (USFWS, 1999). Additionally, critical habitat is proposed for the Mexican spotted owl on Fort Huachuca (USFWS, 2000).

Several candidate species are also found on Fort Huachuca and are protected through habitat management programs. These include the Huachuca springsnail (*Pyrgulopsis thompsoni*) and Lemmon Fleabane (*Erigeron lemmoni*). The Ramsey Canyon leopard frog (*Rana subaquavocalis*) is also located on the installation. The species was recently removed from the candidate list as a result of a multiple-participant Conservation Agreement. Additional research is pending concerning the genetic relationship between the Ramsey Canyon leopard frog and the Chiricahua Leopard frog (*Rana chiracauensis*) which is not found on Fort Huachuca but is currently proposed for federal listing.

Table 3.4-2. ESA Listed Species, Habitat Requirements, and Likelihood of Occurrence in the Proposed Action Area. (1 of 2)

Common Name *Scientific Name*	Federal Status	Habitat Requirements	Likelihood of Occurrence in the Proposed Action Area
BIRDS			
Bald eagle *Haliaeetus leucocephalus*	Threatened	Near coasts, lakes or rivers, nests in large treetops or on cliffs near water.	Transient visitor during migration; no suitable nesting habitat.
Cactus ferruginous pygmy-owl *Glaucidium brasilianum cactorum*	Endangered	Riverbottom woodlands and paloverde cacti-mixed scrub associations of the Sonoran Desert at elevations below 4000'.	Not expected to occur; the Proposed Action area is above the elevational occurrence limit.
Mexican spotted owl *Strix occidentalis lucida*	Threatened	Canyons and forested habitat with uneven-aged stands and high tree density.	Known breeding territories within Fort Huachuca.
Northern aplomado falcon *Falco femoralis septentrionalis*	Endangered	Grasslands and savannas with low ground cover and mesquite or yucca for nesting habitat.	Although potential habitat is present in the Fort Huachuca area, there have been no recent confirmed sightings in recent years.
Southwestern willow flycatcher *Empidonax trailii extimus*	Endangered	Dense riparian habitats along streams, rivers, and wetlands with cottonwood, willow, boxelder, and buttonbush.	May occur in critical habitat in the SPRNCA located east of Fort Huachuca and Sierra Vista.
Whooping crane *Grus americana*	Endangered	Marshes, prairies, and river bottoms.	Occasional visitor to Arizona during migration, usually near Wilcox Playa.
MAMMALS			
Jaguar *Panthera onca*	Endangered	Near water in Sonoran Desertscrub up through subalpine conifer forest. Prefer Madrean evergreen-woodlands	Although potential habitat is present in the Fort Huachuca area, there have been no recent confirmed sightings.
Jaguarundi *Felis yagouaroundi cacomitli*	Endangered	Near streams in dense thorny brushland thickets between 3,500 and 6,000 ft elevation.	Not expected to occur regularly. However, may occur along SPRNCA as individuals have been reported in similar habitat types.
Lesser long-nosed bat *Leptonycteris curasoae yerbabuenae*	Endangered	Roosts in caves and mines and forages on agave, saguaro and columnar cacti.	Known roosts and foraging within Fort Huachuca..
Mexican gray wolf *Canis lupus baileyi*	Endangered	Chaparral, woodlands, and forested area. Known to cross open desert.	Although potential habitat is present in the Fort Huachuca area, there have been no recent confirmed sightings.
Ocelot *Felis pardalis*	Endangered	Desert scrub communities in AZ with dense cover. Preys on small rodents and birds.	Suitable habitat is not present and no recent documented sightings in Arizona.
FISH			
Beautiful shiner *Cyprinella formosa*	Threatened	Small to medium sized streams and ponds with sand, gravel and rock bottoms.	Proposed action area is not within the known range of this species.
Desert pupfish *Cyprinodon macularius*	Endangered	Shallow desert springs, small streams and marshes below 5000 ft elevation. Designated critical habitat in Pima County, Arizona and Imperial County, California.	Proposed action area is not within the known range of this species.
Gila topminnow *Poeciliopsis occidentalis occientalis*	Endangered	Vegetated shallows of small streams, springs, or cienegas.	Proposed action area is not within the known range of this species.

Table 3.4-2. ESA Listed Species, Habitat Requirements, and Likelihood of Occurrence in the Proposed Action Area. (2 of 2)

Common Name *Scientific Name*	Federal Status	Habitat Requirements	Likelihood of Occurrence in the Proposed Action Area
FISH (continued)			
Loach minnow *Rhinichthys cobitis*	Threatened	Historically occurred within the San Pedro River, but thought to be extirpated. Designated critical habitat includes portions of the San Pedro River.	Reintroductions may be implemented within the San Pedro River.
Sonora chub *Gila ditaenia*	Threatened	Perennial and intermittent streams with pools near cliffs, boulders or other cover. Designated critical habitat in Santa Cruz County includes California Gulch and Sycamore Canyon.	Proposed action area is not within the known range of this species.
Spikedace *Meda fulgida*	Threatened	Moderate to large perennial streams with rapid flow. Designated critical habitat includes portions of the San Pedro River.	Reintroductions may be implemented within the San Pedro River.
Yaqui catfish *Ictalurus pricei*	Threatened	Shallow water of desert springs, small streams and marshes below 5,000-ft. elevation.	Proposed action area is not within the known range of this species.
Yaqui chub *Gila purpurea*	Endangered	Small streams, springs and cienegas below 4,500-ft. elevation.	Proposed action area is not within the known range of this species.
Yaqui topminnow *Poeciliopsis occidentalis sonoriensis*	Endangered	Inhabits pools, springs, cienegas, and streams between 2,000-3,500 ft in elevation.	Proposed action area is not within the known range of this species.
REPTILES AND AMPHIBIANS			
New Mexican Ridge-Nosed Rattlesnake *Crotalus willardi obscurus*	Threatened	Primarily inhabits canyon bottoms in Pine-Oak communities.	Documented in the Peloncilo Mountains, Arizona. Only 3 known records from Arizona, none of which are within the Proposed Action area.
Sonora tiger salamander *Ambystoma tigrinum stebbinsi*	Endangered	Inhabits stock tanks and impounded cienegas in San Rafael Valley, Huachuca Mountains	Documented populations on Fort Huachuca, and east slope foothills of Huachuca and Patagonia Mountains.
PLANTS			
Canelo Hills ladies' tresses *Spiranthes delitescens*	Endangered	Finely grained, highly organic, saturated soils of cienegas	Known to occur on Babocomari River.
Huachuca water umbel *Lilaeopsis schaffneriana*	Endangered	Cienegas, perennial low gradient streams, wetlands	Several populations and designated critical habitat occur within Fort Huachuca and in the San Pedro Riparian NCA.
Pima pineapple cactus *Coryphantha scheeri robustispina*	Endangered	Alluvial basins or hillsides in semi-desert grassland and Sonoran desertscrub; 2,300-4,500 ft elevations	Proposed action area is not within the known range of this species.

Sources: USFWS 1999

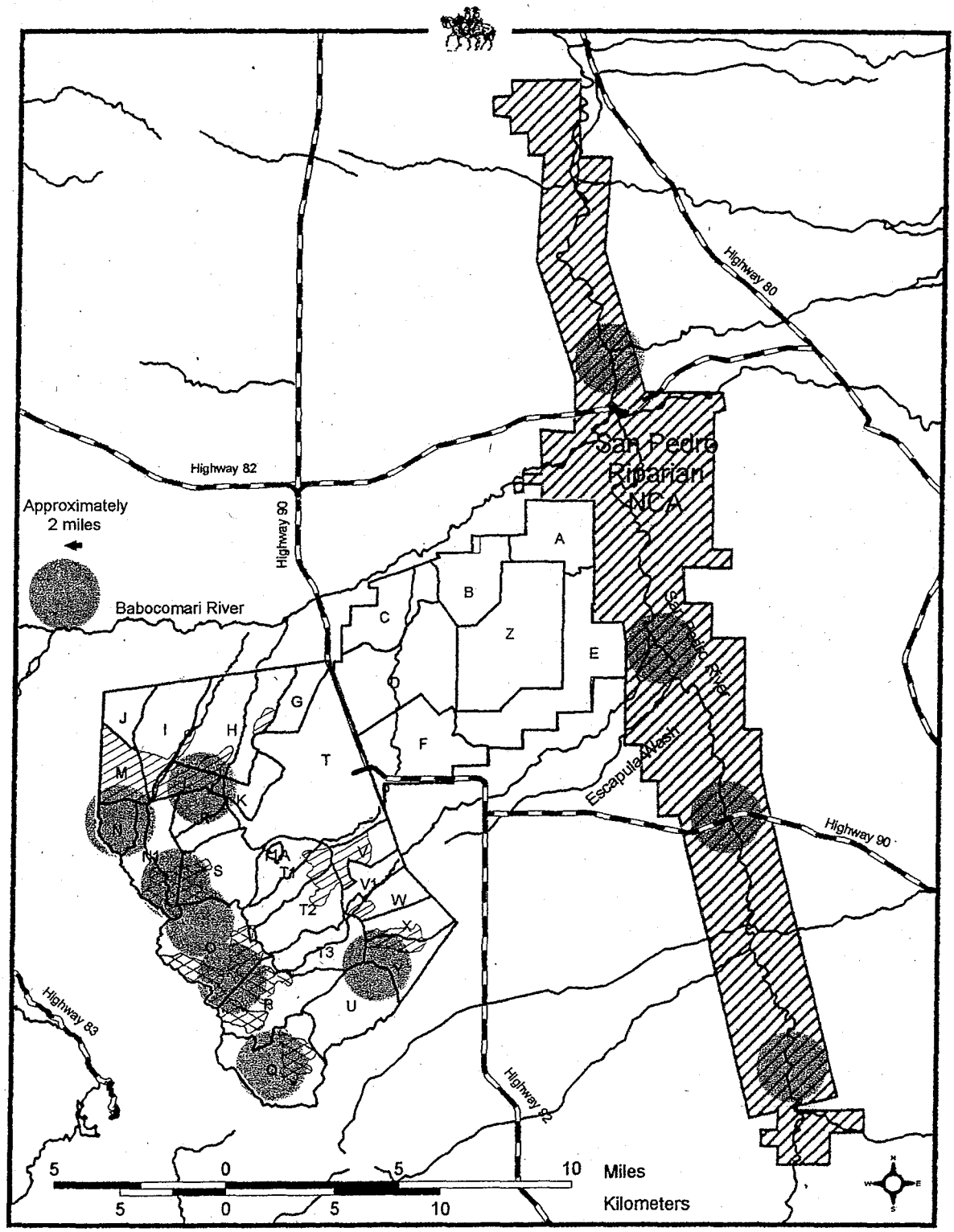

FIGURE 3.4-2

Fort Huachuca Species and Habitats of Concern

- San Pedro Riparian NCA
- Mexican Spotted Owl Protected Activity Centers
- Agave Management Areas
- Generalized Species Locations
- Training Areas

3.5 CULTURAL RESOURCES

This section presents the existing conditions that can be found in the ROI relating to cultural resources. The ROI for cultural resources is also identified as the Area of Potential Effect (APE) and includes the on-post areas identified in Section 2, *Description of Proposed Action and Alternatives*. This baseline information will be used as a point of comparison when evaluating cultural resource impacts that may be caused by the Proposed Action and alternatives discussed in this EA. The Fort Huachuca Integrated Cultural Resources Management Plan (ICRMP) is being updated in the summer of 2000. This revised ICRMP will replace the former 1995 Draft CRMP (Statistical Research Inc. 1995) and will contain up-to-date cultural resource information and management guidelines. The 2000 ICRMP is not currently available; therefore, the majority of data in this section is derived from the 1995 ICRMP.

3.5.1 Applicable Laws and Regulations

NEPA requires consideration of "important historic, cultural, and natural aspects of our national heritage" but provides no specific definition of these "aspects." Based on statutory requirements, cultural resources for NEPA analyses include the following:

- Historic properties, as defined in the National Historic Preservation Act (NHPA).
- Sacred sites, as defined in Executive Order 13007, to which access is provided under the American Indian Religious Freedom Act (AIRFA).
- Cultural items, as defined in the Native American Graves Protection and Repatriation Act (NAGPRA).
- Archeological resources, as defined in the Archeological Resources Protection Act (ARPA).
- Historic and prehistoric resources, as defined by the Antiquities Act.
- Sites that are scientifically significant, as defined by the Archeological and Historic Data Preservation Act (AHPA).
- Collections, as defined in 36 CFR Part 79, Curation of Federally-Owned and Administered Collections.

3.5.2 Fort Huachuca

Cultural resources within the USPB, and specifically the Hereford to Benson area, encompass sites spanning approximately 12,000 years, from the Paleoindian Period to the present. In addition to the prehistoric and protohistoric cultures listed for the Middle San Pedro Valley, Fort Huachuca holds special historic significance for the Apache, Apache Scouts, and African American "buffalo soldiers." Many cultural sites at Fort Huachuca have high scientific value and provide excellent opportunities for public education and interpretation.

As of May 2000, 70 percent of the installation had been surveyed for archaeological sites. The remaining unsurveyed areas (Figure 3.5-1) are mostly within the canyons and slopes of the Huachuca Mountains or on the East Range unsurveyed (Statistical Research Inc. 1995).

Prehistoric archaeological sites on Fort Huachuca tend to be associated with the larger drainages in the northern and eastern portions of the installation. Historic sites tend to be clustered within the developed area of the cantonment or associated with old ranching homesteads on the East Range. Three prehistoric sites in Garden Canyon and the Old Post area of the cantonment are currently listed in the National Register of Historic Places. The Old Post Historic District was placed on the NRHP in 1974, listed as a National Historic Landmark (NHL) in 1996, and revised in 1997. Twenty-six primary buildings dating from 1880 to 1920 were listed within the original NHL boundaries, and 48 within the revised 1977 boundaries.

Of the remaining archaeological sites identified, 7 have been evaluated as eligible for listing on the National Register, 227 are classified as potentially eligible for listing, 29 have been deemed ineligible for listing, and the significance of 75 sites has not been determined as of yet (Nakata 1997). Numerous other sites at Fort Huachuca, both prehistoric and historic, are considered "eligible" or "potentially eligible" for listing in the National Register (Statistical Research Inc. 1995). Evaluation and listing of sites will be a long-term effort, given the large number of sites and limited resources (Murray 1996). Cultural resource sites on the Fort are generally better protected and in better condition than nearby sites off the installation.

Areas to be disturbed by proposed treated-effluent reuse distribution system construction activities and WWTP #2 upgrades are limited to the cantonment area, the majority of which has been surveyed for the presence of cultural resources (see Figure 3.5-1). In addition, a significant portion of this area has been extensively modified by past leveling and grading activities.

Other Settlement Pattern Zones (as defined by Vanderpot, 1994a, 1994b, and n.d.) within the proposed treated-effluent basins and erosion control and stormwater management areas include the Middle Bajada, terraces of the larger drainages on the Upper Bajada Alluvial Fans, Babocomari River Terrace, and Lower Bajada adjacent to the San Pedro River. These zones are discussed further.

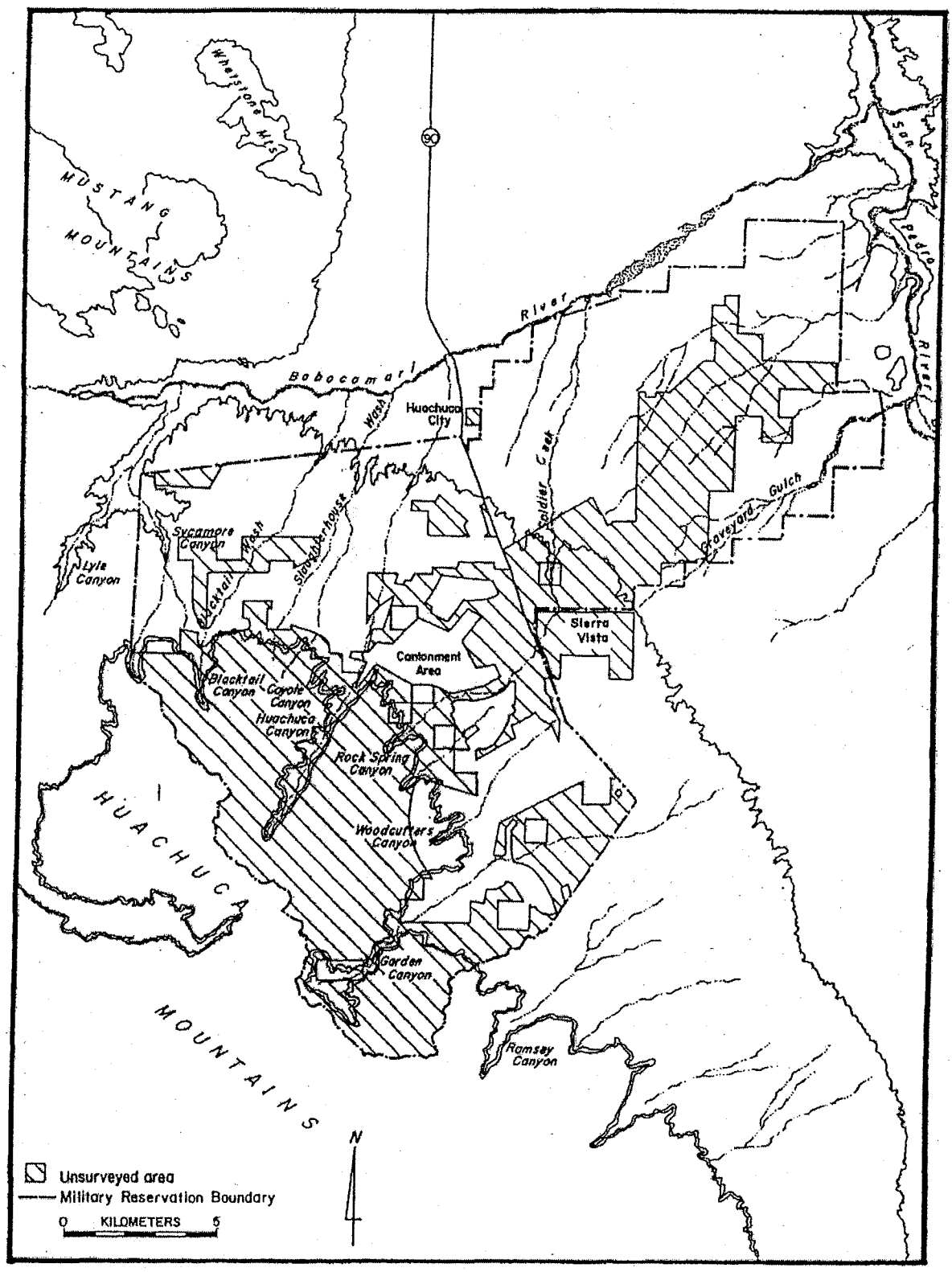

Figure 3.5-1. Unsurveyed land

3.5.2.1 Middle Bajada Settlement Zone

Treated-effluent recharge basins on the East Range occur within the Middle Bajada Settlement Pattern Zone as defined by Vanderpot (1994a, 1994b, and n.d.). Although the areas including and surrounding the treated-effluent basins have not been surveyed to date, in general this zone displays two patterns of site distribution: a linear system along Soldier Creek and a dispersed arrangement of sites on the undissected bajada to the east of that wash. It is currently unknown whether additional sites occur to the west of Soldier Creek in and around the basins.

Soldier Creek is the last northeastward flowing tributary of any size between Huachuca Canyon Wash and the San Pedro River. There is reason to believe that this creek was once a perennial water source that made floodplain agriculture possible in prehistoric times (see Vanderpot 1994b:226). Twenty sites exist on, or overlooking, the floodplain along the lower course of the creek (Statistical Research Inc. 1995). All are Formative in age, and at least five of them can be assigned to the Sedentary period and one to the Classic. The well-represented Sedentary period occupation includes at least five habitations (the largest of which is Soldier Creek Site AZ EE:7:164 ASM), five plant processing sites, and nine artifact scatters (Statistical Research Inc. 1995).

The remaining middle bajada sites are predominately Type A rock pile sites. All occur east of Soldier Creek where the bajada is relatively flat. Approximately 75 percent of all recorded sites in this area are rock pile sites, the balance are artifact scatters (Statistical Research Inc. 1995). Type A rock piles typically are located on low-lying loamy soils adjacent to drainages that are now heavily eroded and within former grassland areas currently dominated by mesquite, acacia and tarbush.

3.5.2.2 Terraces of the Larger Drainages on the Upper Bajada Alluvial Fans

Sites are located primarily along mountain drainages, such as Sycamore Canyon Wash, Slaughterhouse Wash, and Huachuca Canyon Wash, that flow northward into the Babocomari River. Few sites have been recorded along the upper reaches of these drainages, and those that do occur are typically small lithic scatters that mostly date to the Archaic (Statistical Research Inc. 1995). Along the lower reaches where the water table is high and the valley broad, numerous sites have been recorded, including Formative period habitation sites (e.g., AZ EE:7:63 ASM).

Blacktail Wash is among the drainages that flow north to the Babocomari River, but unlike the other three, does not share the pattern of being an entrenched drainage that eventually opens up

into a wide valley. Sites are rare along its lower reaches, however, they do occur near the canyon mouth where a significant amount of alluvium has been deposited (Statistical Research Inc. 1995). Two substantial habitation sites dating to the Archaic have been recorded (AZ EE:7:251 and AZ EE:7:252 ASM).

On the upper bajada away from the drainages are dense stands of Palmer's agave and soaptree yucca—used by desert people for food and fiber in historic and recent times. In these locations several examples of rock piles sites, including Type F rock features argued to be basket supports (e.g., AZ EE:7:184 ASM), occur. Examples of agave knives and large modified flakes and cores have been recorded at sites similar to AZ EE:7:185 ASM, which likely were used to harvest agave and yucca parts (Statistical Research Inc. 1995).

3.5.2.3 Babocomari River Terrace

Only portions of the southside terraces of the Babocomari River are located in Fort Huachuca, yet this small area has produced ample evidence of a high site density along this drainage (Statistical Research Inc. 1995). Located on the southern terrace just outside the Fort is the Classic period Babocomari Village (Di Peso 1951). These findings are consistent with results from the northern terraces where a string of Middle and Late Archaic sites, some with maize radiocarbon dated to approximately 2700 B.P., have been recorded (AZ EE:7:86 ASM Huckell 1990; Onken and Huckell 1989).

On those segments of Babocomari floodplain and terrace within Fort Huachuca, Vanderpot (1994a:213-214) recorded 17 prehistoric sites (representing 19 occupational components). Of these, 14 contained Archaic and five contained Formative period components. Of the five Formative components, two (AZ EE:191 and EE:7:195 ASM) could be assigned to the Hohokam-like Sedentary period occupation (Statistical Research Inc. 1995). Food processing features were found at six of the remaining components. No Type A features occur, but numerous Type B rock piles (hearths) cover the ridge top portions of EE:7:195. Type C rock features (roasting pits) were found at one Formative site excavated by Dart (1982, AZ EE:7:22 ASM), and a Type D feature (multi-use hearths) occurs at another Archaic site (AZ EE:7:203). The remaining sites are small-to-large artifact scatters interpreted to be resource procurement locations (Statistical Research Inc. 1995).

There is some indication that Archaic, Early Formative, and Preclassic sites are located further east and downstream along the Babocomari River than later Classic period sites. It is unknown

whether this site distribution has been influenced by erosion, change in streamflow patterns causing undesirable swampy areas, or other environmental factors.

3.5.2.4 Lower Bajada Adjacent to the San Pedro River

The most diverse assemblage of rock feature sites are found on the lower bajada, making it the focus of the most intensive prehistoric resource procurement and processing on the Fort. All seven rock feature types (Types A-G) are present with Type A rock piles (hearths) representing the most prevalent site class. Large rock pile sites (e.g., AZ EE:8:234, EE:8:267, and EE:8:259 ASM) are common, and sites tend to be clustered (Statistical Research Inc. 1995).

AZ EE:8:267 (ASM), an extensive and heterogeneous plant processing site along Graveyard Gulch, forms the focal point of an especially dense site cluster. The site is tentatively assigned to the Early Formative period and possesses numerous rock piles, most of which are Type A hearths, but also includes paved plant storage or preparation platforms (Type E), and basket rests (Type F). The site may represent a seasonal base camp or habitation, and its large and varied ground stone assemblage suggests an emphasis on small seed processing. Another site, AS EE:8:217 (ASM) is smaller, but contains a similarly diverse artifact and feature assemblages. AZ EE:8:203 (ASM) is a seed grinding artifact scatter site. Importantly, no trough metates or carefully shaped manos were noted among the ground stone items, suggesting a Late Archaic or Early Formative age for these sites. All sites appear to have been seasonally occupied encampments devoted to wild plant acquisition and processing.

Six habitations have been recorded on the lower bajada. Two are Archaic (AZ EE:8:180 and AZ EE:8:210 ASM), three are Sedentary (AS EE:8:161, AZ EE:8:163, and AZ EE:8:207 ASM), and one is Classic (AZ EE:8:206 ASM). All are classified as small farmsteads or fieldhouses, and probably are affiliated with hamlets and villages located further east along the San Pedro River (Statistical Research Inc. 1995).

In June of 1980, the Arizona State Museum (ASM) conducted a survey of 20 acres (8 ha) of land on the floodplain of the Babocomari River that were proposed for an additional wastewater treatment facility for the community. One site, AZ EE:7:22 (ASM), a prehistoric artifact scatter and a roasting pit were recorded (Statistical Research Inc. 1995). Approximately one half of this site is located within the boundaries of Fort Huachuca in the northeastern corner of the East Range adjacent to Huachuca City limits.

3.5.2.5 Protection and Monitoring of Sites

As an active military facility, a large number of operational activities (training, maneuver, equipment testing, live fire, and facilities management) can potentially disturb cultural resources. Because most of the installation is also open to public recreational use, the general public also presents some potential for alteration of sites. Natural events such as flooding, silt deposition, erosion, and wildfire can also damage cultural resources. Finally, particularly with respect to the pictograph sites and historic buildings, ongoing weathering and gradual deterioration must be addressed.

Fort Huachuca has implemented a number of activities and programs to help protect sites. The first level of protection includes specific physical measures focused on major impacts (erosion control structures at the Garden Canyon Village site, fencing to restrict access to the pictograph sites, fire suppression systems in vulnerable historic structures). The second level of protection involves operational and procedural changes designed to prevent alteration of sites (personnel training; designating sites near maneuver or bivouac areas as "chemically contaminated zones" or "minefields" during field exercises, prohibition of civilian off-road vehicle use away from established roads).

The third level of protection involves site monitoring, conducted by the Post Archaeologist and volunteers, and ranges from almost daily at the most visible and vulnerable sites to a small annual sampling of minor, relatively inaccessible sites. The fourth level of protection, applied to any construction or redevelopment project, requires a pre-construction surface survey of the construction site, plus ongoing monitoring of the project once underway. All contractors are required to immediately cease activity and call in the Post Archaeologist if any evidence of a cultural site is uncovered during construction.

3.6 TRANSPORTATION

The ROI for transportation (ground and air) is limited to the portions of the East and West Ranges and cantonment area where activities associated with the Proposed Action or alternatives would occur.

3.6.1 Ground Transportation

3.6.1.1 East Range

Trails and unnamed, unimproved roads are found throughout the East Range for access to the different training areas and facilities (Figure 3.6-1).

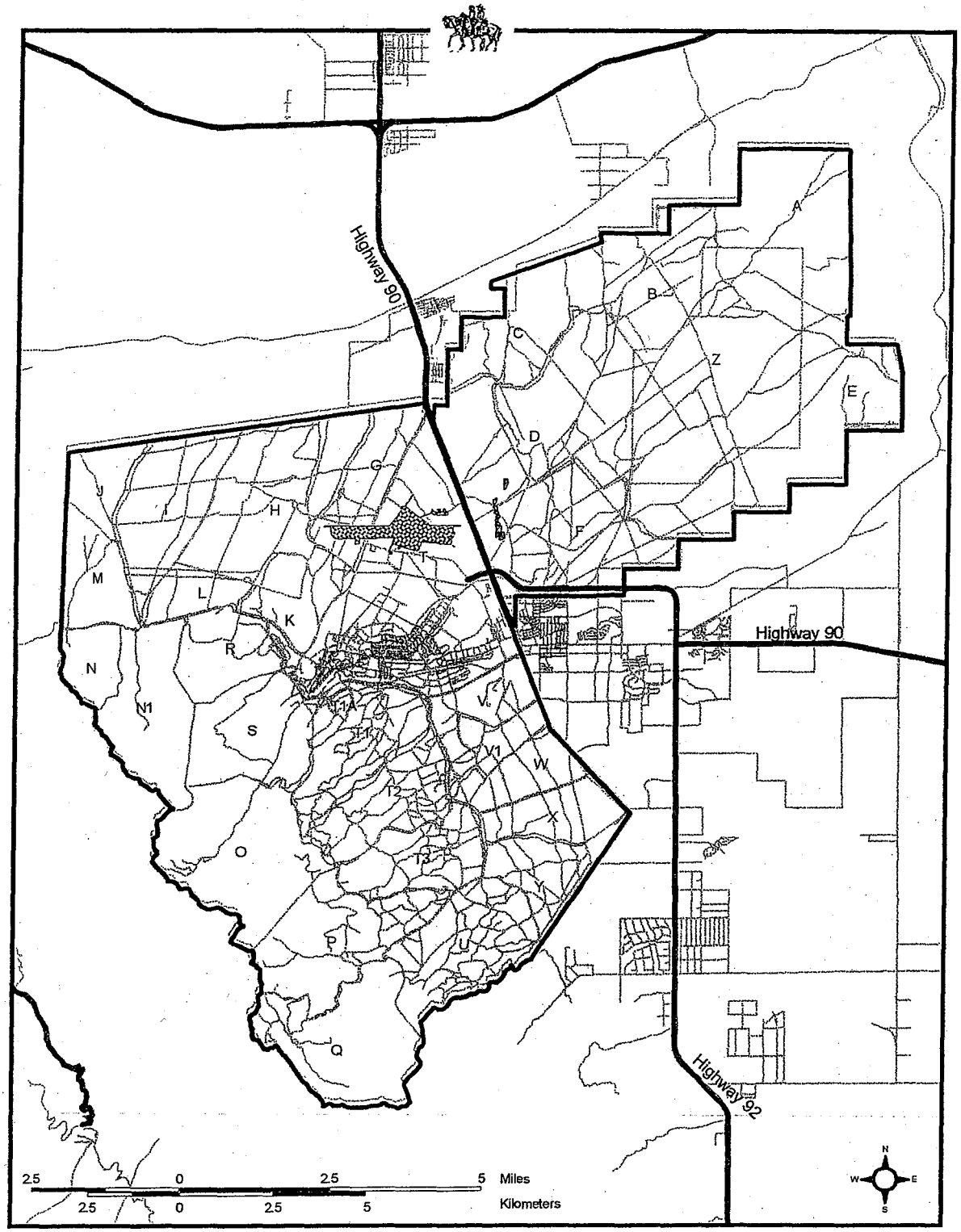

FIGURE 3.6-1

Fort Huachuca and Local Road Network

- Libby Army Air Field
- Training Areas
- Roads and Trails
- Highway
- Basins

The access road to the treated-effluent basins and stormwater infiltration basins is of particular interest in this EA, since the Proposed Action and Enhanced Facilities Alternative include extensions to this road. The road passes along the southern edge of Treated-Effluent Basin #1, where it then extends north along the eastern side of Treated-Effluent Basins #2 through #7 and terminates at the southern end of Stormwater Infiltration Basin #3. This road is graded, well drained, and has a packed gravel surface; it is well maintained and in good condition.

Conversely, several miles of the perimeter road of the East Range along the northern border are impassable, even to tracked vehicles. There is severe gullying at six wash crossings (Figure 3.6-2) with some gullies reaching up to 5-ft (1.5 m) deep and 20-ft (6 m) wide. Further, several dirt trails, many of which are redundant, have developed during tank-related activities and run directly up the face of hills. This type of alignment leaves the trails highly susceptible to erosion in the presence of water.

Figure 3.6-2. Example of Erosion on the East Range

In the southwestern corner of Training Area F, stormwater drainage from Sierra Vista is conveyed via a concrete lined channel (Figure 3.6-3), crosses under Highway 90 through a culvert, and is released into Graveyard Gulch within the Fort's boundary. As this water passes through the channel, sediment settles out, resulting in clean, sediment-hungry water. When this hungry water then hits the wash extensive erosion occurs. Over time, this erosive process has eaten away at the gulch, working the headcut back towards Highway 90 by more than a mile. Consequently, Highway 90 is now in jeopardy of being undercut (see Figures 2.1-3 and 2.1-4). The function of the Perimeter Road has already been compromised, which in turn compromises the mission and security of the East Range.

Figure 3.6-3. Concrete Lined Channel along Highway 90 in Sierra Vista]

3.6.1.2 West Range

The West Range has a number of secondary and tertiary roads leading to the Fort Huachuca West Gate and the various UAV facilities and runways in the northwestern corner of the range. Most of these roads are in fair to poor condition.

3.6.1.3 Cantonment area

The road network within the cantonment area consists of a series of primary and secondary collector streets and local or residential streets. Primary collector streets carry large traffic volumes (6,000 to 10,000 vehicles per day), are often up to four lanes wide, and typically have medians, shoulders, and sidewalks. The primary collector streets within the Fort include Hatfield Street, Irwin Street, Allison Road, Whitside Road, Brainard Road, Winrow Road between the Main Gate and Allison Road, and Smith Avenue between Hatfield Street and Whitside Road.

Secondary collector streets connect residential or commercial areas to primary collector streets. Secondary collectors typically carry less traffic than primary collectors (between 2,000 and 8,000 vehicles per day) and are built to less stringent standards. A secondary collector may also be four lanes wide, and have medians and sidewalks. On-post secondary collector streets include Cushing Street, Arizona Street, Squire Avenue, Smith Avenue east of Hatfield Street, Hines Road, Windrow Road west of Allison Street, and Carter Street south of Hatfield Street. The remaining streets on-post are classified as local or residential streets.

Fort Huachuca experiences two peak traffic times (0600 to 0800 [6-8 AM] and 1530 to 1730 [3:30-5:30 PM]) Monday through Friday. A traffic volume study was conducted in 1990 and was based on the 1989 noonday population (17,133 persons). The 1995 noonday population on base was 15,842 persons, which is 7 percent lower than the 1989 noonday population; therefore, it was expected that 1995 traffic volumes would be 7 percent lower than 1989 volumes. No major deficiencies in transportation infrastructure or service were identified in the Army Audit Agency (AAA) audit of BRAC 95 (ENRD 1997) traffic study, thus with less traffic volumes, no major deficiencies in transportation infrastructure existed at Fort Huachuca in 1995. The noonday population for 1999 was 15,466 persons, slightly less than the 1995 noonday population. As no major deficiencies were found with the 1995 traffic volumes, it can be expected that the existing transportation network is capable of accommodating current traffic volumes.

3.6.2 Air Transportation

LAAF is located within Training Area T on Fort Huachuca, just west of Highway 90. LAAF consists of three runways and approximately 2,500 acres (1,012 ha). The main runway has an east-west orientation and is 12,000 ft long (3,600 m) with 1,000-ft (305 m) overruns at each end. The secondary runway has a north-northwest orientation and is 5,365 ft long (1,635 m) with a

500-ft (152 m) overrun at each end. The third runway is 4,300 ft (1,290 m) long with a 200-ft (61 m) overrun at each end (DEH 1997).

LAAF is a joint airfield facility that houses both the Army and the Sierra Vista Municipal Airport and serves air carriers, general aviation, and the military. A total of 63,870 flights were recorded at LAAF in 1999, including 3,361 air carriers, 12,050 general aviation, and 48,459 military flights (Trafcon 2000).

The eastern end of the main runway is approximately one-half mile west of the treated-effluent basins. In 1999, there were four reported aircraft-bird collisions at LAAF (Graddy, pers. comm., October 10, 2000). It was reported that the birds were using a small seep on the western edge of the runway prior to the collisions, given that the bird remains were found on the western end of the airfield (Kent, pers. comm., October 12, 2000). The issue of airstrikes with waterfowl or any other bird species is not currently considered a problem at LAAF (Rose, pers. comm., October 12, 2000).

3.7 UTILITIES

This section describes the utilities and energy resources that may be affected by the Proposed Action or any of the alternatives. The ROI for these resources is confined to Fort Huachuca.

3.7.1 Potable Water

Reduced consumption of potable water, the use of treated effluent for irrigation, an aggressive water conservation program, and the net decrease in Fort Huachuca personnel have resulted in an overall reduction in the amount of groundwater necessary to meet the needs of the Fort.

The existing water distribution system at the Fort consists of eight production wells, storage and pumping facilities, and a network of transmission and distribution mains. Potable water is drawn from the groundwater supply by these wells. The system is composed of three pressure zones, and water is pumped between the zones. The wells range in depth from 202 ft (62 m) to 1,230 ft (375 m) (ADWR) and pump capacities range from 500-800 gallons per minute (gpm). Total annual pumpage data comes from metering at the wellhead. From the most recent high annual withdrawals of 3,200 ac-ft (1,046 MG) in1989, Fort Huachuca has reduced its annual withdrawal by 1,314 ac-ft (426 MG) (or 41 percent) to 1,893 ac-ft (617 MG) in 1999 (Table 3.7-1). Due to conservation and reuse efforts, the reduction in the installation's withdrawal of water from the local aquifer system and is anticipated to continue.

Table 3.7-1. Fort Huachuca Population and Water Pumpage History (Population Data is from 30 September of Each Year)

Year	Military Assigned	Employees [1]	Military Family Members Residing on Post	Water Pumpage (ac-ft)
1999	5,878	5,262	4,326	1,893
1998	5,421	4,941	4,431	2,176
1997	5,703	4,413	4,734	2,357
1996	5,670	4,613	5,027	2,355
1995	5,854	5,010	4,978	2,428
1994	7,533	5,779	5,108	2,568
1993	5,823	5,430	4,930	3,028
1992	5,682	5,944	4,760	2,846
1991	5,914	5,506	4,775	2,709
1990	6,448	5,671	4,897	2,747
1989	6,440	5,802	4,891	3,207

Source: DRM 1997, 2000

[1]Represents DOD civilian workers and non-DOD civilian workers on Fort Huachuca.

Detailed usage information to distinguish residential use from military or USFS fire-fighting use from LAAF is not currently available because water is metered at the wellhead, not at all end-user locations. (Water use by the USFS is a function of the fire season and has been as much as 300 ac-ft in a big southern Arizona fire year, like in 1994, but may be negligible in other years.) In addition, a Water Wise education program began on the Fort in July 1998, with a focus on individual contributions to conservation through reduction of waste at home and within administrative and industrial areas on the installation. Other water conservation efforts include the installation of low-flow and low-water use fixtures and an aggressive leak detection and repair program. Water use in 1999 decreased from the 1998 level by 13 percent.

Water extraction from wells at the installation has steadily decreased as a result of the use of treated effluent for irrigation and the net decrease in Fort Huachuca personnel. Fort Huachuca uses treated effluent to irrigate the Chaffee Parade Field, the golf course, and the new outdoor sports complex. During 1999, Fort Huachuca produced approximately 1,100 ac-ft (358 MG) of treated effluent.

3.7.2 Electricity

The primary electrical power for the Fort is obtained from a Tucson Electric Power Company (TEP) 138/46/14 kV Substation, located 800 ft due west of Greely Hall. Power is delivered from TEP's Vail Substation via a 54-mile (87 km) long 138 kV transmission line. Back-up power is

available from TEP's South-end Substation near Nogales, Arizona, via a 70-mile (113 km) long 46 kV transmission line and a 46/14 transformer. The voltage is stepped down to standard working voltages via transformers at each point of use. Aboveground power lines distribute electricity within the cantonment area. Table 3.7-2 shows Fort Huachuca's yearly electricity usage from 1993 to 1999.

Table 3.7-2. Electricity Usage at Fort Huachuca

Year	Kilowatt Hours (kWh)
1993	103,723,000
1994	106,478,000
1995	106,645,800
1996	107,980,400
1997	105,712,000
1998	101,018,400
1999	96,712,000

The above table indicates a 4.1 percent increase from 1993 to 1996, but a 10.4 percent decrease from 1996 to 1999. Existing electricity supply facilities on Fort Huachuca can support a population growth of over 13,000 persons (Nakata Planning Group 1997).

3.8 HAZARDOUS MATERIALS AND WASTES

In accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), hazardous materials or hazardous wastes are substances that, because of their quantity, concentration, or physical, chemical, or toxic characteristics, may present substantial danger to public health or welfare, or the environment when released into the environment. The EPA has granted the state of Arizona the authority to promulgate and enforce certain environmental regulations, including RCRA. The state regulations, which are at least as stringent as federal regulations, are found in the Arizona Administrative Code (A.A.C.), Title 18.

The EPA and the ADEQ, under the provisions of the Resource Conservation and Recovery Act (RCRA) and the Arizona Hazardous Waste Management Act regulate hazardous waste management on Fort Huachuca. Hazardous materials storage on the Fort complies with Occupational and Health Administration (OSHA) hazardous communications standards and with the National Fire Prevention Association (NFPA) standard codes.

The ROI for hazardous materials is confined to areas where construction activities would take place. Therefore, the ROI considered for the purposes of this evaluation are limited to the area within the Fort's boundaries.

3.8.1 Hazardous Materials

Fort Huachuca operates a Hazardous Material Center (HAZMART), which allows for collection and withdrawal of usable hazardous materials on the installation. Additionally, the Fort Huachuca *Installation Spill Contingency Plan* (ISCP), dated 20 December 1996, describes the procedures to be implemented in response to an accidental spill of hazardous substances or petroleum, oil, and lubricants (POLs). The plan establishes personnel duties and levels of response based on the type and quantity of the spill, and it provides basic guidelines and information on the prevention, control, and clean up of spills.

In event of a hazardous materials release, the Directorate of Public Safety has first responder responsibilities, with the DIS maintenance contractor responsible for cleanup once imminent danger to life and health has passed.

As was mentioned previously, the upgrade of the secondary unit of Wastewater Treatment Plant #2 is part of the Proposed Action. Hazardous materials stored at the plant include chlorine and sulfur dioxide compressed gases used in the tertiary treatment. The gases are not flammable but are strong oxidizers. They are stored in fireproof sheds away from where the proposed activity will occur.

3.8.2 Hazardous Wastes

Fort Huachuca is a large quantity generator of hazardous wastes, but does not maintain a Part B permit to operate a treatment, storage and disposal facility (TSDF) under RCRA. The Fort operates one 90-day accumulation point and approximately 35 satellite accumulation points established by the Defense Reuse and Marketing Organization (DRMO) of the Defense Logistic Agency. The DRMO ensures that transporters are qualified, maintain required permits and licenses, and manifest the packaged waste off the installation. The Fort implements several environmental plans and programs for hazardous waste management and monitoring, including:

- AR 420-47 Solid Waste Management
- Hazardous Waste Management Plan
- Hazardous Waste Analysis Plan

- Hazardous Waste Training Plan
- Installation Spill Contingency Plan
- Spill Prevention, Control and Countermeasure Plan
- Pollution Prevention Plan (Hazardous Waste Minimization)

In the case of a hazardous waste release, the Directorate of Public Safety has first responder responsibilities on the Fort, with the DIS maintenance contractor responsible for cleanup once imminent danger to life and health has passed. Under agreement with Cochise County and the City of Sierra Vista, backup for response to accidental spills of hazardous substances or POL on the Fort is available.

The Fort Huachuca *Installation Hazardous Waste Management Plan* (HWMP), dated January 1996, is designed to provide necessary procedures to achieve compliance with the foregoing regulations regarding the accumulation, storage, transportation, and disposal of hazardous wastes generated on the Fort. A copy of this plan is available for review at the office of the DIS ENRD.

Used POL products are tested to ensure that RCRA requirements are not triggered. Used POL products that are not considered as RCRA waste are sold to a qualified recycler through the DRMO.

3.8.3 Wastewater

Wastewater at Fort Huachuca is collected and treated at WWTP #2, a tertiary treatment facility. The plant was constructed in 1970 as a secondary treatment system and upgraded in 1995 to a tertiary system. The system treats both domestic (approximately 85 percent of the flow) and industrial (approximately 15 percent of the flow) wastewater.

The wastewater treatment process consists of preliminary, primary, secondary, and tertiary treatment. The preliminary treatment process includes a comminutor, bar screen, and grit chamber, followed by another comminutor and grit chamber. The wastewater from the preliminary treatment flows into the primary treatment system, which consists of pre-aeration basins and settling basins. The secondary treatment is provided by one trickling filter followed by two secondary clarifiers. Tertiary treatment is provided by chlorination, followed by sand filtration, dechlorination, and ultraviolet disinfection.

From December 1998 to March 2000, the plant generated an average of 30.1 MG of treated effluent a month. During that period, the plant had an average daily flow of 1.08 MG per day

(MGD) and a maximum daily flow of 1.7 MGD. Approximately 37 percent of the treated effluent was used for irrigating the Golf Course, the Chaffee Parade Ground and outdoor sports complex. The rest was pumped to evaporation/infiltration ponds on the East Range. From April to June, the irrigation demands doubled, while the treated-effluent flow remained relatively stable.

The quality of the influent (raw sewage), primary, secondary and tertiary treated-effluent water is monitored through laboratory analysis. Samples are collected to measure specific parameters, such as biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids, pH, nitrates, and fecal coliform. A sampling and analysis plan with detailed information on the frequency of the analysis and specific analytical procedures is kept at the WWTP #2 analytical laboratory. The amount of total suspended solids (TSS) in the treated-effluent water is measured three times a week. During the above-mentioned period, the average TSS in the treated effluent was found to be between 4-6 milligrams per liter (mg/L).

4.0 ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental consequences associated with the Proposed Action, the Enhanced Existing Facilities Alternative, and the No-Action Alternative (fully discussed in Section 2, *Description Of Proposed Action And Alternatives*). Consistent with the discussion of the affected environment in Section 3, this section has been organized by resource area to provide a comparative framework for evaluating the impacts of the Proposed Action and alternatives on the eight individual resources. Each resource section states the criteria used to determine whether an impact is considered significant.

4.1 GEOLOGY AND SOILS

Geologic impacts can be direct (addressed in this section) or indirect related to groundwater and surface water (covered in Section 4.3, *Water Resources*). A determination of significant impact on geology could result if either of the following criteria were met:

- Project activities cause the movement of earth related to existing geologic hazards such as sinkholes, caves, mines, or quarries.
- Project activities cause seismic activity along existing fault lines.

Soil impacts resulting from project implementation are related to the amount of soil redistribution. A determination of significant impact on soils could result if there is increased off-post sedimentation in the Babocomari or San Pedro Riparian areas caused by project-related construction activities or actions.

4.1.1 Proposed Action

During the installation of reuse distribution lines in the cantonment area, minor impacts to topsoil will result from trenching and backfilling. These impacts relate to surface disturbance and could result in a negligible loss of soils from erosion during the construction period. Once construction is completed, surface areas will be backfilled, compacted, and revegetated with native species. These activities will restore the sites to near original conditions.

Approximately 400,000 cubic yards (306,000 cubic m) of soil will be excavated during construction activities associated with AAR improvements. Additional (smaller scale) excavation and construction will occur as a result of future erosion control and stormwater management projects. Surface disturbance from excavation and construction will be limited to the extent practical and will not cause seismic activity. Excavated soils will be temporarily stockpiled at

predetermined locations and eventually redistributed to other areas of the East and West Ranges as part of subsequent erosion control projects. During construction, topsoil erosion could result from heavy rains or strong winds. Appropriate engineering techniques will be applied in conformance with accepted soil erosion and sediment control standards (see management methods below) to manage these impacts to below a level of significance.

Proposed erosion control measures will involve the removal of impervious surfaces including many roads and trails on the East Range. The removal of these surfaces and recontouring and revegetation of these areas will decrease local runoff volumes by increasing the infiltration area available during precipitation events. These activities will result in positive impacts.

Construction activities associated with the Proposed Action will not impact any existing geologic hazards such as sinkholes, caves, mines, or quarries, and will not cause any seismic activity along existing fault lines.

Management Methods Included in the Proposed Action

Methods for managing the Proposed Action activities include minimizing the areas of disturbance, short-term and long-term erosion control, seeding of native species, and provision of silt barriers and detention basins. During trenching or excavation work, soil will be deposited on the upgrade side of the excavation wherever possible to minimize soil migration from the excavated areas. Standard industry Best Management Practices (BMPs) must be in place to manage sediment transport during high winds and heavy rains. Soil preparation, fertilizing and seeding will follow construction as soon as possible. With these methods in place, there will be a positive impact to soils from implementation of the Proposed Action.

4.1.2 Enhanced Existing Facilities (Alternative A)

Some erosion control and stormwater management projects will be implemented, but less than envisioned in the Proposed Action. With less disturbance to contend with, the methods for managing these activities will be similar to those outlined for the Proposed Action, though at a smaller scale. There will be no significant impacts to geology or soils under this alternative. Methods to control soil erosion will include minimizing soil transport and revegetation of disturbed areas following construction. Proposed erosion control measures will still involve the removal of impervious surfaces, including many roads and trails on the East Range. The removal of these surfaces and recontouring and revegetation of these areas will decrease local runoff

volumes by increasing the infiltration area available during precipitation events. These activities will result in positive impacts.

4.1.3 No-Action (Alternative C)

Under this alternative, existing conditions will remain as they are with no construction disturbance. However, proposed system enhancements will not occur and therefore, will not contribute to arresting the current severe erosion trends on the installation. Additional reductions in water consumption will not occur and storm events will continue to pose erosion problems. A continuation of baseline erosion control activities on the East Range will continue to address problem areas, but the impact of those measures will be much less effective and less of a positive impact than will the implementation of either of the two action alternatives (above).

4.2 WATER RESOURCES

Impacts to water resources (surface water and groundwater) could be direct, indirect, short-term, or long-term. A determination of significant impact to water resources could result if the Proposed Action creates a situation where:

- Surface water quality is degraded by runoff constituents associated with grading, construction of barriers and structures, and impervious surfacing.
- A groundwater aquifer is impacted by contamination.
- Depletion of groundwater results in reduced stream baseflow and/or land subsidence.

4.2.1 Proposed Action

Activities associated with the Proposed Action have the potential to affect surface water and groundwater resources.

4.2.1.1 Surface Water Resources

Treated-effluent reuse lines are all underground and do not intersect any stream crossings or other major drainage areas. All upgrades to the WWTP #2 will be elevated above local stormwater floodflow elevations, thereby precluding inundation. Standard industry BMPs will be used during all construction activities to limit siltation resulting from temporary disturbance of surface soils. Disturbed surfaces will be re-contoured and revegetated with native species, as appropriate, following construction to minimize erosion.

Since AAR facilities will be constructed in an ephemeral wash which has been designated a "water of the U.S." in accordance with Section 404 of the Clean Water Act of 1977 (33 U.S.C.

1251), a 404 permit will be required. Future erosion control and stormwater management projects impacting "waters of the U.S." will also require permitting under Section 404. The Proposed Action includes construction of a vegetated ephemeral stream channel and upland buffer to offset impacts to "waters of the U.S." at a 1:1 ration. In addition, management methods and BMPs will be used during construction activities to control erosion and minimize impacts to surface waters as required under National Pollutant Discharge Elimination System (NPDES) stormwater pollution prevention permit conditions. With these methods and BMPs, no significant impact to surface water resources will occur from implementation of the Proposed Action.

4.2.1.2 Groundwater Resources

The Proposed Action seeks to reduce consumptive use of groundwater and enhance aquifer recharge through expansion of the treated-effluent reuse distribution system and construction of facilities to increase treated effluent and stormwater recharge capacity. Therefore, no significant impacts to groundwater quantity will occur as a result of the Proposed Action. Significant impacts to groundwater quality as a result of implementation of the Proposed Action are not anticipated for the following reasons:

- the Proposed Action includes improvements to the wastewater treatment facility which will improve the quality of treated effluent,
- the depth to groundwater in the proposed construction areas is in excess of 300 ft, and
- effluent will be recharged through surface infiltration allowing in-situ treatment including absorption, adsorption, and biochemical reactions to occur in the vadose zone.

4.2.2 Enhanced Existing Facilities (Alternative A)

4.2.2.1 Surface Water Resources

Alternative A involves minor reengineering of the East Range Basins to enhance effluent recharge. This alternative would not provide the same level of effluent recharge and consumptive water use reduction as the Proposed Action. Under this alternative, impacts to "waters of the U.S." would be temporary and would not likely require mitigation beyond revegetation of disturbed areas. BMPs for stormwater pollution prevention would still be applicable. No significant impacts to surface water resources would occur as a result of implementation of Alternative A.

4.2.2.2 Groundwater Resources

No significant impacts to groundwater resources will occur as a result of implementing Alternative A for the same reasons as stated for the Proposed Action.

4.2.3 No-Action (Alternative C)

4.2.3.1 Surface Water Resources

Under the no-action alternative, improvements to surface water resources will not occur as fewer erosion control and stormwater management projects would be implemented. Increased peak stormwater discharges resulting from urbanization in the Sierra Vista and Fort Huachuca areas will not be attenuated, resulting in continued erosion and sediment migration. No significant impact to surface water resources is anticipated as a result of the No-Action Alternative.

4.2.3.2 Groundwater Resources

Under the no-action alternative, no additional enhancement of groundwater resources will occur. Specifically, projects to increase the capacity of effluent recharge and to reduce consumptive groundwater use by expanding the effluent reuse distribution system would not be implemented. No significant impact to groundwater resources is anticipated as a result of the No-Action Alternative.

4.3 AIR QUALITY

Impacts on air quality can be divided into both short-term and long-term. Short-term impacts are usually associated with construction and grading activities, and long-term impacts are typically associated with build-out conditions. Most long-term emissions will be due to increased vehicle use. Reactive organic gas (ROG) emissions are associated with storing and dispensing fuel used in heavy vehicle transportation. A determination of significant impact on air quality could result if either of the following criteria is met:

- Activities release criteria pollutants that exceed the federal primary and secondary standards for pollutant species adopted by the State of Arizona.
- Activities are not in conformity with Section 176 of the Federal Clean Air Act for federal actions.

On November 1993, EPA published the general conformity Final Rule in the Federal Register (58 FR 63214). The purpose of the rule, titled "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" is to ensure that all federal actions conform to the SIP applicable to the project site. The applicable regulations are cited in 40 CFR 6, 51

Subpart W, and 93. A "federal action" is defined as any activity engaged in by a federal agency, department, or other entity licensed, permitted, funded, or otherwise supported by a federal entity. "Conformity to SIP" is defined as meaning conformity to a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

As a result of the general conformity rule, federal actions must be evaluated to assess whether emissions associated with the project will interfere with an area's air quality improvement plan. The general conformity rule applies only to federal actions that may emit a criteria pollutant for which an area has been designated as non-attainment or maintenance. Since the area within which the proposed activities will occur is an attainment area, the activities associated with the Proposed Action or any of the alternatives will not result in a violation of the general conformity rule. The procedural requirements of the General Conformity Rule are not applicable to the Proposed Action as it will occur entirely within an NAAQS attainment area.

4.3.1 Proposed Action

Construction activities associated with the Proposed Action will be a source of dust emissions that can have a temporary yet substantial impact on local air quality. However, by using dust-control measures (wind speed reduction, wet suppression, paving, chemical stabilization) during construction these emissions can be significantly reduced. The quantity of dust emissions from the construction operations is estimated using the procedure presented in AP-42 (Sections 13.2.2, 13.2.3, 13.2.4) and Report No. NR-009A (Exhaust Emissions Factors for Nonroad Engine Modeling). Table 4.3-1, Table 4.3-2, and Table 4.3-3 show the estimated emissions for each component of the Proposed Action. Table 4.3-4 shows the estimated construction time period associated with each activity.

Table 4.3-1. Emission Calculations from Treated-Effluent Distribution Lines and WWTP Upgrade Construction Activities (Tons of Pollutants)

Equipment Type	Miles Traveled	Hours of Operation	PM_{10}	ROG
2 Backhoes	-	320	2.60	0.10
4 4WD-Trucks	1600	-	1.226	0.003
Total			3.826	0.1033

PM_{10}= aerodynamic particle diameter less than 10μm
ROG= reactive organic gases (hydrocarbons)

Table 4.3-2. Emission Calculations from AAR Improvement Activities (Tons of Pollutants)

Equipment Type	Miles Traveled	Hours of Operation	PM_{10}	ROG
6 Scrappers	240	-	2.40	0.18
2 Water Trucks	1240	-	1.294	5.6E-4
2 Compactors	-	80	0.66	0.12
2 Tracked Dozers	-	80	0.66	0.12
2 Graders	400	-	0.045	0.12
One Maint. Truck	80	-	0.081	3.5E-5
12 Misc. Trucks	72,000	-	0.507	0.15
Loading/Unloading	-	526	6.95	0.396
Total	-		12.597	1.087

PM_{10}= aerodynamic particle diameter less than 10μm
ROG= reactive organic gases (hydrocarbons)

Table 4.3-3. Emission Calculations from Erosion Control and Storm Water Management Construction Activities (Tons of Pollutants)

Equipment Type	Miles Traveled	Hours of Operation	PM_{10}	ROG
2 Scrapers	320	-	3.23	0.12
2 Misc. Trucks	800	-	0.81	3.55E-4
2 Tracked Dozers	-	320	2.64	0.12
2 Graders	400	-	0.61	0.12
One Maint. Truck	80	-	0.081	3.5E-5
12 Misc. Trucks	960	-	0.605	1.97E-3
Total			7.976	0.362

PM_{10}= aerodynamic particle diameter less than 10μm
ROG= reactive organic gases (hydrocarbons)

Table 4.3-4. Estimated Construction Time Period for Proposed Action

Proposed Action Component	Estimated Construction Time Period
Treated-effluent reuse distribution system and upgrading the WWTP #2	4 weeks
AAR improvements	8 weeks
Erosion control and stormwater management improvements	8 weeks per year cumulatively, over the course of several years.

Since none of the above-described activities will release criteria pollutants in quantities that exceed federal standards, a SIP Conformity Analysis does not have to be prepared. During construction activities, dust from the stockpiled-dirt carried by strong winds has the potential to add to overall levels of particulates, thus resulting in minor impacts to air quality. However, the management methods included in the Proposed Action, listed below, will reduce this impact and ensure that it remain below significant levels.

Management Methods Included in the Proposed Action

Several methods are available to reduce the amount of airborne particulates generated from the construction stockpiles. One approach is to regularly apply water to the stockpiles to increase their surface tension and the weight of the particles, thereby reducing the wind's erosive actions. It is possible that wetting the dirt prior to excavation and thoroughly watering the stockpile will result in the development of a temporary crust. This crust serves to minimize wind erosion and reduce the amount of water necessary. While the application of water is a common method of dust suppression, this approach is in conflict with the overall goal of this program unless treated-effluent is used. Even so, treated effluent that is used to minimize particulates is not available for recharge. While this option is available, it is not preferred.

Another dust control method available is the application of chemical agents to the stockpiles. These chemicals serve as suppressants, surfactants, or as palliatives. A suppressant functions by removing particles from the air and keeping them from becoming airborne. A surfactant on the other hand works by forming a crust over the outer surface of the stockpile. A palliative is an oily substance that binds the particles together as well as collects additional airborne particles that come in contact with the treated surface. Many products are available that are both effective at controlling dust and are environmentally friendly.

Yet another approach is to physically minimize the capability of the wind to erode, which is accomplished by covering or shielding the stockpiles. Covers can be made from fabric or hydroseeded for a vegetation cover for more long-term abatement. Alternatively, a structural windbreak can be erected to shield the piles from the wind. The use of any one or a combination of these alternatives will sufficiently control the emissions of PM_{10} from the stockpiles to ensure that levels of significance are not exceeded.

4.3.2 Enhanced Existing Facilities (Alternative A)

The levels of construction involved with this alternative are similar to, but on a lesser scale than, the Proposed Action, which exhibited no significant impacts. Therefore, like the Proposed Action, the Enhanced Existing Facilities Alternative will not result in any significant impacts on air quality following the implementation of applicable management methods (see above).

4.3.3 No-Action (Alternative C)

No construction or other emitting activities will occur. It is anticipated that the existing levels of pollutants, which are not significant, will continue under this alternative.

4.4 BIOLOGICAL RESOURCES

Impacts on biological resources could be determined significant if one or more of the following conditions result from implementation of the Proposed Action or alternatives:

- Loss or disturbance of individuals or populations of a federally-listed threatened or endangered species.
- Substantial loss of individuals or populations of a federal-candidate, regionally-rare, or otherwise sensitive species.
- Adverse modification of designated Critical Habitat.
- The loss of a critical, yet limited resource used by a federally-listed threatened or endangered species.
- Permanent disruption of heavily used wildlife movement areas, such as international migratory bird routes.

4.4.1 Proposed Action

The following discussion is organized by vegetation, wildlife, federally-listed threatened, endangered, and candidate species, and other species of concern. A discussion on possible impacts on the San Pedro Riparian NCA is also included.

4.4.1.1 Vegetation

No significant impact on existing vegetation is anticipated from treated-effluent pipeline construction activities. Most underground pipeline construction activity will occur in areas of the installation with little or no native vegetation. Construction activities at the WWTP#2, will be limited to previously disturbed, sparsely vegetated areas that are not of significance to any wildlife species.

It is anticipated that the proposed modifications to the treated-effluent and stormwater recharge facilities will disturb vegetation in the existing basins, proposed stockpiles, and the stormwater

diversion channel immediately adjacent to the basins. Approximately 28 acres (11 ha) of native vegetation were previously disturbed during construction of the existing treated-effluent basins and access roads. An additional 10 acres (4 ha) of vegetation will be permanently disturbed and 67 acres (27 ha) will be temporarily disturbed by this project. Where appropriate, the areas disturbed during construction will be revegetated with native species.

Because a development plan has not yet been produced, the extent of vegetation impacts that may result from proposed erosion control and stormwater management improvements cannot be determined at this time. Each erosion control and stormwater management technique will have a different footprint of disturbance, but the maximum total area of disturbance for any particular site will be less than one acre, with the exception of areas included as a part of any major stormwater detention or diversion facility. At this time it is anticipated that no more than 75 cumulative acres (30 ha) of vegetation on the East or West Range will be removed for proposed erosion control and stormwater management improvements. This includes the proposed 50-acre (20-ha) Graveyard Gulch storm detention basin. Because the proposed cumulative total of habitat removal will be no more than 75 acres (30 ha) over a period of many years, implementation of the proposed erosion control and stormwater management improvements will have no significant impact to vegetation on Fort Huachuca in terms of net loss to native habitat.

At and near Fort Huachuca, forage plants for the federally-listed lesser long-nosed bat include Palmer's agave and possibly Parry's agave (the two are known to hybridize, as well) (USFWS 1999). As a part of the 1996 Fort Huachuca Agave Management Plan (Howell and Robinett 1996), five areas on the Fort were identified as Agave Management Areas (see Figure 3.4-1). Special management prescriptions resulting from the 1996 plan and the 1999 Programmatic Biological Opinion (PBO) apply to all activities performed within these areas, in order to ensure the preservation of major stands of agave on Fort Huachuca for lesser long-nosed bat foraging habitat. Proposed erosion control and stormwater management activities will not occur in these areas. If any agave are affected by the Proposed Action, all necessary actions will be taken to minimize disturbance (as outlined in the PBO).

Management Methods Included in the Proposed Action

To limit the size of the impact area, the removal of vegetation will be restricted to construction areas (i.e., utility trenches, roadways, and building sites). Disturbed areas outside of the

permanent facility footprints will be revegetated with native species, where appropriate. After the revegetation period, natural successional changes will be allowed to proceed wherever possible. Implementation of revegetation measures will reduce the impacts below a level of significance.

Erosion control and stormwater management improvements will not occur in Agave Management Areas. If any agaves are disturbed during the Proposed Action, necessary actions will be taken to minimize disturbance as outlined in the 1999 PBO. Further, no nighttime construction activities will occur in these management areas.

With management methods for the proposed activities in place, there will be no significant impact to vegetation from implementation of the Proposed Action.

4.4.1.2 Wildlife

A minor, temporary impact on wildlife is possible during construction activities, where noise and human activity may disturb wildlife. This impact is most likely to be negligible, of short duration, and will not result in a significant impact on wildlife at Fort Huachuca.

Construction activities will not significantly impact habitat for wildlife on Fort Huachuca. The common (non-special status) wildlife species found at and surrounding the proposed construction sites on the East and West Ranges will be displaced temporarily during construction. However, considering that similar habitat exists in the immediate vicinity of the sites and the displacement is of short duration, the impact of this habitat displacement is expected to be relatively minor and not significant.

There will be a decrease in the quality of the habitat immediately adjacent to the construction sites due to increased noise levels, traffic, lights, and other human activities. Wildlife species that require isolation from such impacts may be displaced into surrounding, less disturbed areas. However, after construction has been completed, it is expected that some of the displaced species, particularly birds, would return and use the spreading basins and open areas at the recharge facility.

The loss of acreage due to construction will result in a reduction of breeding and foraging habitat for wildlife using the sites. Habitat removed from along the sides of the basins, along the stream corridors leading to the proposed stormwater diversion channel (west of the basins), at equipment staging areas, and at excavated dirt stockpile locations will be revegetated with native species to a natural state upon completion of the project. In total, approximately 10 acres (4 ha)

of vegetation will be permanently lost, and 105 acres (42 ha) will be temporarily disturbed and revegetated with native species, where appropriate, upon project completion.

Because a development plan has not yet been produced, the extent of wildlife impacts that may result from proposed erosion control and stormwater management improvements cannot be determined at this time. However, these impacts will be similar to those listed in Section 4.4.1.3 below (i.e. displacement) and will likewise not be significant.

Management Methods Included in the Proposed Action

Disturbed areas outside of the permanent facility footprints will be revegetated with native species to facilitate the their return to useful habitat. After the re-vegetation period, natural successional changes will be allowed to proceed wherever possible. Implementation of revegetation measures will reduce the level of permanent habitat loss. With these methods in place, there will be no significant impact to wildlife from implementation of the Proposed Action.

4.4.1.3 Federally-listed Endangered, Threatened, and Candidate Species

Construction activities associated with the treated-effluent reuse distribution and WWTP #2 upgrades were addressed in the *1999 USFWS Biological Opinion on Ongoing and Programmed Future Military Operations and Activities at Fort Huachuca, Arizona.* This Biological Opinion determined that these activities would not jeopardize the existence of any federally-listed threatened or endangered species. Because the Biological Opinion addressed the pipeline activities and associated effects, these activities are not further addressed in this section. No take of federally-listed species was anticipated from this action.

The remainder of activities under the Proposed Action were addressed in a separate Biological Evaluation (EEC 2000), provided as Appendix B to this EA. Of the 26 federally-listed species occurring on or in the vicinity of Fort Huachuca, 9 were evaluated in the BE in terms of their potential to be affected by the Proposed Action: bald eagle, Mexican spotted owl, southwestern willow flycatcher, lesser long-nosed bat, loach minnow, spikedace, Sonora tiger salamander, Huachuca water umbel, and Canelo Hills ladies' tresses. In addition, the peregrine falcon, which was recently delisted, was evaluated.

This BE determined that the Proposed Action may affect, but is not likely to adversely affect the southwestern willow flycatcher, lesser long-nosed bat, loach minnow, spikedace, Huachuca

water umbel, and peregrine falcon or destroy or adversely modify designated critical habitat. Conversely, it is anticipated that the Proposed Action will have a beneficial effect on these species and their associated habitats. There will be no effect on the remaining 3 species.

Management Methods Included in the Proposed Action

To ensure compliance with terms and conditions of the 1999 Biological Opinion, all proposed activities shall conform to the Reasonable and Prudent Measures and Terms and Conditions listed in the BO.

4.4.1.4 Other Species of Concern

Several other species of concern (not federally-listed as endangered or threatened) are found on Fort Huachuca and protected through habitat management programs. These include the Huachuca springsnail, Lemmon Fleabane, Chiricahua Dock, and Ramsey Canyon leopard frog. None of these species are located within the project area.

4.4.1.5 The San Pedro Riparian NCA

The overall nature of the Proposed Action will have a positive impact on biological resources in the San Pedro Riparian NCA. It is anticipated that the Proposed Action will reduce peak urban runoff from past urbanization and recharge it into the ground. This is, in part, to restore the infiltration that has not occurred due to impermeable surfaces in the urban landscape. Impacts should be positive to the San Pedro Riparian NCA due to the recharge and increasing the hydraulic head of the system near the river. This will reduce sediment transport to the river and make more shallow groundwater available to base flow. It is anticipated that the Proposed Action may affect, but is unlikely to adversely affect, known or potential southwestern willow flycatcher or Huachuca water umbel populations in the San Pedro Riparian NCA and will not destroy or adversely modify designated critical habitat in the San Pedro Riparian NCA. The Proposed Action is anticipated to have no significant impact on federally-listed endangered, threatened or candidate species or critical habitat on the San Pedro Riparian NCA.

4.4.2 Enhanced Existing Facilities (Alternative A)

Implementation of the Enhanced Existing Facilities Alternative will create the same types of vegetation disturbance and habitat loss as the Proposed Action but to a much smaller degree of impact. Site development under this alternative will disturb approximately 38 acres (12 ha) of previously disturbed land in and around the existing treated-effluent basins on the East Range.

Disturbance of this area will be expected to result in some minor habitat loss and will not constitute a significant impact.

Modifications to the treated-effluent recharge basins under this alternative will create a lower level of wildlife disturbance than that of the Proposed Action, but the types of disturbance will be similar. Wildlife species found at and surrounding proposed construction sites on the East Range at Fort Huachuca will be displaced during construction. However, the surrounding native habitats should accommodate any displaced wildlife. There will be no significant impact to wildlife as a result of this alternative.

A Biological Evaluation for the potential presence of federally-listed threatened or endangered species or possible habitat was prepared for improvements to the AAR facilities (EEC 2000). This BE determined that AAR improvements may affect, but are not likely to adversely affect the southwestern willow flycatcher, lesser long-nosed bat, loach minnow, spikedace, Huachuca water umbel, and peregrine falcon or destroy or adversely modify designated critical habitat. A copy of the BE is provided as Appendix B to this EA.

Management Methods Included in the Proposed Action

Where possible, removal of vegetation will be restricted to areas proposed for the treated-effluent basin improvements to limit the size of the impact area. Areas that are disturbed outside of the basins will be revegetated with native species, where appropriate, to facilitate the reestablishment of habitat lost during the construction process. After the revegetation period, natural successional changes will be allowed to proceed wherever possible.

4.4.3 No-Action (Alternative C)

For the No-Action Alternative, no land will be disturbed, and no change in vegetation is anticipated. No change in current wildlife diversity or populations, habitat, or foraging areas is anticipated. No significant change in current federally-listed populations, habitat or foraging areas on Fort Huachuca and surrounding environment are anticipated. In the event that this alternative is implemented, the potential long-term positive impacts to the San Pedro Riparian NCA will not occur.

4.5 CULTURAL RESOURCES

Potential impacts to cultural resources could result from ground-disturbing activities such as grading and excavation for new construction. A determination of significant impact to cultural

resources (prehistoric, historic or traditional) could result if one or more of the following criteria were met:

- Construction were to adversely effect properties listed on, or determined eligible for, the National Register of Historic Places.
- Proposed construction activities were to disturb or damage significant cultural resources and/or cultural resource sites.

4.5.1 Proposed Action

The majority of the cantonment area has been surveyed for the presence of cultural resources (see Section 3.5), including the areas proposed for underground pipeline construction in the cantonment area. Therefore, trenching and other ground-disturbing construction activities associated with underground pipeline installation and facility construction at the WWTP #2 site are not anticipated to cause impacts to resources in the cantonment area

Construction activities will only temporarily affect the viewshed of the Old Post Historic District on the cantonment area and will not alter or otherwise affect the viewshed or individual structures within the Old Post District. The WWTP#2 is less than 50 years old and does not meet the requirements of a historic property. No other known historic resources will be affected by underground pipeline, trenching or other construction activity associated with this component.

No previous cultural surveys have been conducted within the AAR site on the East Range, however there are no previously recorded cultural resources present. It is possible that the APE includes resources similar to those found approximately 1,000 yards (9 m) to the east along Soldier Creek. This may include (at a minimum) rock pile and artifact scatter sites. The likelihood for additional subsurface resources is neutral to favorable based on a 1990 Site Favorability Map/ Predictive Model prepared by Altschul and Jones (in Statistical Research Inc. 1995:4-9a). Direct impacts to cultural resources in the southwestern portion of the East Range could be caused by grading, excavating, trenching and other ground-disturbing construction activity associated with proposed AAR activities. These activities will be managed to avoid significant impact to prehistoric resources (see Management Methods Included in the Proposed Action), if such resources were encountered.

No significant architectural or historic period resources have been identified within the APE for AAR activities. No additional architectural study is necessary for the AAR site. There will be no significant impacts to known historic period resources.

Various portions of the APE for erosion control and stormwater management improvements have been surveyed for cultural resources. Several previously recorded archaeological resources have been found within the APE and documented by the Post Archaeologist at Fort Huachuca. These resources are documented in the 1995 Fort Huachuca Draft CRMP. Grading, excavating, trenching, and other ground-disturbing construction activity associated with proposed erosion control and stormwater management activities could cause direct impacts to prehistoric resources in the APE. These activities will be managed to avoid the potential for significant impact (see Management Methods Included in the Proposed Action).

The APE for this activity includes the Old Post Historic District in the cantonment area. Direct and indirect impacts to the historic district could be caused by construction activity associated with future erosion control and stormwater management improvements. These activities will be managed to avoid the potential for significant impact (see Management Methods Included in the Proposed Action).

Management Measures Included in the Proposed Action

All areas identified for Proposed Action activities not already surveyed will be subject to Class III surveys for cultural resources prior to any ground disturbance. Any resources encountered will be evaluated to determine if they are eligible for the National Register of Historic Places. If resources are not found to be eligible, no mitigation will be required. Resources that are found eligible will either be avoided or impacts to these resources will be mitigated in compliance with the NHPA. Mitigation activities will be implemented after the preparation and approval of appropriate work plans. If resources are encountered that are of indeterminate eligibility, appropriate testing methods will be implemented to classify eligibility.

Any future activities proposed for sites within or adjacent to the Old Post Historic District will be evaluated for their potential to affect the district. Existing resources will either be avoided or impacts to these resources will be further mitigated in compliance with the NHPA. The specific measures for ensuring the reduction of impacts to the district will be subject to SHPO concurrence and documented to ensure regulatory compliance.

NAGPRA requires that certain procedures be followed when there is a discovery of cultural items or human remains on federally-owned or tribal lands. In the event that such resources are discovered pursuant to future cultural resource surveys or construction activities associated with

the Proposed Action, work will be halted at the site and Native American tribes that have claimed affiliation to the area will be notified and consulted by the Post Archaeologist.

To ensure the protection of archaeological resources that may be unearthed during construction activities, the U.S. Army will provide a qualified cultural resource specialist to monitor construction activities. This cultural resource monitor will be present at all sites within the APE during all construction-related activities. In the event that any cultural resources are discovered pursuant to any construction or ground disturbance, construction activities will be halted and resources will be evaluated by the Post Archaeologist as per Altshul and Jones (1995). The Post Archeologist will then consult with SHPO. If resources were not found to be eligible, no mitigation will be required prior to disturbing them. For resources that are eligible, they will either be avoided, or impacts to these resources will be mitigated in compliance with the NHPA, after the preparation of required plans.

4.5.2 Enhanced Existing Facilities (Alternative A)

Activities associated with the Enhanced Existing Facilities Alternative will result in substantially less ground disturbance than those of the Proposed Action. The APE for this alternative is limited to areas within 50 yards (46 m) of the existing treated-effluent basins and the areas between Treated-effluent Basins #2 and #4.

No previous archaeological surveys have been conducted at the existing treated-effluent recharge basins site on the East Range and there are no previously recorded archaeological resources present. The potential for prehistoric resources on the East Range site was discussed under the Proposed Action (Section 4.6.1.2) and is not repeated here. Indirect impacts to cultural resources in and around the treated-effluent recharge basins could be caused by grading, excavating, trenching and other ground-disturbing construction activity associated with proposed enhancement activities. These activities will be managed to avoid the potential for significant impact to cultural resources (see Mitigation Measures for Enhanced Existing Facilities).

No significant architectural or historic resources have been identified within the APE for basin enhancement activities. No additional architectural study is necessary for the site. There will be no impact to known historic resources.

Management Methods Included in Enhanced Existing Facilities

All areas to be disturbed under this alternative will be subject to a Class III survey for cultural resources prior to any ground-disturbing activity. Any resources encountered within the area will be evaluated to determine if they might be eligible for the National Register of Historic Places. If resources were not found to be eligible, no further mitigation will be required prior to disturbing them. Resources that are found eligible will either be avoided or impacts to these resources will be mitigated in compliance with the NHPA.

In the event that any cultural resources are discovered pursuant to any construction or ground disturbance, construction activities will be halted and resources will be evaluated by the Post Archaeologist. The Post Archeologist will then consult with SHPO. If resources were not found to be eligible, no mitigation will be required. Resources that are found eligible will either be avoided or impacts to these resources will be mitigated in compliance with the NHPA.

NAGPRA requires that certain procedures be followed when there is a discovery of cultural items or human remains on federally-owned lands. In the event that such resources are discovered pursuant to future cultural resource work or construction activities associated with this alternative, work will be halted at the site and Native American tribes that have claimed affiliation to the area will be notified and consulted by the Post Archaeologist.

4.5.3 No-Action (Alternative C)

Under the No-Action Alternative, there will be no change to recorded prehistoric, historic, or traditional resources on Fort Huachuca. There will be no impact to existing resources and no additional areas on Fort Huachuca will need to be surveyed for activities proposed in the Proposed Action and the Enhanced Existing Facilities Alternative.

4.6 TRANSPORTATION

Potential impacts to transportation due to activities associated with the Proposed Action and alternatives will affect traffic flow in the cantonment area and access to the AAR facilities on the East Range. A determination of significant impact on transportation could result if one or more of the following criteria were met:

- Proposed Action or construction-related activities result in a substantial safety hazard to air transportation, motor vehicle, pedestrian, or bicycle traffic in the ROI.

4.6.1 Proposed Action

The activities associated with the Proposed Action have the potential to affect ground and air transportation.

4.6.1.1 Ground Transportation

Construction associated with improvements to the treated-effluent reuse distribution system will only affect transportation in the cantonment area. During construction activities, traffic flow will be impeded. The distribution line extensions will be installed within existing roadways and utility rights-of-way and trenching will occur within partially or completely closed roads to ensure safe working conditions for the construction crews. Upon completion of the line installation, all disturbed road surfaces will be refinished to equal or better than pre-construction condition. Once installed, the extended distribution system will create no further impacts to transportation under ordinary circumstances.

Approximately 6.5 miles (10.5 km) of roads within the cantonment area will be disturbed by these activities. Disruptions to the roads will last approximately 4 weeks, for 8 hours a day. It is common practice to place a temporary asphalt finish on roads where the subsurface has been disturbed to allow time for the earth to settle. Roads are usually repaved after a settling period (up to three months) to prevent sagging of the final surface. However, during this settling period, traffic can flow normally in the repaired area.

Impacts to transportation may result from prolonged restrictions in the road network due to construction activities. These activities will interfere with traffic flow on primary and secondary collector streets: Smith Avenue (between Hatfield and Whitside) is a primary collector and Carter Street and the rest of Smith Avenue are secondary collectors. The remaining streets that will be affected are local or residential roads. While these streets will be affected, there are some methods to manage the activities (described below) that will reduce the overall impact to a level below the threshold of significance.

Improvements to the treated-effluent basins will only occur within the East Range of the Fort. The effects of this action will directly impact the roads on the East Range, and indirectly effect LAAF. During construction heavy machinery will need to gain access to the area. The most

direct and accessible route from Sierra Vista will be through the 7th Street Gate and over the packed-gravel road from the gate to the basins. A pole-mounted traffic light at the 7th Street intersection will assist trucks in crossing the Highway 90 Bypass—passage of high-profile vehicles will not be an issue. Traffic volume on the dirt road from the gate to the basins is very low. Furthermore, during construction the vehicles will remain on site, thereby minimizing their presence on access road or roads within Sierra Vista. The only regular daily traffic generated by these construction activities will be from the workers' personal vehicles. Twelve personal trucks are anticipated. The limited presence of the large construction vehicles and the negligible traffic generated will not present a significant impact as a result of this action.

Access roads to the basins will be extended by approximately 1 mile (1.6 km) total. The new stretches of road will be consistent with the existing road and constructed of packed gravel. These new road sections will only be used by maintenance and operation personnel and are expected to only carry vehicles necessary for the maintenance and operation of the treated-effluent basins. The expansion of basin-access roads will not significantly impact the transportation network of the Fort or surrounding area.

Two proposed erosion control or stormwater management improvements, temporary stream crossings and water spreading bars, will have an influence on transportation if installed. All other erosion control and stormwater management improvements will not affect transportation on or near Fort Huachuca. All devices will serve to control stormwater flows to protect existing roads from erosion.

Temporary stream crossings will help reduce direct damage to streambeds from vehicles and will also decrease the time that a wash is not passable during and after a storm. The preferred form of temporary stream crossing is a dip crossing, which consists of a hardened surface that lines the streambed. The dip crossings will be angled downstream so that water will flow easily over. The surface will be self-cleaning (no sediment buildup). When the presence of stormwater makes crossing unsafe, traffic will be temporarily suspended at the crossing. However, as soon as the stormwater receded sufficiently, the crossing will once again be available for use. During 100-year flood flow washes, the wash would be impassable for approximately one hour. There is the possibility that traffic accustomed to using dip crossings will attempt to cross when water is present, thereby endangering human life. Such risks can be minimized though the use of signs

placed at crossings warning drivers to not enter the wash when flooded. The use of this stormwater management device will not result in any significant impact.

Spreader bars are similar to speed bumps except they only extend half way across the road, are angled (30 degrees) to the centerline of the road in a chevron pattern, and are only a couple of inches in height. The devices will be placed in roadways to help divert stormwater before it gullies or erodes the roadway. The water is released on the side of the road, where it resumes its movement as less erosive sheet flow. In the absence of stormwater, these bars will result in a slightly rougher ride for vehicular traffic, but will not impede or adversely impact traffic flow in any way. There will be no significant impact as a result of using spreader bars. During the construction period for installing these devices, there will be some delays in traffic throughput. However, since the volume and speeds of the traffic are extremely low, this impact will be negligible. There will be no significant impact to ground transportation from implementation of the Proposed Action.

Management Methods Included in Proposed Action

During treated-effluent reuse pipeline construction, advisory signs will be posted to warn commuters of the construction activity.

4.6.1.2 Air Transportation

The configuration of the proposed effluent-recharge basins on the East Range includes measures to reduce the potential for bird strikes as a result of standing water. Areas directly under the approach and departure corridors are intentionally absent of effluent recharge or stormwater detention basins that would introduce standing water. The Proposed Action has been reviewed by the LAAF Air Traffic and Airspace Officer (Rose, pers. comm. October 12, 2000) and the U.S. Army Aeronautical Services Agency (Smith, written comm., June 28, 2000) with regards to safety issues. Both agencies indicated a lack of any significant safety risk to air transportation at LAAF.

Based on this expert review and the fact that there would be no standing water directly underneath the approach and departure corridor, the Proposed Action is not anticipated to result in a substantial risk to air transportation at LAAF.

4.6.2 Enhanced Existing Facilities (Alternative A)

Under this Alternative, the treated-effluent reuse distribution system will not be improved. Therefore, the roads will not be disturbed for construction, eliminating traffic flow impacts discussed in the Proposed Action. In addition, even if the existing treated-effluent reuse lines failed, they are not situated along primary or secondary collector roads, and will therefore not trigger the criteria for significance.

Expansions to the treated-effluent basin roads, including the access ramps will not be constructed under this alternative. While slight improvements to some of the existing basins will occur, there will be no regular maintenance as in the Proposed Action. Failure to extend the road and access to the basins will not result in a significant impact on traffic flow, since there will be no higher demand to access the basins than the current level. In addition, stormwater will not be channeled north around the treated-effluent spreading basins, and there is the possibility that the existing road could be saturated to the point that vehicles will not be able to use it. While the low volume of traffic will not result in a significant impact, the road itself could experience deterioration and erosion, which could amount to costly repairs.

Under this alternative, erosion control and stormwater management improvements will still occur but to a lesser scale. The consequences of these improvements will be identical to those described in the Proposed Action above. Anticipated impacts to transportation, such as closures due to running washes will be temporary and nominal due to the low volumes of traffic. There will be no significant adverse impacts to transportation.

4.6.3 No-Action (Alternative C)

Under the No-Action Alternative, the transportation network within the Fort will not be affected in any way. Therefore, no significant impacts will occur as a result of this alternative.

Erosion control and stormwater management improvements will not occur. Failure to employ some form of erosion control in the southeastern portion of Training Area F near Highway 90 where the Fort meets Sierra Vista at Graveyard Gulch could result in an adverse impact. Erosion has already undercut the Perimeter Road by 3 to 4 ft (0.9 to 1.2 m) and will undercut Highway 90 in the future if abatement measures are not taken. The instability of the Perimeter Road currently presents a danger to automobiles that cross the undercut area and eventually, the road will fail completely. Likewise, the reach of this erosional formation is not far from Highway 90,

and failure of the highway is imminent in the absence of actions that reverse the current trend. If the highway were to collapse due to a lack of substructure damage will be significant and could range from severe road damage to the loss of human life. Repairing the road after it fails will be far more time consuming and costly than repairing the existing damage and installing erosion control measures to ensure the long-term safety of the roadway.

4.7 UTILITIES

Potential impacts on utilities or energy resources could be determined significant if any of the following occurred as a result of the Proposed Action and alternatives:

- A resource exceeds its present and/or future capacity to serve.
- A long-term interruption to, or interference of, service.
- A significant increase in annual energy consumption or peak potential loading is calculated to exceed the capacity of the transmission lines and transformers.

4.7.1 Proposed Action

The activities associated with the Proposed Action have the potential to affect potable water and electricity on the Fort.

4.7.1.1 Potable Water

The activities evaluated in this EA are designed to lessen the withdrawal and maximize recharge of the aquifer. The implementation of these actions will result in a more abundant aquifer water supply. The extension of the treated-effluent reuse lines will result in reduction of potable water use for irrigation. The reduction in groundwater withdrawal will be a positive impact.

The proposed AAR facilities improvements will not result in any adverse consequences to potable water. On the contrary, recharging the groundwater supply by this method allows for treated-effluent water to replenish the aquifer supplies with water that is additionally cleansed by natural processes that occur during infiltration. In addition, the stormwater diversion channel will be built to convey stormwater around the treated-effluent basins, protecting them from large sediment loads. Stormwater confined to stormwater infiltration basins will have more time to infiltrate than if the water continued to move downstream as surface flow. By enhancing the existing treated-effluent basins and managing stormwater around these basins, the amount of water that can be returned to the aquifer is increased. The Proposed Actions is anticipated to result in a net positive effect on potable water supplies at the Fort.

Under the Proposed Action, a variety of erosion control and stormwater management practices are proposed for the cantonment area, East Range, and West Range. While some of the methods that involve water detention could inadvertently contribute to increased levels of recharge, this additional quantity will be relatively small. Some devices, such as drywells and rooftop rain collection devices will increase the amount of stormwater that could be directly reused for other, non-consumptive purposes, reducing the demand on potable water. Reduction of erosion around recharge areas, such as the treated-effluent basins, will decrease the amount of maintenance necessary to keep infiltration at a maximum. Decreasing erosion and maximizing the capacity to reuse stormwater will have a net positive effect on potable water by decreasing the demand on potable water.

There will be no significant impacts on potable water within Fort Huachuca as a result of the implementation of the Proposed Action.

4.7.1.2 Electricity

An increase in the amount of electricity the plant will use will result from improvements proposed for the WWTP #2. Additional energy consumption is estimated at 75 to 150 kilowatts (kW) per hour (CH2MHILL 2000). This level of consumption will not affect the electrical substation's ability to provide the Fort with electrical power or result in intermittent service (brownouts/blackouts). Therefore, the additional power demand due to the Proposed Action will not result in any significant impacts.

Electrical service will have to be extended to the new structure on the East Range adjacent to the treated-effluent basins. The facility will only use the electricity to provide standard power to the building for uses such as lighting, heating, and cooling. The valves between basins will be electric, so the improvements to the basins themselves will only result in a negligibly higher level of electricity consumption. Given the low additional demand for electricity, there will be no significant adverse impact to this utility as a result of the Proposed Action.

There will be no significant impacts on the electricity supply or distribution system as a result of implementation of the Proposed Action.

4.7.2 Enhanced Existing Facilities (Alternative A)

4.7.2.1 Potable Water

Under this alternative minor improvements will be made to the existing treated-effluent basins, which will improve infiltration, thereby increasing the total volume of groundwater. This alternative will not affect the consumption of potable water. There will be no significant adverse impacts as a result of this alternative.

Under this alternative, some erosion control or stormwater management improvements will occur within the East Range and cantonment area. Some of the erosion control devices will serve to slow or detain water on the Fort, which could contribute to AAR to a small degree. However, there will be no significant benefits or impacts to potable water associated with implementing erosion control or stormwater management.

4.7.2.2 Electricity

Under this alternative, the new structure will not be built. Therefore, there will be no new requirements electricity supply and no new transmission lines will be necessary. No significant impacts to this utility will occur as a result of the Enhanced Existing Facilities Alternative. There will be no affect on the electricity supply or distribution system as a result of the implementation of the Enhanced Facilities Alternative.

4.7.3 No-Action (Alternative C)

Current trends show that total potable water consumption at the Fort is declining due to conservation measures and educational programs. Likewise, the wastewater services of the Fort are capable of accommodating existing and foreseeable demands on the system. Further there will be no additional demands for electrical services and no powerline extension will be required. While some of the positive effects of increasing AAR capabilities and the reuse of water resources will not be realized, no significant adverse impacts to these utilities will be occur under this alternative.

4.8 HAZARDOUS MATERIALS AND WASTES

Evaluation of the Proposed Action and alternatives for impacts from hazardous materials and wastes is based on both the potentials for upset (accident) and the consequences of any project-related adverse event (negative effect associated with normal operations). Beneficial impacts may result from any direct or indirect safety improvements due to project implementation. A

determination of significant impact related to hazardous materials and wastes could result if one or more of the following criteria were met:

- Exposure of humans to unsafe levels of hazardous materials or hazardous waste.
- Generation hazardous materials or hazardous waste in quantities or of a type that could not be accommodated by the current disposal system.
- Significant increase in the likelihood of an uncontrolled release of hazardous materials that could contaminate soil, surface water, and groundwater.
- Endangerment or unusual risk to military personnel, visitors, nearby residents, and the general public off-site.

4.8.1 Proposed Action

The installation of the new treated-effluent distribution lines is a short-term construction activity that will not generate or use hazardous waste, with the exception of temporary on-site storage of fuel for construction equipment. The contractor will be required, as part of the bid requirement, to provide a written plan to show how the fuel will be transported, stored, and dispensed. The plan will also include a section on emergency response procedures to accidental spill. The contractor will also be required to collect and properly dispose of any oil leaks from construction equipment that is parked on-site during the construction period. There will be no significant impacts to public safety and no hazardous material issues associated with this action.

Under the Proposed Action, sediments from the spreading basins on the East Range will be removed and disposed. Based on the quality of the treated effluent from the wastewater treatment plant, there is no reason to suspect the sediment load from the basins will qualify as a regulated waste. However, because the plant influent (incoming waste) composition is reported to be 15 percent industrial, the sediments will be profiled prior to disposal, using the toxicity characteristic leaching procedure (TCLP). The TCLP analysis is designed to determine the mobility of both organic and inorganic analytes present in liquid, solid, and multi-phasic wastes.

The improvements to the treated-effluent basin will be a short-term construction activity that will not generate, or use hazardous waste, with the exception of temporary on-site storage of fuel for construction equipment. As mentioned above, the contractor will be required to provide a written plan to show how the fuel will be transported, stored, and dispensed. Emergency response procedures to accidental spills will also be outlined. The proper collection and disposal of any oil leaks from construction equipment that is parked on-site during the construction period

will be the responsibility of the contractor. There will be no significant impacts to public safety and no hazardous material issues associated with this action.

Erosion control and stormwater management methods considered under the Proposed Action include surface stabilization, runoff control and conveyance measures, outlet protection, sediment traps and barriers, stream protection and stormwater detection and infiltration basins. These actions do not require the use of or generate regulated substances that may constitute an adverse environmental impact. There will be no significant impacts to public safety and no hazardous material issues associated with this action.

It is possible that project-related excavation and grading could encounter subsurface hazardous material associated with previous or existing on-site uses. Excavation and construction activities encountering such hazardous substance sites could result in significant impacts to surface water quality through effects such as improper storage or disposal of excavated hazardous substances (e.g., adjacent to canals, in open stockpiles or other areas subject to surface runoff). Under such a scenario, hazardous substances could potentially be released directly or exposed to storm (or other) runoff, resulting in the discharge of suspended or dissolved contaminants into local surface waters (i.e., Babocomari and San Pedro Rivers).

Wastewater is collected and conveyed through a series of sewer lines to WWTP #2, where it undergoes treatment to ready it for reuse. The current sewer system and the capacity of WWTP #2 are sufficient to accommodate current and foreseeable future demands on these services. Enhancements to WWTP #2 will increase the holding capacity for treated effluent, which will increase the available amount for reuse. This will allow for more efficient irrigation. Currently, irrigation must occur on some parts of the Fort during times of high evaporative loss. With increased holding capacity, a larger area will be irrigated during times that will minimize evaporative loss. The sewer lines and WWTP #2 are contained within the cantonment area and are within infrastructure that protects them from erosion processes. Implementation of programs to control erosion and stormwater will have no impact on these systems.

There will be no significant impact from hazardous materials and wastes as a result of implementation of the Proposed Action.

Management Methods Included in the Proposed Action

If unanticipated on-site hazardous substances are encountered during construction, activities will cease until appropriate remediation efforts are completed.

4.8.2 Enhanced Existing Facilities (Alternative A)

All the work proposed under this alternative has been discussed under the Proposed Action and will not constitute a significant impact to the human environment as far as hazardous materials or wastes are concerned. Aside from the treated effluent that will be used in the basins originating at WWTP #2, the wastewater services to the Fort will not be benefited or adversely affected by the actions considered here. There will be no significant impact to wastewater as a result of these actions. As mentioned in the Proposed Action, there will be no significant impacts associated with the implementation of this component of the Enhanced Existing Facilities Alternative.

4.8.3 No-Action Alternative (Alternative C)

Under the No-Action Alternative, the proposed activities will not occur, and most likely, the existing conditions will continue. Currently there are no hazardous material issues and none are anticipated in the foreseeable future. Therefore, there will be no significant impact to issues surrounding hazardous materials with the No-Action Alternative.

4.9 OTHER RESOURCES

As a result of the preliminary screening process for this EA, the following resource areas were identified as having only a negligible chance of being affected by the activities evaluated.

Land Use—A short-term impact to installation land use could result from possible conflict with ongoing military training due to temporary construction activities near training sites. The majority of the project activities will take place in locations that will not significantly change the land use of the specific or surrounding property. Long-term impacts to installation land use would only result from removal of selected areas (those used for AAR, erosion control, or stormwater management activities) from lands available for military training. However, these training area losses are not significant and will not affect the ongoing mission or training capabilities at the Fort (Beil, pers. comm., May 5, 2000). No direct or indirect impacts to off-post land uses are anticipated from the proposed activities. Based on these findings, the Proposed

Action will not result in any significant impact to land use within the local (Fort Huachuca) or regional context. Therefore, land use impacts are not further evaluated in this EA.

Socioeconomics— Proposed activities will not change local demographics or adversely affect housing or employment opportunities in or around Fort Huachuca. There may be a temporary short-term increase in local employment during facility construction. Operation and maintenance duties for the proposed activities will likely be added to the job responsibilities of existing positions at the Fort and no additional full-time employees will be required. These changes are not anticipated to be significant within either the local or regional context. Therefore, socioeconomic impacts are not further addressed in this document.

Environmental Justice—Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental impacts of their programs, policies, and activities on minority or low-income populations in the surrounding communities. Activities evaluated in this EA occur on the installation, are isolated from the surrounding community, and will not disproportionately affect any income or minority group. Therefore, impacts on environmental justice are not further addressed in this document.

Noise—Sensitive noise receptors on the installation include human and wildlife populations. The construction associated with the installation and extension of the reuse distribution pipelines will generate noise levels of approximately 85-90 decibels (dB) near noise-sensitive residential areas within the cantonment area. However, this noise will be temporary, will occur only during daylight hours, and will not create any human health or safety hazard. While the noise could be a short-term annoyance to local residents, the impact will not result in a serious disruption of normal activities, and will therefore not be significant.

The construction of facilities on the East and West Ranges will not be near human population areas, and the noise will not create any incompatibility with ongoing military training activities. Wildlife populations present during daytime hours on the East and West Ranges and within the cantonment area, are accustomed to regular human activities (a detailed description of these species is provided in Section 3.4, *Biological Resources*). As such, it is not anticipated that wildlife will experience significant impacts from construction-related noise. It was determined

that no significant impacts will result from project-related noise. Therefore, noise impacts are not further addressed in this document.

Public Safety—The evaluated activities will not generate or increase the public's exposure to any hazardous or biological wastes or materials; result in the likelihood of an uncontrolled release of any hazardous materials, nor create a situation that could expose the public to unusual risk. During construction in the cantonment area, crews could be working near areas of traffic congestion; however, all reasonable precautions will be taken to ensure their safety. The proposed activities were determined to pose no significant impact to public safety or the welfare of children on the Fort or in surrounding communities. Therefore, public safety impacts and health and safety risks to children are not further addressed in this document.

Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks (April 21, 1997)—A growing body of scientific knowledge demonstrates that children may suffer disproportionately from environmental health and safety risks. These risks arise because (1) children's bodily systems are not fully developed, (2) children eat, drink, and breathe more in proportion to their body weight, (3) their size and weight may diminish protection from standard safety features, and (4) their behavior patterns might make them more susceptible to accidents. Based on these factors, the President directed each federal agency to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. The President also directed each agency to ensure that its policies, programs, activities, and standards address disproportionate risks to children resulting from environmental health risks or safety risks. Implementation of the Proposed Action will not introduce any health or safety risk that would disproportionately affect children. The proposed activities were determined to pose no significant impact to public safety or the welfare of children on the Fort or in surrounding communities. Therefore, public safety impacts and health and safety risks to children are not further addressed in this document.

5.0 CUMULATIVE IMPACT ANALYSIS

Cumulative impacts are defined in the CEQ regulations (40 CFR 1500-1508) as those impacts attributable to the Proposed Action combined with other past, present, or reasonably foreseeable future impacts regardless of the source or agency causing them. Because there are few, if any, direct or indirect environmental impacts that would result from adoption of the Proposed Action, in the strictest sense, there are no significant cumulative impacts associated with the Proposed Action.

However, there is a need to put the minimal impacts of the Proposed Action into a regional context. To that end, the cumulative impacts of past, present, and reasonably foreseeable future activities which have, are, and will continue to occur in the region regardless of actions at Fort Huachuca are described in this section.

5.1 METHODOLOGY

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. However, in order to be considered a cumulative impact, the effects must: 1) occur in a common locale or region; 2) not be localized (i.e., they would contribute to effects of other actions); 3) impact a particular resource in a similar manner, and 4) be long-term (short-term impacts would be temporary and would not typically contribute to significant cumulative impacts).

Analysis of cumulative impacts requires the evaluation of a broad range of information that may have a relationship to the Proposed Action, Enhanced Existing Facilities Alternative, and the No-Action Alternative. A good understanding of the politics, sociology, economics, and environment of the region is key to this analysis, as is an accurate evaluation of factors that contribute to cumulative impacts.

Therefore, the methodology employed in this section required the review of a range of recent references regarding regional events and trends; the review of political, legal, and socioeconomic changes and expected changes; and interviews with knowledgeable sources involved in day-to-day developments in the region. This broad information base was then narrowed to include those events and trends that impact or may reasonably be expected to impact the affected environment.

The most common environmental concerns voiced during previous public scoping activities included the following:

- Trends relating to water resources (the San Pedro River, groundwater mining, water quality).
- Trends affecting ecological resources (particularly federally-listed species and their habitats).
- Population growth and economic activity in the Fort Huachuca/Sierra Vista area and the resulting implications on water and ecological resources in the region.

The resource areas of geology and soils, air quality, cultural resources, transportation, utilities, hazardous materials and wastes, land use, environmental justice, noise, and public safety were examined and it was determined that Proposed Action and Alternatives A and C would have no contribution to their regional trends or conditions of the environment. Therefore these resource areas are not discussed from a cumulative impact perspective.

Although population growth and economic activity were listed above as a primary area of regional concern, the Proposed Action and Alternatives A and C would not include the addition or loss of any FTE positions at the Fort and would not involve any significant influx of military spending in the area. Therefore, population growth and economic activity are not further addressed.

5.2 CONTRIBUTION IMPACTS

This section address the only two resource areas where the impacts of the Proposed Action and alternatives, in connection with related past, present, and reasonable foreseeable future actions, warrant further consideration: water resources and biological resources. This consideration is given because of the elevated sensitivity regarding these resources, not because the Proposed Action or alternatives would create any significant contribution to past, present, and reasonably foreseeable future actions in the local or regional context for any given resource including water resources and biological resources.

5.2.1 Water Resources

The Sierra Vista subwatershed of the Upper San Pedro River is an active area with respect to water resource management activities. Concern about regional groundwater withdrawal and potential impacts to the stream flow in the San Pedro River have increased in recent years. Considerable effort has been devoted to assessing the nature and extent of these impacts, as well

as to developing and implementing plans to mitigate any impacts. The City of Sierra Vista, Fort Huachuca, numerous federal, state, and local agencies, and a large number of citizens and interest groups have been involved in this process. The Upper San Pedro Partnership, comprised of federal, state, and local agency representatives, is actively pursuing, and in the process of implementing a wide variety of water recharge and consumption-reduction projects that will have a positive cumulative impact on regional water.

Through careful planning, Fort Huachuca has experienced an overall decline in installation water use. The Fort's impact on water resources has diminished through lower annual withdrawals. Significant factors to this reduction have been better management of water resources and a concerted effort to find additional sources of water savings. The Proposed Action and other programs that are planned or in place at the installation will ensure the continued reduction in water use.

Table 5.2-1 presents a number of water resource projects at Fort Huachuca that have been either studied for implementation, tested through pilot projects, or fully implemented through the Fort and the Upper San Pedro Partnership (USPP), a consortium of 17 local organizations (governmental and non-governmental organizations) formed in 1998 to address water resource concerns within the Upper San Pedro Basin.

The region is experiencing a continuing population increase. Over the long-term, this increase may impact with respect to water resources and, by extension, ecological resources. If off-post population, urban growth, and urban water consumption in the region continue to increase as projected, additional mitigation measures will be required in the region to protect the Sierra Vista subwatershed and existing environmental resources.

Another risk to both the water resources and ecological resources of the region is posed by economic activities within the San Pedro River watershed in Mexico. Existing and planned mining activity (USGS 1996) could pose a direct impact to regional water quality. Ongoing expansion of mining activity in northern Mexico, combined with the possible development of at least one additional major mine within the basin, would result in major increases in water consumption upstream of the international border (USGS 1996).

Table 5.2-1. Water Resource Projects and Studies at Fort Huachuca as of January 2000

Project	Goal	Status
Demolish WWII Wood Structures	Remove/shut off leaky potable water and sewer infrastructure	Work began in 1992 and will continue through 2002, subject to availability of funds. Over 1 million sq. ft demolished since 1992.
Low-flow fixture retrofit Replacement of urinals in high-use areas with waterless models	Replace older, higher use fixtures to reduce water use	Began in 1992. Replaced shower heads and toilets and added aerating faucets to reduce consumption. 275 waterless urinals installed from July 1997 to present, 80 pending installation. Each can save approximately 45,000 gal. per year in high use areas. Replacement of 2.5 gpm to 1.5 gpm showerheads underway since July 1999.
Landscape renovation	Reduce irrigation	Xeriscaped some existing areas, required desert landscaping in new construction. Goal is at least 1 acre per year for conversion
Use of effluent for irrigation	Use treated effluent where irrigation required, if cost effective	Began in 1969. Effluent used for Chaffee Parade Field, Outdoor sports complex and Golf Course. New ET monitoring system installed in Nov. 1999 to reduce watering and make more effluent available for recharge.
Lawn watering reduction (installation irrigation policy)	Minimal, prudent use of water	March 1994 (and updates) policy restricts all watering to low-evaporation times of day. Residential units allowed only 4 hr. per week, 2 months per year. Enforcement by Commanders and Military Police.
East Range Watershed Improvement	Improve infiltration and recharge, reduce erosion	Funding greatly reduced by TRADOC. Most ITAM funds are in withhold for TRADOC Operations
Riparian Area Protection Projects	Restore or protect riparian areas on post	Funding varies year-to-year
Artificial Aquifer Recharge	Return 1,000 ac-ft or more of treated effluent and stormwater to the aquifer annually	2 projects funded. Both are in design. Major project on the East Range will be state-of-the-art shallow basin recharge.
Groundwater monitoring	Monitor static groundwater levels to determine trends	A line of wells was installed on Fort Huachuca between State Route 90 and the San Pedro River in 1994. Monitoring water levels every 50 days began in Feb. 1995. HEC provides annual analysis Fort Huachuca also funded the establishment and maintenance of a USGS stream gage on a major tributary to the San Pedro
Regional and other geophysics studies	To better understand the hydrologic connectivity of the region	State-of-the-art geophysics to provide information on the basin configuration and the general health of the water table. First half was published by USGS in Jan. 1999, more is in progress.
Leak detection surveys	Find leaky infrastructure and repair	Potable lines surveyed in 1997, leaks repaired. Reservoir adjustments in 1999 measurably reduced pumpage. Sewer line lead detection funded to begin in FY2000.
Pilot projects: • Roof top capture, Vet Clinic • Hot water return systems • Horizontal axis washers	•Capture and reuse roof runoff •Determine adaptability of technologies for use on the Fort	•Installation complete, but design flaws discovered •Different status for each technology
Water Wise Conservation Education Program	To reduce unnecessary water use by Fort residents and employees	Publications and presentations tailored for Fort. Program began in October 1998.

Overall, the water resource future of the region is complex and difficult to predict because it is comprised of both negative and positive trends. However, the contribution of the Proposed Action or Alternative A to cumulative impacts on water resources will be positive in the context of these larger regional trends.

Selection of the No-Action Alternative (Alternative C) would mean that the levels of reuse and recharge of water at the Fort would remain at their current levels. While the Fort is currently taking an aggressive approach to managing and minimizing water use, valuable opportunities to improve these efforts would be passed over. Thus, while there would be no adverse impacts associated with not implementing the reuse and recharge actions, the positive impacts described above would not occur either.

5.2.2 Biological Resources and Ecosystems

Cumulative impacts to biological resources at or near Fort Huachuca are the result of the complex interactions of several different trends. The Fort's water resource management is a factor in the overall future of the region's biological resources. Fort Huachuca's water resources management program (discussed above) addresses both groundwater and local riparian concerns, and will provide an important long-range contribution to the overall health of the region's biological resources, particularly that of the San Pedro Riparian NCA. The NCA is Critical Habitat for a number of species (avian, fish, and plant) and serves as a significant international migratory bird corridor in the southwest.

As a result of Fort Huachuca's activities, its impact on local biological resources is diminishing, and its contribution to recovery of species populations and their habitats is increasing. This positive trend will continue and strengthen in the future so long as action continues to be taken. Implementation of the No-Action Alternative would significantly hinder the Fort's efforts improve available water supplies and indirectly support the recovery of species populations. Likewise, regional population growth and economic activity not associated with the Fort (and resulting increases in private groundwater consumption in the Sierra Vista subwatershed) may overshadow and offset these efforts.

The intrusion of non-native or exotic species into the area and the accompanying displacement of vulnerable native species present environmental concerns. Some disruptive exotics have shown the ability under current conditions to out-compete native species. These include fish species in

the San Pedro River as well as grasses like buffalo, Johnson, and Lehmann's lovegrass; bullfrogs; and tamarisk. Several programs introduced by Fort Huachuca address these concerns, and the Proposed Action includes several revegetation activities that may further reduce the presence of non-native vegetation on the Fort.

Among other key programs being developed or planned for implementation are the Integrated Natural Resource Management Plan; various endangered species management plans; active management and protection of key sites like Agave Management Areas, bat roosts, springs, and owl nesting sites; participation in management and recovery programs for such species as the Ramsey Canyon leopard frog; erosion control range rehabilitation programs; and implementation of a prescriptive fire program to improve habitat conditions and avoid catastrophic wildfire.

The Proposed Action and Alternative A contain several components that will create a positive impact on local as well as regional water resources. The proposed expansion of the Fort's treated-effluent reuse distribution system will irrigate areas on the Fort that were at one time irrigated by groundwater. The treated effluent AAR project will increase infiltration and recharge of the aquifer. The various erosion control and stormwater management improvements proposed for the East and West Ranges would decrease the amount of soil erosion and increase the infiltration and recharge of stormwater. Areas of the Fort that have experienced high levels of surface soil loss due to human activity and natural processes would gain habitat through surface topsoiling and revegetation.

In the larger regional and international context, Fort Huachuca's contribution to cumulative impacts on ecological resources has been quite positive for many years. Fort Huachuca serves as an incidental federal protectorate of several species of federally-protected threatened and endangered species and their on-post habitats.

Both independently and together, the various components of the Proposed Action and Alternative A would contribute to the positive trends in biological resources already being experienced on the Fort. With respect to the San Pedro Riparian NCA and other regional environs, the Proposed Action and Alternative A will have a positive impact on ecological conditions and the quality of habitat in the area. Continued regional increases in water consumption are detrimental to the long-term ecological well-being of the San Pedro River and

surrounding environment. The Proposed Action and Alternative A will have a positive impact on regional conditions.

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6.0 FINDINGS AND CONCLUSIONS

6.1 FINDINGS

Implementation of the Proposed Action will reduce net consumptive water use on Fort Huachuca, improve watershed conditions on the East and West Ranges, and reduce sediment transport from the East and West Ranges into riparian areas. This section summarizes findings presented in Section 4.0 and the reader is urged to review that section for more a more detailed discussion of the findings. Table 6-1 provides a summary of the anticipated impacts that may result under the three alternatives evaluated.

6.1.1 Proposed Action

6.1.1.1 Geology and Soils

Construction activities associated with the Proposed Action will not impact any existing geologic hazard such as sinkholes, caves, mines, or quarries, and will not cause any seismic activity along existing fault lines. Therefore, there would be no significant impact to geology as a result of implementation of the Proposed Action.

During the installation of reuse distribution lines in the cantonment area, minor, temporary impacts to topsoil will result from trenching and backfilling. Approximately 400,000 cubic yards (306,000 cubic meters) of soil will be excavated on the East Range for AAR improvements. Excavated soils would be temporarily stockpiled for use in erosion control projects. Areas disturbed by construction activities will be recontoured and revegetated with native vegetation, as appropriate. Overall, some erosion may occur during construction associated with the Proposed Action, but these impacts to soil resources are temporary and will be minimized through the use of best management practices (BMPs) and post-construction restoration. The improved stormwater management and erosion control strategies for the East and West Ranges will offset the short-term impacts and have a long-term positive effect on overall soil resources.

6.1.1.2 Water Resources

The Proposed Action includes construction of a vegetated ephemeral stream channel and upland buffer to offset impacts to "waters of the U.S." at a 1:1 ration. In addition, management methods and BMPs will be used during construction activities to control erosion and minimize impacts to surface waters as required under National Pollutant Discharge Elimination System (NPDES)

stormwater pollution prevention permit conditions. With the management methods and BMPs, no significant impact to surface water resources is anticipated as a result of the Proposed Action.

The Proposed Action seeks to reduce consumptive use of groundwater and enhance aquifer recharge through expansion of the treated-effluent reuse distribution system and construction of facilities to increase treated effluent and stormwater recharge capacity. Therefore, a positive impact to groundwater is anticipated as a result of the Proposed Action

6.1.1.3 Air Quality

The general conformity rule applies only to federal actions that may emit a criteria pollutant for which an area has been designated as non-attainment or maintenance. The procedural requirements of the General Conformity Rule are not applicable to the Proposed Action as it will occur entirely within a NAAQS attainment area. Construction activities associated with the Proposed Action will be a source of dust emissions with a temporary impact on local air quality. However, by using dust-control measures (wet suppression, paving, chemical stabilization) during construction these emissions will not be significant.

None of the activities under the Proposed Action will release criteria pollutants in quantities that exceed federal standards. The Proposed Action is not anticipated to have a significant impact on air quality.

6.1.1.4 Biological Resources

Construction activities associated with the treated-effluent pipeline will have minimal impact since underground pipeline construction activity will occur in areas of the installation with little or no native vegetation. Construction activities at the WWTP#2 will be limited to previously disturbed sparsely vegetated areas. The proposed modifications to the treated-effluent and stormwater recharge facilities will disturb vegetation in the areas surrounding the existing basins, proposed stockpiles, and the stormwater diversion channel immediately adjacent to the basins. Site development will require the permanent removal of 10 acres (4 ha) of vegetation and the temporary disturbance of 67 (27 ha) additional acres. This loss is not anticipated to be a significant impact on biological resources.

Table 6-1: Summary of Anticipated Impacts

Resource Area	Proposed Action	Alternative A	No-Action Alternative	Management Methods
Geology / Soils	No impacts to geology anticipated. Potential for erosion of loose soil and stockpiles due to surface water/wind; reduced erosion on the East and West Ranges.	No impacts to geology anticipated. Potential for erosion of loose soil due to surface water/ wind; reduced erosion on the East and West Ranges	Existing soil erosion conditions would continue to progress.	Use of BMPs to reduce and reverse erosion.
Water Resources	Potential for erosion of stormwater diversion channel, dirt roads, and wash beds; increased AAR.	Potential for erosion of dirt roads, wash beds, and existing infiltration basins; downstream sediment transport; some increase in AAR.	Potential for significant erosion of roads, wash beds, and existing infiltration basins; downstream sediment transport.	Manage sediment transport with BMPs.
Air Quality	PM_{10} emissions from construction and stockpiles.	PM_{10} emissions from construction.	No impacts anticipated.	Use of dust abatement measures.
Biological	Some loss of vegetation and wildlife habitat; some wildlife disturbance; potential to disturb agave stands; improved riparian habitat; may affect some listed species, but not significantly.	Some loss of vegetation and wildlife habitat; some wildlife disturbance; potential to disturb agave stands; may affect some listed species, but not significantly.	Loss of long-term benefit from AAR recharge and improved range conditions.	Post-construction revegetation and careful monitoring and avoidance of agave stands; no nighttime construction activities.
Cultural Resources	Potential to disturb subsurface cultural resources during construction.	Potential to disturb subsurface cultural resources during construction.	No impacts anticipated.	Survey prior to construction; halt all activities if cultural resources are discovered.
Transportation	Minor traffic delays; periodic road closures on the East Range during construction; improved road conditions.	Periodic road closures on the East Range during construction; improved road conditions.	Erosion may under-cut the Perimeter Road and Highway 90 and cause other problems on East Range.	Provision of alternate routes; erosion and control measures.
Utilities	Decreased potable water use; improved quality of treated effluent for reuse/ recharge.	Decreased potable water use; improved quality of treated effluent for reuse/ recharge.	No reduction in potable water use.	None
Hazardous Materials and Wastes	Fuel storage and potential for fuel spills.	Fuel storage and potential for fuel spills.	No impacts anticipated.	Storage and spill plan filed prior to use/storage of fuels.

No more than 75 cumulative acres (30 ha) of habitat on the East or West Range would be disturbed for proposed erosion control and stormwater management improvements. This includes the proposed 50-acre (20-ha) Graveyard Gulch stormwater detention basin. The removal of vegetation will be restricted to areas proposed for facility construction, utility trenching, roadways, and building sites. Disturbed areas outside of the permanent facility footprints would be revegetated, followed by natural successional changes wherever possible. Because the proposed cumulative total of habitat disturbance will be no more than 75 acres (30 ha) over a period of many years, implementation of the proposed erosion control and stormwater management improvements will have no significant impact to vegetation on Fort Huachuca in terms of net loss of native habitat.

A minor, temporary impact on wildlife is possible during construction activities, where noise and human activity may disturb a roaming or foraging animal. This impact will be negligible considering that similar habitats exist in the immediate vicinity of the sites, and disturbance will be of short duration. The impact of this habitat displacement is expected to be relatively minor and will not be significant.

Construction activities associated with the treated-effluent reuse distribution and WWTP #2 upgrades were addressed in the *1999 USFWS Biological Opinion on Ongoing and Programmed Future Military Operations and Activities at Fort Huachuca, Arizona.* It was determined that these activities would not jeopardize the existence of any federally-listed threatened or endangered species. The remainder of activities under the Proposed Action were addressed in a separate Biological Evaluation (EEC 2000). This evaluation determined that the Proposed Action may affect, but is not likely to adversely affect the southwestern willow flycatcher, lesser long-nosed bat, loach minnow, spikedace, Huachuca water umbel, and peregrine falcon or destroy or adversely modify critical habitat. Conversely, it is anticipated that the Proposed Action will have a beneficial effect listed species and their critical habitat.

Long-term positive effects that are the goal of the Proposed Action include, but are not limited to, increased water recharge, improved water quality, and decreased erosion. Increased recharge and improved water quality will enhance the survival and fitness of riparian species and will likely result in increases in the amount and quality of available habitat. Decreased erosion could help promote increased water and habitat quality and thereby improve overall conditions for

survival of wildlife utilizing the East Range and nearby riparian habitats, and the San Pedro Riparian NCA.

6.1.1.5 Cultural Resources

The majority of the cantonment area has been surveyed for the presence of cultural resources (see Section 3.5), including negative surveys in the areas proposed for underground pipeline construction. Therefore, trenching and other ground-disturbing construction activities associated with underground reuse distribution pipeline installation and facility construction at the WWTP #2 site are not anticipated to have a significant impact on cultural resources in the cantonment area.

There are no known cultural resources present within the AAR site on the East Range, however, no previous cultural surveys have been conducted on the site. In addition, because the locations for future erosion control measures on the East and West ranges are unknown at this point it is unknown if all applicable areas have been surveyed for cultural resources. Direct impacts to cultural resources on the Fort could occur from grading, excavating, trenching and other ground-disturbing construction activity associated with proposed AAR activities and erosion control and stormwater management measures.

Therefore, all areas outside of the cantonment identified for Proposed Action activities will be subject to Class III surveys for cultural resources prior to any ground disturbance. Any resources encountered will be evaluated to determine if they are eligible for the National Register of Historic Places. Any future activities proposed for sites within or adjacent to the Old Post Historic District will be evaluated for their potential to affect the district. Existing resources will either be avoided or impacts to these resources will be mitigated in compliance with the NHPA. The specific measures for ensuring the reduction of impacts to the district will be subject to SHPO concurrence and documented to ensure regulatory compliance. Based on the completion of subsequent Class III surveys and regulation compliance requirements, the Proposed Action is not anticipated to have a significant impact on cultural resources.

6.1.1.6 Transportation

Construction associated with improvements to the treated-effluent reuse distribution system will only affect transportation in the cantonment area while roads are partially or completely closed so that existing roadways and utility rights-of-way can be trenched. Improvements made to the

treated-effluent basins will directly affect transportation on the East Range and indirectly affect LAAF. During construction heavy machinery will gain access to the area and will remain on site. Traffic volume on the dirt road from the gate to the basins is very low and any increase will be primarily due to workers' personal vehicles. Access roads to the basins will be extended by approximately 1-mile (1.6 km) total with packed gravel and will only be used during the maintenance and operation of the treated-effluent basins.

The configuration of the proposed effluent-recharge basins on the East Range includes measures to reduce the potential for bird strikes as a result of standing water. Areas directly under the approach and departure corridors are intentionally absent of effluent recharge or stormwater detention basins that would introduce standing water. The Proposed Action has been reviewed by the LAAF Air Traffic and Airspace Officer (James Rose, personal communication October 12, 2000) and the U.S. Army Aeronautical Services Agency (Lt. Colonel Ricky Smith, Chief Aeronautical Information Division, written communication of June 28, 2000) with regards to safety issues. Both agencies indicated a lack of any significant safety risk to air transportation at LAAF. Based on the above information, the Proposed Action is not anticipated to result in a significant impact on transportation.

6.1.1.7 Utilities

The activities evaluated in this EA are designed to lessen withdrawal from and maximize the recharge of the aquifer. The extension of the treated-effluent reuse lines will result in reduction of potable water use for irrigation. This reduction in potable water use for irrigation will result in a positive impact. The proposed AAR facilities improvements will not result in any adverse consequences to potable water. On the contrary, this method of recharging the groundwater supply allows treated-effluent water to replenish the aquifer supplies with water additionally cleansed by natural processes that occur during infiltration. Overall, the Proposed Action is anticipated to result in a positive impact on potable water supplies at the Fort.

There will be a slight increase in the use of electricity at the WWTP #2 following improvements to it. Additional energy consumption is estimated at 75 to 150 kilowatts (kW) per hour (CH2MHILL 2000). This level of consumption will not affect the electrical substation's ability to provide the Fort with electrical power or result in intermittent service (brownouts/blackouts). No significant impact to any utility is anticipated as a result of the Proposed Action.

6.1.1.8 Hazardous Materials and Wastes

The installation of the new treated-effluent distribution lines is a short-term construction activity that will not generate or use hazardous waste, with the exception of temporary on-site storage of fuel for construction equipment. Under the Proposed Action, sediments from the spreading basins on the East Range would be removed and disposed. Because the plant influent (incoming waste) composition is reported to be 15 percent industrial, the sediments will be profiled prior to disposal to determine if they need to be managed as hazardous wastes. Erosion control and stormwater management methods do not require the use of or generate regulated substances that may constitute an adverse environmental impact. It is possible that project-related excavation and grading could encounter subsurface hazardous material associated with previous or existing on-site uses. If this occurs, activities will cease until appropriate remediation efforts are completed. No significant impact to the human environment relating to hazardous materials and wastes is anticipated as a result of the Proposed Action.

6.1.2 Alternatives

The Enhanced Existing Facilities action (Alternative A) will result in both positive and adverse environmental impacts in the local context similar to the Proposed Action; however these impacts will be of a smaller magnitude since there are fewer activities associated with this alternative. Decreasing the scale of the project results in a reduction of both adverse and beneficial effects. Eliminating the construction of the treated-effluent reuse lines, significantly downscaling the construction for improving the AAR infiltration basin and associated infrastructure (road expansion, stormwater diversion channel), and fewer erosion control and stormwater management practices will result in fewer land disturbances. By disturbing a smaller area of land there will be less of a short-term impact to soils, less air pollution (PM10 and ROG), fewer impacts to vegetation, less disruption to wildlife, less of a potential to impact cultural resources, less disruption of traffic due to road closures, and fewer fuels and lubricants will be brought to job sites. Small reductions in short-term adverse impacts do not outweigh the long-term loss of water recharge. Therefore, this alternative would be less beneficial to the environment than the Proposed Action but would still be anticipated to have no significant impact on the human environment.

No-Action (Alternative C) reflects a continuation of baseline environmental conditions at Fort Huachuca. Under this alternative, no improvements will be made to existing water management

facilities and no new facilities will be constructed. This alternative will have a higher level of adverse environmental impact than either the Proposed Action or Alternative A. Both action alternatives include the repair and reversal of significant soil erosion and resulting damages to infrastructure, vegetation, and wildlife habitat on the East Range and the No-Action Alternative will lead to a continuation of these problematic conditions. Further, under the No-Action Alternative, the Fort will not receive the additional aquifer recharge associated with the improvements described in the two action alternatives. Therefore, this alternative would be less beneficial to the environment than the Proposed Action or the Enhanced Facilities Alternative but would still be anticipated to have no significant impact on the human environment.

Cumulatively, neither the Proposed Action nor the Enhanced Existing Facilities Alternative or the No-Action Alternative will contribute to any significant impact on the human environment in the regional context. There will be no changes in regional land use, and there will be no project-related growth in either the economy or population. The action alternatives will reduce the demand on local aquifers and increase aquifer recharge, which will ameliorate some concerns regarding water quality and supply in the region and result in a positive impact.

6.2 CONCLUSIONS

It is the conclusion of this analysis that neither the Proposed Action nor any of the alternatives constitute a major federal action with significant impact on the human environment, and a Finding of No Significant Impact for the Proposed Action should be issued to complete the documentation.

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4.11 Other Wildlife

Wildlife that currently inhabit the Proposed Action area will experience short-term adverse effects related to construction noise and temporary loss of food, cover, and access to water. These adverse effects, however, are anticipated to be offset by long term beneficial effects on habitat and the Proposed Action could potentially benefit all wildlife and plants populations in the area. Among those beneficial effects are increased recharge, better water quality, and decreased erosion that should promote a healthy ecosystem.

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4.9 Canelo Hills ladies' tresses

The Canelo Hills ladies' tresses (*Spiranthes delitescens*), a native orchid, is a federally listed endangered species that occurs in finely grained, organic soils that are seasonally or perennially saturated. Currently, this plant is only known to occur in one cienega in Cochise County and three cienegas in Santa Cruz County. The Cochise County population, identified in 1981, is located northwest of the Fort (upstream) on private land along the Babocomari River (ENRD 1998). The Nature Conservancy is currently working with the landowners to develop a conservation agreement for this species (ENRD 1998). Because the Babocomari River downstream of this population does not contain perennial, transitional wet meadows, it is not considered good potential habitat for this orchid (ENRD 1998). This population is upstream of tributaries that originate on Fort Huachuca's West and East Range training areas. These tributaries only flow during rainy seasons and are not suitable Canelo ladies' tresses. The Santa Cruz County populations are all located within the Canelo Hills to the distant west of Fort Huachuca and far from the Proposed Action area.

No Canelo Hills ladies' tresses were found during our site assessment of the Proposed Action area. Canelo ladies' tresses is not known to occur within Fort Huachuca and habitat suitable for this plant is not present on the Fort (ENRD 1998). Thus we conclude that the Proposed Action will have no effect on the Canelo Hills ladies' tresses.

4.10 Huachuca water umbel

The Huachuca water umbel (*Lilaeopsis schaffneriana* var. *recurva*) is federally listed as an endangered subspecies. The plant inhabits cienegas and associated vegetation within Sonoran desertscrub, grassland, oak woodland, and coniferous forests at elevations of 4,000 to 6,500 ft (1,210 to 1,980 m). Presently, the Huachuca water umbel occurs in southwestern New Mexico, southeastern Arizona, and adjacent Sonora, Mexico (ENRD 1998). In Arizona, populations occur in Pima, Santa Cruz, and Cochise counties. The Huachuca water umbel has been documented from 24 sites in Arizona, six of which have been extirpated. These sites occur in the following four major watersheds: the San Pedro River, Santa Cruz River, Rio Yaqui, and Rio Sonora (ENRD 1998).

Seven populations of this species are known to occur on Fort Huachuca. All are located within the South Range of the installation in Garden, Sawmill, and McClure Canyons (ENRD 1998). Much of the riparian area within Upper Garden Canyon is designated as critical habitat for the Huachuca water umbel.

The Huachuca water umbel is also known to occur within six disjunct areas along the San Pedro River. These populations are vulnerable to potential adverse effects related to groundwater deficits in the area. Potential habitat for this plant exists at the edge of ponds in the southwestern corner of the East Range of Fort Huachuca; however, no plants were found during formal and surveys of these areas (ENRD 1998).

No known populations of Huachuca water umbel occur within or in close proximity to the Proposed Project area. Critical habitat for the species also does not occur in close proximity to the Proposed Action area. The Proposed Action has the potential to benefit Huachuca water umbel populations along the San Pedro River through increased recharge, better water quality, and decreased erosion. Thus, we conclude that the Proposed Action may affect, but is not likely to adversely affect the Huachuca water umbel or destroy or adversely modify designated critical habitat.

may affect, but is not likely to adversely affect the loach minnow and is not likely to destroy or adversely modify designated critical habitat.

4.7 Spikedace

The spikedace (*Meda fulgida*) is federally listed as a threatened species. It typically inhabits shallow portions of stream channels where rapid flow occurs over sand and gravel substrates (ENRD 1998). Habitat use by this species has been reported to vary with age, geographical location, and season (ENRD 1998). Juveniles inhabit quiet pools with soft, fine-grained bottoms along the stream periphery. In winter months, adults move toward stream margins where they inhabit cobble-bottomed areas.

The spikedace is endemic to the Gila River basin and historically occurred throughout New Mexico, Arizona and Sonora (Mexico) below 6,000 ft (1828 m) (ENRD 1998). In Arizona, this species was once widespread throughout the large river systems including the Gila, Salt, Verde, San Francisco, and San Pedro River systems. Currently in Arizona, populations of the spikedace are limited to less than 118 miles (190 km) of streams in Eagle Creek, the upper Verde River, and Aravaipa Creek. The Aravaipa Creek population is the only extant population in the San Pedro River Basin. The fish has otherwise been extirpated from the mainstream of the San Pedro River and its tributaries (ENRD 1998).

Although the spikedace does not occur within the Proposed Action area, the San Pedro River NCA adjacent to Fort Huachuca has been designated critical habitat and the Proposed Action has the potential to affect this area. No adverse effects to this species are expected as a result of the Proposed Action. Furthermore, anticipated increased aquifer recharge and decreased erosion near the San Pedro River, along with better overall water quality in the area, should improve the quality of designated critical habitat for the species. Thus, we conclude that the Proposed Action may affect, but is not likely to adversely affect the spikedace and is not likely to destroy or adversely modify designated critical habitat.

4.6 Sonora tiger salamander

The Sonoran tiger salamander (*Ambystoma tigrinum stebbinsi*) is an endangered subspecies of the tiger salamander (*Ambystoma tigrinum)* that inhabits ponds and stock tanks within a small range in the San Rafael Valley, and the foothills of the Patagonia and Huachuca Mountains. This subspecies has only been found in stock tanks and from 4,000 to 6,500 ft elevations (1,210 to 1,980 m). Jones et al. (1988) asserted that these subspecies populations are the result of humans' introductions. Currently, all known populations are located in Santa Cruz and Cochise Counties, Arizona.

Within Fort Huachuca, the Sonora tiger salamander is only known to occur within one man-made stock tank located in a high elevation canyon. The subspecies identified for this population is being studied by Arizona State University. Tiger salamanders have been documented in several East Range wastewater lagoons, however repeated surveys of these lagoons by ASU researches have revealed only the non-native subspecies, *A. t. mavortium.*

Because no Sonora tiger salamander populations inhabit the proposed project area, no adverse effects to this subspecies are anticipated as a result of the proposed project. Furthermore, the anticipated increased recharge, improved water quality, and decreased erosion that are expected as a result of project implementation may result in potential suitable introduction sites for the Sonora tiger salamander. We conclude that the Proposed Action will have no effect on the Sonora tiger salamander.

of the southwestern United States. In Arizona, New Mexico and northwestern Mexico, this species is migratory. Lesser long-nosed bat roosts are known to occur in six counties in southern Arizona and one county in New Mexico. These bat populations occupy the northern portion of their range from spring to autumn then migrate south for the winter. Seasonal movements of bats coincide with the blooming of appropriate food plant species, namely agave (*Agave* spp.) and columnar cacti such as organ pipe (*Cereus thurberi*). Lesser long-nosed bats prefer to forage on palmer's agave (*Agave palmeri*).

The greatest densities of lesser long-nosed bats are located in northern Mexico and in southern Arizona (ENRD 1998). The estimated sizes of roosts in 1992-1993 ranged from 200-150,000 bats. The largest of three known maternity roosts in Arizona is located approximately 150 miles from Fort Huachuca in Organ Pipe Cactus National Monument. In 1998, this site contained an estimated 20,000 adult bats (ENRD 1998). At least two large post-maternity roosts are located near Fort Huachuca (Sidner 1996). Observers counted 31,000 lesser long-nosed bats within the bounds of the Coronado National Monument in 1999. Surveys indicate that both day and night roost locations occupied by the lesser long-nosed bat exist on Fort Huachuca during the post-breeding season, which is typically July through October. During the reproductive season of April through June, lesser long-nosed bats are found in Sonoran desertscrub habitats in the northern part of their range.

Stands of agave located on the West Range provide forage for the bats, however no agave were noted during the site visit to the Proposed Action area. Nonetheless, scattered individuals may occur in the Proposed Action area. If any agaves are affected by the Proposed Action, disturbance will be minimized as identified in the 1999 Biological Opinion. No columnar cactus are present on the East Range or within any of the Proposed Action area. Other potential adverse effects related to the Proposed Action include temporary construction noise, which could affect bat foraging, however construction activities will be restricted to daylight hours only. Thus we conclude that the Proposed Action may affect, but is not likely to adversely affect the lesser long-nosed bat.

4.8 Loach minnow

The loach minnow (*Rhinichthys cobitis*) is federally listed as a threatened species. This small fish inhabits shallow portions of rapidly flowing, turbulent streams characterized by moderate to high gradients at elevations below approximately 7,000 ft (2,200 m) ENRD 1998). This species inhabits areas of elevated cobble and rubble substrates with rocks and crevices, generally located along stream margins or in eddying currents at the heads of riffles. Historically, the loach minnow occurred in the Gila River basin of New Mexico, Arizona, and Sonora (Mexico). In Arizona, loach minnows were once known to occur in the Salt, White, East Fork White, Verde, Gila, San Francisco, Blue, and the San Pedro Rivers. They were also known to occur in Aravaipa and Eagle Creeks and other major tributaries of large streams. The loach minnow was last recorded from the San Pedro River in the 1950s (ENRD 1998).

Although the loach minnow does not occur within the Proposed Action area, the San Pedro River NCA adjacent to Fort Huachuca has been designated critical habitat and the Proposed Action has the potential to affect this area. No adverse effects to this species are expected as a result of the Proposed Action. Furthermore, anticipated increased aquifer recharge and decreased erosion near the San Pedro River, along with better overall water quality in the area, should improve the quality of designated critical habitat for the species. Thus, we conclude that the Proposed Action

and to supply an ample prey base. Because the breeding habitat of this species is confined to mountain ranges and canyons, owl distribution is patchy throughout its range.

In 1995, survey and nest monitoring efforts documented a total of 17 occupied spotted owl territories in the Huachuca Mountains (ENRD 1998). Five of these territories occurred on Fort Huachuca, and four of these were located within the South Range (ENRD 1998). A single owl heard during these surveys might have been a dispersing juvenile from a territory on the Coronado National Forest or an unpaired adult (ENRD 1998). Unoccupied areas may be marginal habitat for spotted owls due to historical habitat disturbance including the construction of a road and firebreak (ENRD 1998). Results of the Year 2000 surveys for this species revealed that Mexican spotted owls currently occupy three of five known territories on Fort Huachuca. Two possible new territories have been identified on the South Range. Known nest sites are all at lower elevations within Madrean Woodlands and Chaparral associations near rock canyons and cliffs. Additionally, critical habitat is proposed for the Mexican spotted owl on Fort Huachuca (USFWS, 2000).

No Mexican spotted owls are known to occur in the Proposed Action area nor is any proposed critical habitat within or in close proximity to the Proposed Action area. Thus, we conclude that the Proposed Action will have no effect on the Mexican spotted owl and it will not destroy or adversely modify proposed critical habitat

4.4 Southwestern willow flycatcher

The southwestern willow flycatcher (*Empidonax traillii extimus*) is federally listed as an endangered subspecies. In southern Arizona, this subspecies inhabits the San Pedro River system, primarily in the lower reaches of the river north of Benson. This subspecies breeds in dense riparian forests and thickets.

In 1996, a possible nesting pair was identified in the vicinity of St. David, Arizona, approximately 30 miles downstream of the Fort Huachuca installation boundary. In 1997 an individual was confirmed within the San Pedro Riparian Conservation Area (SPRNCA) during the annual Bureau of Land Management (BLM) surveys for this species. The area within the 100-year floodplain of the San Pedro River from Hereford Bridge to the Interstate 10 overpass in Benson, Arizona is designated critical habitat for the southwestern willow flycatcher. No southwestern willow flycatchers have been documented within the Proposed Action area, and no habitat appropriate for breeding is present within the area. Occurrence of this species within the Proposed Action area is very unlikely.

Potential effects related to the Proposed Action include temporary construction noise and removal of vegetation, which could discourage this species from stopping in area during migration. The long term beneficial effects expected as a result of project implementation should more than offset these potential temporary adverse affects and furthermore may help restore potential flycatcher habitat along the San Pedro River. Increased recharge into the river, along with better water quality and decreased erosion can provide increased opportunities for habitat regeneration. Thus we conclude that the Proposed Action may affect, but is not likely to adversely affect the southwestern willow flycatcher or destroy or adversely modify designated critical habitat.

4.5 Lesser long-nosed bat

The lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*) is federally listed as an endangered species and is found in arid regions ranging from Central America to a small portion

falcon occupies diverse habitats that include tall cliffs suitable for nesting and habitat that is capable of supporting a healthy prey base, which comprises primarily birds (ENRD 1998). Despite the recent delisting, the Fort remains committed to assisting in recovery efforts for this species.

In recent years, sightings of the American peregrine falcon (*Falco peregrinus anatum*) on the installation have been documented. In 1996, the first confirmed nesting of peregrines in over 30 years were documented on Fort Huachuca. Another nesting pair was documented in 1999 and three young were fledged. No nesting habitat occurs within or in close proximity to the Proposed Action area, however, the species may forage over the East Range recharge basins on occasion

Potential effects related to the Proposed Action include disturbance due to temporary construction noise and removal of vegetation, which could discourage foraging in the area. However, long term beneficial effects are expected to offset potential temporary adverse affects as a result of implementation of the proposed project including increased water recharge, decreased erosion and better water quality, all of which should improve the foraging habitat available for this species. Thus we conclude that the Proposed Action may affect, but is unlikely to adversely affect the peregrine falcon.

4.2 Bald eagle

Previously federally listed as endangered, the bald eagle (*Haliaeetus leucocephalus*) was downlisted to a designation of threatened in 1995 due to a significant increase in the number of breeding pairs (ENRD 1998). The species has a limited breeding distribution in Arizona and nesting populations are found only along the Colorado, Salt, and Verde Rivers in the northern and central portions of the state (Hunt et al. 1992). Wintering areas include the Colorado River and scattered reservoirs in northern and central Arizona. Consistent wintering areas have not been documented in southeastern Arizona, although transient bald eagles have occasionally been recorded along the San Pedro River and a small number of eagles may winter intermittently in large cottonwood or sycamore trees in the SPRNCA adjacent to Fort Huachuca (ENRD 1998).

In January 1998, a bald eagle was observed flying over the West Range of Fort Huachuca (ENRD 1998). Although bald eagles may pass through Fort Huachuca during migration, habitat suitable for nesting or communal roosts does not exist within Fort Huachuca. Foraging within the area may take place during migration, but is more likely along rivers such as the San Pedro and the Santa Cruz.

The Proposed Action is not expected to remove any habitat that is likely to be used by the bald eagles. Potential effects related to the Proposed Action include disturbance to temporary construction noise and removal of vegetation, which could discourage foraging in the area, however, the likelihood of such an effect is discountable. Furthermore increased recharge, better water quality, and erosion control in the Proposed Action area may increase the likelihood that any transient eagles will occur either on Fort Huachuca or along the San Pedro River. Thus we conclude that the Proposed Action will have no effect on the bald eagle.

4.3 Mexican spotted owl

The Mexican spotted owl (*Strix occidentalis lucida*) is federally listed as a threatened subspecies. This subspecies inhabits portions of the southwestern United States and portions of Mexico. Nesting and roosting habitat generally consists of multi-layered, uneven-aged forests with high canopy closure or rocky, shaded canyons (ENRD 1998). The multi-layered canopy in the forests that the Mexican spotted owl inhabits is believed to afford it protection against avian predators

4. RESULTS

Two distinct biotic communities are present within the Proposed Action area: semidesert grassland, and xeroriparian communities (Brown, 1994). The majority of the Proposed Action area is located within semidesert grassland biotic community, particularly, more specifically, Chihuahuan semidesert grassland (Brown, 1994). Vegetation typically found in this biotic community include perennial grasses, including several types of three-awn (*Aristida* spp.), grama (*Bouteloua* spp.), velvet mesquite (*Prosopis velutina*), creosote bush (*Larrea tridentata*), cholla (*Opuntia* sp.), and soaptree yucca (*Yucca elata*). All of these species were present within the project site. No agaves were observed within the Proposed Action area.

Several dry washes, vegetated by xeroriparian plant communities, traverse the project area. These washes are classified as intermittent, because they flow only during rain events. Xeroriparian vegetation is similar to that found in surrounding plant communities, however it is usually larger and more dense. Vegetation observed along the washes included velvet mesquite (*P. velutina*), creosote bush (*L. tridentata*), desert broom (*Baccharis sarothroides*), desert willow (*Chilopsis linearis*), Gooding willow (*Salix goodingii*), and Mexican elder (*Sambucus mexicana*).

At the time of our site visit, one of the treated-effluent basins (ER-1) was completely full of water and contained vegetation normally associated with wetland habitats. Gooding willow (*S. goodingii*), desert broom (*B. sarothroides*), and Sacaton grass (*Sporobous wrightii*) were all present at this basin. A second basin (ER-3) contained only a small pool of water and was in the process of drying out. Very little vegetation was present within this basin. The remaining basins were dry.

Wildlife present in the Proposed Action area are those species that are typically found in semi-desert grassland and xeroriparian plant communities. Wildlife species likely use the basins as a water source, and also the vegetation associated with these basins for foraging, cover, and/or breeding habitat. Species observed during our site visit included red-winged black bird (*Agelaius phoeniceus*) (nesting), barn swallow (*Hirundo rustica*), northern rough-winged swallow (*Stelgidopteryx serripennis*), ruddy duck (*Oxyura jamaicensis*), mallard (*Anas platyrhynchos*), American coot (*Fulica americana*), killdeer (*Charadrius vociferus*), snowy egret (*Egretta thula*), phainopepla (*Phainopepla nitens*) (nesting), white-winged dove (*Zenaida asiatica*), mourning dove (*Z. macroura*), brown-headed cowbird (*Molothrus ater*), turkey vulture (*Cathartes aura*), and white-tail deer (*Odocoileus viriginianus*). Although these species are not protected by the ESA, disturbance to these areas should be minimized to the extent possible, particularly in areas where migratory songbirds nest.

As previously described, 17 of the 26 species federally-listed species were eliminated from further consideration in this BE due to known range limitations and/or the absence of required habitat within or adjacent to the Proposed Action area (Table 2). The remaining nine listed species along with potential direct and indirect effects related to the Proposed Action are discussed in the following portions of this document along with a discussion of the American peregrine falcon.

4.1 American peregrine falcon

The American peregrine falcon (*Falco peregrinus*) was formerly listed under the ESA as an endangered species but a successful reintroduction program facilitated recovery of the species over the last two decades allowing the species to be delisted. In Arizona, the American peregrine

Table 2: ESA Listed Species, Habitat Requirements, and Likelihood of Occurrence in the Proposed Action Area. Santa Cruz and Cochise Counties, Arizona (Cont'd)

Common Name *Scientific Name*	Federal Status	Habitat Requirements	Likelihood of Occurrence in the Proposed Action Area
FISH (continued)			
Gila topminnow *Poeciliopsis occidentalis occientalis*	Endangered	Vegetated shallows of small streams, springs, or cienegas.	Proposed action area is not within the known range of this species.
Loach minnow *Rhinichthys cobitis*	Threatened	Historically occurred within the San Pedro River, but thought to be extirpated. Designated critical habitat includes portions of the San Pedro River.	Reintroductions may be implemented within the San Pedro River.
Sonora chub *Gila ditaenia*	Threatened	Perennial and intermittent streams with pools near cliffs, boulders or other cover. Designated critical habitat in Santa Cruz County includes California Gulch and Sycamore Canyon.	Proposed action area is not within the known range of this species.
Spikedace *Meda fulgida*	Threatened	Moderate to large perennial streams with rapid flow. Designated critical habitat includes portions of the San Pedro River.	Reintroductions may be implemented within the San Pedro River.
Yaqui catfish *Ictalurus pricei*	Threatened	Shallow water of desert springs, small streams and marshes below 5,000-ft. elevation.	Proposed action area is not within the known range of this species.
Yaqui chub *Gila purpurea*	Endangered	Small streams, springs and cienegas below 4,500-ft. elevation.	Proposed action area is not within the known range of this species.
Yaqui topminnow *Poeciliopsis occidentalis sonoriensis*	Endangered	Inhabits pools, springs, cienegas, and streams between 2,000-3,500 ft in elevation.	Proposed action area is not within the known range of this species.
REPTILES AND AMPHIBIANS			
New Mexican Ridge-Nosed Rattlesnake *Crotalus willardi obscurus*	Threatened	Primarily inhabits canyon bottoms in Pine-Oak communities.	Documented in the Peloncilo Mountains, Arizona. Only 3 known records from Arizona, none of which are within the Proposed Action area.
Sonora tiger salamander *Ambystoma tigrinum stebbinsi*	Endangered	Inhabits stock tanks and impounded cienegas in San Rafael Valley, Huachuca Mountains	Documented populations on Fort Huachuca, and east slope foothills of Huachuca and Patagonia Mountains.
PLANTS			
Canelo Hills ladies' tresses *Spiranthes delitescens*	Endangered	Finely grained, highly organic, saturated soils of cienegas	Known to occur on Babocomari River.
Huachuca water umbel *Lilaeopsis schaffneriana*	Endangered	Cienegas, perennial low gradient streams, wetlands	Several populations and designated critical habitat occur within Fort Huachuca and in the San Pedro Riparian NCA.
Pima pineapple cactus *Coryphantha scheeri robustispina*	Endangered	Alluvial basins or hillsides in semi-desert grassland and Sonoran desertscrub; 2,300-4,500 ft elevations	Proposed action area is not within the known range of this species.

Sources: USFWS 1999

Table 2. ESA Listed Species, Habitat Requirements, and Likelihood of Occurrence in the Proposed Action Area. Santa Cruz and Cochise Counties, Arizona

Common Name *Scientific Name*	Federal Status	Habitat Requirements	Likelihood of Occurrence in the Proposed Action Area
BIRDS			
Bald eagle *Haliaeetus leucocephalus*	Threatened	Near coasts, lakes or rivers, nests in large treetops or on cliffs near water.	Transient visitor during migration; no suitable nesting habitat.
Cactus ferruginous pygmy-owl *Glaucidium brasilianum cactorum*	Endangered	Riverbottom woodlands and paloverde cacti-mixed scrub associations of the Sonoran Desert at elevations below 4000'.	Not expected to occur; the Proposed Action area is above the elevational occurrence limit.
Mexican spotted owl *Strix occidentalis lucida*	Threatened	Canyons and forested habitat with uneven-aged stands and high tree density.	Known breeding territories within Fort Huachuca.
Northern aplomado falcon *Falco femoralis septentrionalis*	Endangered	Grasslands and savannas with low ground cover and mesquite or yucca for nesting habitat.	Although potential habitat is present in the Fort Huachuca area, there have been no recent confirmed sightings in recent years.
Southwestern willow flycatcher *Empidonax traillii extimus*	Endangered	Dense riparian habitats along streams, rivers, and wetlands with cottonwood, willow, boxelder, and buttonbush.	May occur in critical habitat in the SPRNCA located east of Fort Huachuca and Sierra Vista.
Whooping crane *Grus americana*	Endangered	Marshes, prairies, and river bottoms.	Occasional visitor to Arizona during migration, usually near Wilcox Playa.
MAMMALS			
Jaguar Panthera onca	Endangered	Near water in Sonoran Desertscrub up through subalpine conifer forest. Prefer Madrean evergreen-woodlands	Although potential habitat is present in the Fort Huachuca area, there have been no recent confirmed sightings.
Jaguarundi *Felis yagouaroundi cacomitli*	Endangered	Near streams in dense thorny brushland thickets between 3,500 and 6,000 ft elevation.	Not expected to occur regularly. However, may occur along SPRNCA as individuals have been reported in similar habitat types.
Lesser long-nosed bat *Leptonycteris curasoae yerbabuenae*	Endangered	Roosts in caves and mines and forages on agave, saguaro and columnar cacti.	Known roosts and foraging within Fort Huachuca.
Mexican gray wolf *Canis lupus baileyi*	Endangered	Chaparral, woodlands, and forested area. Known to cross open desert.	Although potential habitat is present in the Fort Huachuca area, there have been no recent confirmed sightings.
Ocelot *Felis pardalis*	Endangered	Desert scrub communities in AZ with dense cover. Preys on small rodents and birds.	Suitable habitat is not present and no recent documented sightings in Arizona.
FISH			
Beautiful shiner *Cyprinella formosa*	Threatened	Small to medium sized streams and ponds with sand, gravel and rock bottoms.	Proposed action area is not within the known range of this species.
Desert pupfish *Cyprinodon macularius*	Endangered	Shallow desert springs, small streams and marshes below 5000 ft elevation. Designated critical habitat in Pima County, Arizona and Imperial County, California.	Proposed action area is not within the known range of this species.

Table 1: Erosion Control and Stormwater Management Methods

Category	Methods
Surface Stabilization	Riprap Surface Roughening/contouring Revegetation Geotextiles Vegetated Filter Strip
Runoff Control and Conveyance Measures	Grass-Lined Channel Hardened Channel Riprap Channel Runoff Diversion
Outlet Protection	Level Spreader Outlet Stabilization Structure
Sediment Traps and Barriers	Brush Barrier Check Dam/Rock Wire Gabion Sediment Basin Sediment Fence/Straw Bale Barrier
Stream Protection	Grade Stabilization Structure Stream bank Stabilization Temporary Stream Crossing
Stormwater Detention and Infiltration Basins	Infiltration Basins Dry-wells Rooftop Collection

3. METHODS OF EVALUATION

A site visit to the project area was conducted by EEC field biologists Brian J. Wooldridge and Joanne Kirchner on 9 June 2000. Habitat was evaluated in terms of the ability to support federally listed species known to occur in the vicinity of the project site. A description of vegetative communities within the project area is included within this BE.

In response to a request from EEC, Inc., the USFWS provided a list of 26 federally-listed species known to occur in both Santa Cruz and Cochise Counties (USFWS 2000). Table 2 provides a summary of these species, their current ESA status, habitat requirements, and the likelihood of occurrence of each within the vicinity of the Fort Huachuca Proposed Action area. Of the 26 species, 17 were eliminated from further consideration due to known range limitations and/or the absence of required habitat within or adjacent to the Proposed Action area. The remaining nine species, along with the potential for effects to each species, are described in the results section of this document. In addition to the species listed by the USFWS, we have included the American peregrine falcon due to Fort Huachuca's ongoing commitment to the assisting with recovery efforts for this species, even though it was recently delisted.

In addition to the site evaluation and correspondence with USFWS, EEC contacted Jim Hessil, a Fort Huachuca Wildlife Biologist, for information concerning species-specific known occurrences within the project area and habitat requirements of the species included in this evaluation.

additional treatment. Analysis of this option is not intended to construe that formal negotiations or commitments of any kind have been made by any of the parties potentially concerned.

Soils stockpiled from the AAR construction area may be transported to any of three proposed stockpile areas for both temporary and long-term storage. Approximately one half of the 400,000 cubic yards (306,000 cubic m) of excavated soils may be redistributed on the East and West Ranges as a part of erosion control and stormwater management improvements within the next one to two years. For example, this soil may be used to backfill the highly entrenched eroded gully at the upper Graveyard Gulch basin site. Other sites on the East Range would use additional soil for surface recontouring and revegetation. The remaining 200,000 cubic yards (153,000 cubic m) of excavated soils will remain at the stockpiles until further uses arise. Approximately 20 acres (8 ha) will be used to accommodate the stockpiling of soil excavated during construction. (where?)

2.4 Erosion Control and Stormwater Management Improvements

Several methods, or combination of methods, to manage erosion and stormwater and thereby improve watershed conditions are considered in order to accomplish the following objectives:

- Reduce or reverse the entrenchment of streambeds.
- Reduce sediment transport
- Aid stormwater infiltration by allowing it to remain in the channel longer.
- Protect water recharge mechanisms such as in-stream basins from inundation.

These methods (summarized in Table 1) include combinations of surface stabilization, runoff control and conveyance, outlet protection, sediment traps and barriers, stream protection and stormwater detention, infiltration, and distribution systems. It is anticipated that these activities will disturb approximately 75 acres (30 ha) by removal of vegetation and land surface excavations and recontouring. One specific project, accounting for 50 (20 ha) of the 75 acres of this disturbance, is discussed in greater detail in the following paragraph.

Upper Graveyard Gulch Stormwater Detention Basin

Construction of a 50-acre (20.2 ha) stormwater detention basin on the south edge of Training Area F is proposed. Currently, stormwater enters the East Range from a large culvert that passes under SR 90 Business Bypass (mile marker 319) and storm events have caused significant erosion in Graveyard Gulch.

Under the Proposed Action, stormwater flows would be detained in a proposed stormwater detention basin and conveyed downstream at a lower rate than the rate upon entering the basin. This would reduce the tendency of the water to erode recipient lands and form gullies. Typically, this type of basin is constructed below existing ground level with a flat bottom. The depth is anticipated to be between 2 ft and 10 ft (0.6 m and 3 m), but deeper excavation may necessary to reach acceptable soil types. During initial construction, all vegetation at the site would be removed and the area would be tilled and recontoured. The sides of the basin and any disturbed areas outside of the basin would be revegetated after construction using native plants. Occasional maintenance would involve the removal of sediment and minerals that collect over time. The existing eroded gully would be backfilled and compacted. The perimeter road would be reconstructed. Low flows into the basin can be metered and conveyed to revegetation areas as a source of irrigation.

2.2 Upgrade to WWTP #2

The WWTP #2 is part of the treated-effluent reuse distribution system described above. Addition of a new secondary treatment process and an upgrade of the existing digester are proposed to increase the capacity of the plant and to improve the quality of the final treated effluent. These new facilities will occupy approximately 2 acres (0.8 ha) adjacent to WWTP #2.

2.3 Implementation of AAR Capabilities

AAR methods are being considered to improve infiltration into the aquifer using shallow-spreading basins. This involves directing water to the basins for infiltration into the vadose zone. To reach necessary soil types to facilitate infiltration, basin depth is anticipated to be between 2 ft and 10 ft (0.6 m and 3 m), but deeper excavation may be required. The reconstructed basins will allow wet-dry cycles within the basins.

Effluent treated to the tertiary level will be gravity fed or pumped into these basins from the WWTP #2. To inhibit the growth of algae, which reduces infiltration rates, these treated-effluent basins will be permitted to dry out every 5 to 10 days. During initial construction, the existing basins will be tilled, and all vegetation will be removed from the sides and bottom. Occasional maintenance will involve the removal of sediment and minerals that collect over time as a result of the wet-dry cycle. Although each facility is different, anticipated maintenance will occur every 12 to 24 months.

To prevent stormwater from entering the treated-effluent basins and potentially flushing diluted treated effluent from the basins, an open diversion channel will be built to convey stormwater along the western side of the basins. The approximately 35 ft-wide (11 m) channel will include riprap and/or native vegetation to protect the channel sides against erosion. Concrete drop structures will also be used to allow the actual channel slope to remain relatively flat. This will reduce the velocity of water flow and erosion potential. To further reduce erosion, engineered aprons will be used where tributary washes enter the channel. Approximately 0.25-mile north (downstream) of the treated-effluent basins, stormwater will discharge from the open channel into a series of stormwater infiltration basins. Thus, the treated-effluent basins are considered off-channel basins; off-channel basins are less susceptible to flooding during storm events than their in-channel counterparts. Approximately 105 acres (42 ha) are included within the proposed AAR footprint.

Minor additions to the infrastructure of the Fort will be required to support these proposed AAR activities. Approximately one mile of additional dirt roads amongst and between the treated-effluent basins will be constructed to provide access around and into each basin

A small utility building will be required to support the infiltration basin facility. This structure will be located on the south side of Treated-Effluent Basin #2 and will consist of a concrete foundation and a one-story metal superstructure. The estimated footprint is 10 ft by 10 ft (3 m by 3 m) and an area of approximately 20 ft by 20 ft (6 m by 6 m) will be permanently disturbed as a result of this construction. In addition, Huachuca City's sewage disposal basins, located along the northwestern edge of Training Area C on the East Range, are being considered for possible inclusion in the Fort Huachuca AAR program.

The piping of treated effluent from the Huachuca City Basin to the East Range Recharge Facilities is also analyzed as part of the Proposed Action, should this option eventually be considered advantageous to all parties concerned. This will require trenching for pipelines and a booster station to support delivery of the treated effluent uphill to the facility, as well as some

adversely affect the southwestern willow flycatcher, lesser long-nosed bat, loach minnow, spikedace, the Huachuca water umbel, and the American peregrine falcon. Furthermore, we determined that the Proposed Action is not likely to destroy or adversely modify any designated critical habitat.

2. PROJECT NARRATIVE

Several of the activities of the Proposed Action have been under analysis by Fort Huachuca for several years as part of its water and natural resources management program. The Army is committed to identification and implementation of additional ways to reduce consumptive water use and improve range conditions across the installation in partial fulfillment of a recent U.S. Fish and Wildlife Service Biological Opinion (USFWS 1999), prepared for on-going activities at Fort Huachuca in compliance with the Section 7 consultation process of the Endangered Species Act (ESA). Implementation of the Proposed Action will contribute to goals identified in the Biological Opinion and will lead to reductions in consumptive water use at Fort Huachuca.

The Proposed Action involves upgrades and expansions to water management capabilities on Fort Huachuca by:

1) Expanding the treated-effluent reuse distribution system within the cantonment area.
2) Upgrading the Wastewater Treatment Plant #2 (WWTP #2) within the cantonment area.
3) Implementing AAR capabilities on the East Range.
4) Constructing erosion control and stormwater management improvements on the East and West Ranges.

A description of these expansions and upgrades is presented below followed by a discussion of potential effects to federally protected species.

2.1 Treated-Effluent Reuse Distribution System Expansion

The existing treated-effluent reuse distribution system consists of a network of reuse pipelines, storage tanks and basins, and the WWTP #2, all located in the cantonment area and East Range. The proposed enhancements to this system include:

- Extending the existing reuse pipelines.
- Expanding the capacity of and improving the reuse facilities at Chaffee Parade Ground and installation ball fields to provide more efficient irrigation.
- Replacing the feeder line to the golf course.
- Replacing some current potable water irrigation with non-potable water.
- Returning unconsumed treated effluent to the East Range recharge facility.
- Installing heat exchange technology for cooling and heating in lieu of current consumptive uses at major consuming facilities along the reuse route.

Construction activities associated with the treated-effluent reuse distribution and WWTP #2 upgrades were addressed in the *1999 USFWS Biological Opinion on Ongoing and Programmed Future Military Operations and Activities at Fort Huachuca, Arizona.* This Biological Opinion determined that these activities would not jeopardize the existence of any federally listed threatened or endangered species. As the Biological Opinion also addressed the pipeline activities and associated effects, these activities are not addressed in this BE. No take of federally listed species was anticipated from this action.

TECHNICAL MEMORANDUM

DATE: 10 October 2000

TO: Michael Collins, Vice President
Engineering and Environmental Consultants, Inc.
3501 North 16th Street, Phoenix, Arizona 85016

FROM: Brian J. Wooldridge, Wildlife Biologist

SUBJECT: Biological Evaluation for Artificial Aquifer Recharge and Treated Effluent Reuse Management for Fort Huachuca

EEC Project No. 99190.15

1. SUMMARY OF FINDINGS

Fort Huachuca is proposing a variety of activities to increase the efficiency of treated-effluent reuse and Artificial Aquifer Recharge (AAR) on the installation and to improve watershed conditions on the East and West Ranges. The purpose of these activities (Proposed Action) is to reduce consumptive water use, improve watershed health on the East and West Ranges, and prevent excess sediment transport across the East and West Ranges into riparian habitats. This Biological Evaluation (BE) was prepared to analyze potential effects of the Proposed Action on species that are federally-listed under the federal Endangered Species Act (ESA) and any corresponding designated critical habitat that may be affected by the Proposed Action.

The United States Fish and Wildlife Service (USFWS) provided a list of 26 species protected under the ESA that have the potential to occur within Santa Cruz or Cochise Counties (Table 2). Of these 26 species, 17 were eliminated from further consideration due to known range limitations and/or the absence of required habitat within or adjacent to the Proposed Action area. The remaining nine species, the bald eagle (*Haliaeetus leucocephalus*), Mexican spotted owl (*Strix occidentalis lucida*), southwestern willow flycatcher (*Empidonax traillii extimus*), lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*), loach minnow (*Rhinichthys cobitis*), Spikedace (*Meda fulgida),* Sonora tiger salamander (*Ambystoma tigrinum stebbinsi),* Canelo Hills ladies' tresses (*Spiranthes delitescens*), and Huachuca water umbel (*Lilaeopsis schaffneriana* var. *recurva*), along with the potential for affects related to the Proposed Action for each species, are described in the results section of this document. In addition to listed species, the American peregrine falcon was included in this evaluation due to the commitment of Fort Huachuca to assist recovery efforts for the species.

All components of the Proposed Action are anticipated to provide beneficial effects for wildlife. Increased recharge will increase the potential for aquatic and semi-aquatic species on the SPRNCA to have the necessary water and riparian habitat that enable survival and increased fitness. Better water quality and decreased erosion that will result from the proposed action will also prove beneficial to terrestrial wildlife in the project area and habitats. By analyzing known habitat requirements, habitat within the Proposed Action area, and potential effects of the Proposed Action, we determined that the Proposed Action may affect, but is not likely to

APPENDIX B

BIOLOGICAL EVALUATION OF THE AAR SITE

collection of stormwater is the collection of stormwater off of any impermeable man-made surface, whether for stormwater management or for infiltration. Parking lots and roads are typically the largest features.

should be constructed in lieu of other types of stream crossing because they cause the least destruction to streambeds, banks, and surrounding floodplains; provide the least obstruction to flow; and have the least erosion potential. Culvert crossings are the most common and the most destructive form of crossings. Culverts generally cause destruction of the streambed and create a potential for channel erosion from scouring. Low-span bottomless arched conduits have been developed, which offer the simplicity of a culvert crossing and minimize impacts to the streambed. These crossings can be placed over the top of stream channels without disturbing the streambed at the crossing.

A.6 Stormwater Detention, Recharge, and Distribution Management

Under the Proposed Action, two existing in-stream stormwater infiltration basins (SW2 and SW3) located north of the shallow spreading ponds on the East Range would be improved to provide additional on-site infiltration. Stormwater would be conveyed via the stormwater open channel and released into the infiltration basins. These basins would detain the stormwater and allow the water to infiltrate. Since stormwater usually has a high sediment load, the ponds would require regular maintenance to remove the sediment that would accumulate over time. In-channel infiltration basins are quite susceptible to damage during flooding events. Additional stormwater infiltration basins could be built within the Cantonment area, in Areas G, H, I, J, K, L, M, and T on the West Range, and Areas A, B, C, D, E, and F on the East Range where soil conditions and stormwater flows permit

Drywells are devices built at the bottom of depressions or basins to hold and direct water to areas where infiltration can occur. They can be designed so that they accommodate only the nuisance flows locally, or can be sized to hold all of the water that reaches a given location. The size of a drywell is based on the amount of water to be infiltrated, and the rate at which it must infiltrate the ground. Drywells are used to deal with nuisance water can be a depression filled with gravel. Drywells designed to accommodate a large volume of water may be a system of trenches several feet wide and several feet deep, and many dozens of feet long, filled with cobbles and gravel.

Rooftop collection of stormwater takes advantage of existing gutters and downspouts that are part of building design. The downspouts can be connected to a pipe and/or channel system to collect the water into infiltration basins or drywells, depending on the volume of water being collected and space availability near the building or at a remote site. Similar to rooftop

delta is formed into a non-eroding gradient over which the water cascades to a dam through a spillway into a hardened apron. Other alternatives of protecting the channel bottom should be evaluated before selecting the check dam on a temporary basis. Dams may either be porous or nonporous. Porous dams will decrease the head of flow over spillways by releasing part of the flow through the actual structure.

Sediment Detention Basins can be either a permanent pool or a self-dewatering (i.e., complete flow through) type. Detention basins are designed to capture runoff or conveyed stormwater and sufficiently reduce water velocity through the pond to allow sediments to settle out. Storm flows eventually pass through an outflow structure leaving the sediment in the basin. The design and use of these basins is perhaps the most important method applied to control erosion at construction sites.

Sediment Fence (Silt Fence)/Straw Bale Barriers are temporary measures used to control sediment loss by reducing the velocity of sheet flows. They consist of filter fabric buried at the bottom, stretched, and supported by posts, or straw bales staked into the ground. Overflow outlets and sufficient storage area need to be provided to control temporary ponding.

A.5 Stream Protection

Grade Stabilization Structures are vertical "walls" or structures built within the wash channel to maintain the bed of the wash at a desired elevation. Frequently grade stabilization structures are built as part of erosion control, reducing the bed slope of a wash reduces the water velocity, which reduces the sediment carrying capacity of the wash. The size of the wash, such as a 100-year flow rate, dictates the size or strength of the grade stabilization structure. The structures may be constructed of gabions, a concrete slurry, or reinforced concrete.

Stream bank stabilization is used to stabilize the channel bank and prevent the wash from moving laterally. The composition of the materials used depends on the size of the wash and the amount of water energy the stabilization must withstand. Low cost stabilization could include dumped (loose) riprap, where gabions, concrete, and soil cement would be higher strength and higher cost examples.

An additional stream protection method is a Temporary Stream Crossing. These crossings usually consist of a bridge, ford, or temporary structure installed across a stream or watercourse for short-term use by construction vehicles or heavy equipment. Wherever possible, bridges

Knowing the expected velocity of water in a wash, the channel can be lined with riprap of a size that will be stable for that velocity. Large angular rocks also increase the roughness of a channel, increasing the friction and so reducing the velocity of the water.

Runoff Diversions are temporary or permanent structures that channel, divert, or capture runoff and transport it to areas where it can be used or released without erosion or flood damage. Typical structures include graded surfaces to redirect sheet flow, dikes or berms which force surface runoff around a protected area, and storm water conveyances which intercept, collect, and redirect runoff. Temporary diversions include channel excavation combined with spoil placement in a dike on the down gradient side of the channel, and gravel placement in a ridge below an excavated swale. When a larger runoff flow is expected, permanent diversions are built to divide specific drainage areas, sized to capture and carry a specific magnitude of design storm, and constructed of permanent material.

A.3 Outlet Protection

A level spreader outlet is designed to convert concentrated runoff to sheet flow and disperse it uniformly across a slope. The landscape of the receiving area must be uniformly sloped, the outlet lip leveled, and the land unsusceptible to erosion. To avoid the formation of a gully, the use of hardened structures, stiff grass hedges, or erosion-resistant matting should be incorporated during design. This type of outlet is often used for runoff diversions.

Outlet Stabilization Structures reduce outlet flow velocity and dissipate flow energy. These types of structures are used at the outlet of a channel or conduit where the discharge velocity exceeds that of the receiving area. The most common designs are riprap-lined aprons, riprap stilling basins, or plunge pools (stabilized basins with a vertical drop within a wash).

A.4 Sediment Traps And Barriers

Brush Barriers are temporary sediment barriers, which are constructed to form a berm across or at the toe of a slope that is susceptible to interrill and rill erosion. They may consist of limbs, weeds, vines, root mats, rock, or other cleared materials.

Check Dams are temporary, emergency, or permanent structures constructed of gabion or reinforced concrete that are situated across drainage ways, other than live streams, and used to restrict the flow velocity and reduce channel erosion. In their permanent application, these dams gradually accumulate sediment until they are completely filled. At that point, a level surface or

surface of fine material. Moisture is retained under the mat and seed germination is fostered, accelerating the re-vegetation cycle.

Vegetated Filter Strips (VFS) are natural or planted low-gradient vegetated areas consisting of relatively flat slopes, which filter solids from overland sheet flow. Dense, herbaceous, erosion-resistant plant species are appropriate for vegetating these strips. The effectiveness of VFSs is increased, if channeled flows are absent. The main factors influencing removal efficiency are: vegetation type and condition, soil infiltration rate, flow depth, and travel time. For even distribution of runoff across the VFS, level spreaders are often utilized.

Topsoiling is the augmentation or replacement of topsoil for an area to replenish the nutrients required to support re-vegetation, particularly grasses. There are some areas that have been denuded of topsoil (fine-grained particles) by wind and water, leaving a pebble covered, nutrient deficient surface. This makes it very difficult to re-vegetate. Without vegetation, the denudation process will continue, further removing the nutrients necessary to sustain vegetation.

A.2 Runoff Control And Conveyance Measures

Grass-Lined Channels are dry conduits vegetated with grass, which are used to conduct storm water runoff. In order for this system to function properly, the grass must be well established and rooted before flows are introduced. Lining of the channels is required if design flows are to exceed 2 cubic feet per second (cfs). A grass channel increases shear stress within the channel, reduces flow velocities, and promotes the deposition of sediments in storm water. The channel itself is also protected from erosion of the bed and sides.

Hardened Channels are conduits or ditches lined with structural materials such as riprap or paving. These channels are designed for the conveyance, transfer, and safe disposal of excess stormwater. Hardened channels are often used in places with steeply graded slopes, prolonged flow, potential for traffic damage, erodible soils, or design velocities over 5 cfs.

Riprap is rock used to line and stabilize a channel. The riprap can be loose (dumped) or held in place with grout for additional strength. The riprap can be uniform in size or it can be graded, so that small rocks fit within the spaces of larger rocks. If all of the spaces between the large rocks are filled, it is more difficult for the water to roll the large rocks. Filling the spaces also reduces water turbulence around the large rocks, which can produce lift and move the rocks. The ability of flowing water in a wash to move objects is directly related to the velocity of the water.

APPENDIX A
METHODS FOR EROSION CONTROL AND STORMWATER MANAGEMENT

A.1 Surface Stabilization Methods

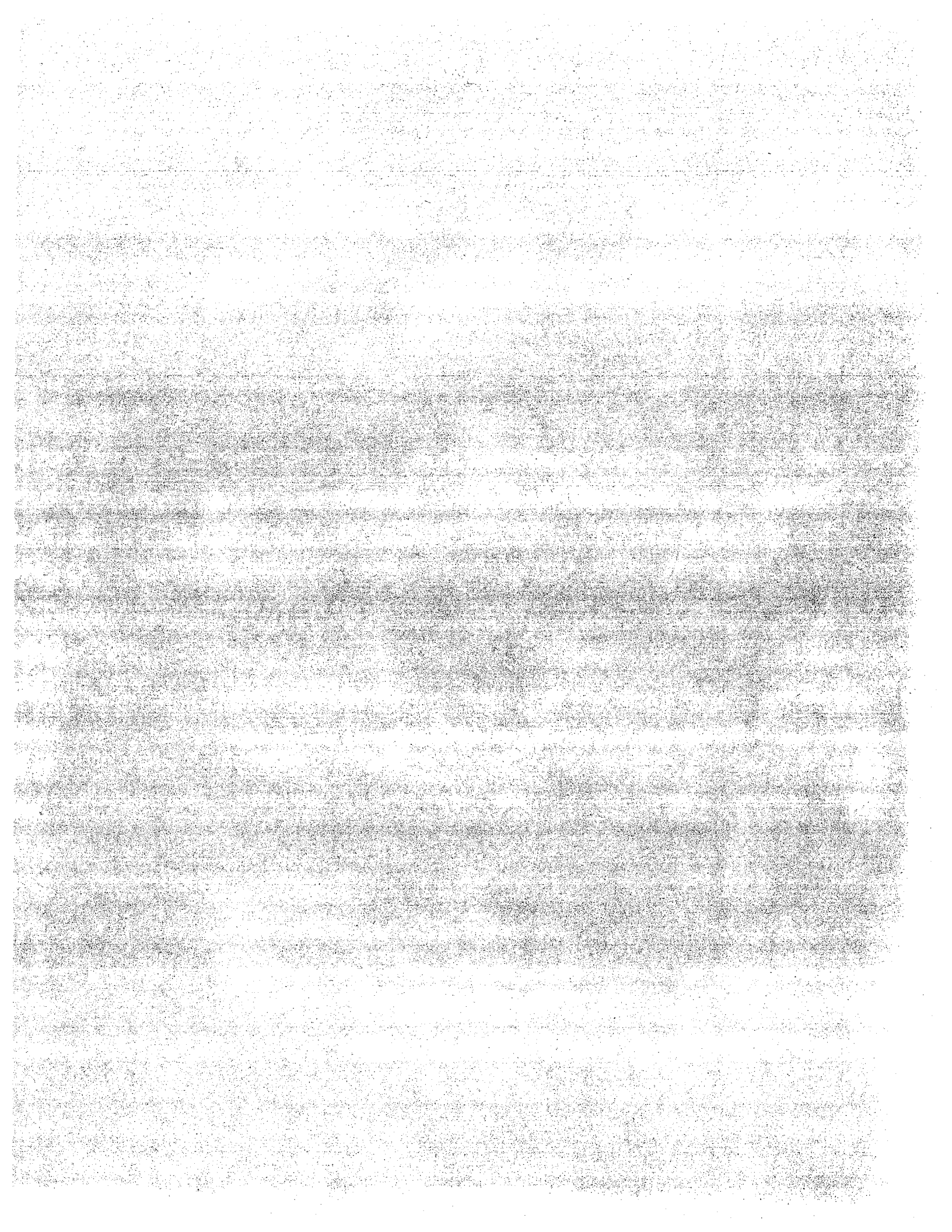
Riprap consists of graded stone underlain with a filter blanket of gravel, sand and gravel, or synthetic material designed to protect and stabilize areas that are susceptible to erosion, seepage, or poor soil structure. Riprap is used in areas where vegetation cannot be established or maintained due to stream or basin characteristics. This includes channel and basin slopes and bottoms, storm water structure inlets and outlets, slope drains, and stream banks.

Surface roughening/contouring consists of ripping or discing the soil to create furrows perpendicular to the slope of the hill. The micro-topography of the furrows serves to catch sheet flow and reduce the velocity of the water moving down the hill slope. A lower water velocity results in less erosion. The tilled area would also be planted with grasses to further slow the water, and the root system of the grasses would stabilize the soils. Tilling the soil and planting grass in corridors across the hill slope is performed as a cost saving measure. The grassy corridors stabilize much of the hill slope and reduce the speed of the water at a fraction of the cost of tilling and grassing the entire hill side.

Revegetation is the process of replanting native vegetation to hold the soils in place in an area of erosional concern. Two revegetation approaches are temporary and permanent seeding. Temporary and permanent seeding involve planting areas with rapid-growing annual grasses, small grains, or legumes to provide stabilization of disturbed areas. Areas are temporarily seeded if the soils are not to be brought to final grade for more than approximately one month. Permanent seeding is established on areas that will be covered with vegetative growth for more than two years. This method provides a relatively quick growing vegetative cover to provide stabilization.

Geotextiles are synthetic fabrics with specifically engineered capabilities laid down as a surface covering on hill slopes. They range from thin, lightweight mesh made of organic material or plastics, to a relatively heavy three-dimensional plastic mat. The fabric protects soils from rain splash and some surface flow, and the heavier mats (up to several inches thick) actually hold the surface materials in place. The mats are also used hold seeds in place along with a stabilized

APPENDIX A
METHODS FOR EROSION CONTROL AND STORMWATER MANAGEMENT



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TEP	Tucson Electric Power Company
TSD	Treatment, storage and disposal facility
TSP	Total suspended particulate
TSS	Total suspended solids
UAV	Unmanned Aerial Vehicles
U.S.C.	United States Code
USA	United States Army
USFWS	United States Fish and Wildlife Service
USPB	Upper San Pedro Basin
UTM	Universal Transverse Mercator
VFS	Vegetated Filter Strip
WWTP	Waste Water Treatment Plant
$\mu g/m^3$	Micrograms per cubic meter
µm	Microns

FAA	Federal Aviation Administration
FY	Fiscal Year
HAZMAT	Hazardous Material Center
HWMP	Installation Hazardous Waste management Plan
ICRMP	Huachuca Integrated Cultural Resource Management Plan
ISCP	Installation Spill Contingency Plan
KWh	Kilowatt hours
LAAF	Libby Army Airfield
LDN	Day-night average levels
mg/L	Milligrams per liter
MGD	Million Gallons per Day
MSL	Mean sea level
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NCA	National Conservation Area
NEPA	National Environmental Policy Act
NFPA	National Fire Prevention Association
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NO_x	Nitrogen Dioxide
NPDES	National Pollution Discharge Elimination System
O_3	Ozone
OHWM	Ordinary High Water Mark
OSHA	Occupational and Health Administration
PBA	Programmatic Biological Assessment
POLs	Petroleum, oil, and lubricants
ppm	Parts per million
PM_{10}	Particulate matter smaller than 10 microns in diameter
RCLF	Ramsey Canyon leopard frog
RCRA	Resource Conservation and Recovery Act
ROG	Reactive Organic Gases
ROI	Region of Influence
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_x	Sulfur Dioxide
TCLP	Toxicity characteristic leaching procedure

11.0 ACRONYMS AND ABBREVIATIONS

AAA	Army Audit Agency
AAAQS	Arizona Ambient Air Quality Standards
A.A.C.	Arizona Administrative Code
AAQS	Ambient Air Quality Standards
AAR	Artifiical Aquifer Recharge
ac-ft	Acre-feet
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AHPA	Archeological and Historic Data Preservation Act
AIRFA	American Indian Religious Freedom Act
APE	Area of Potential Effect
APP	Aquifer Protection Permit
AR	Army Regulation
ARPA	Archeological Resources Protection Act
BOD	Biological Oxygen Demand
B.P.	Before present
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulation
cfs	Cubic Feet per Second
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
COE	United States Army Core of Engineers
DB	Decibels
DEH	Directorate of Engineering and Housing
DEHE	Directorate of Environmental Health Engineering
DIS	Directorate of Installation Support
DRMO	Defense Reuse and Marketing Organization
EA	Environmental Assessment
EIS	Environmental Impact Statement
ENRD	Environmental and Natural Resources Division
EPA	Environmental Protection Agency
EPG	Electronic proving ground
ESA	Endangered Species Act

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