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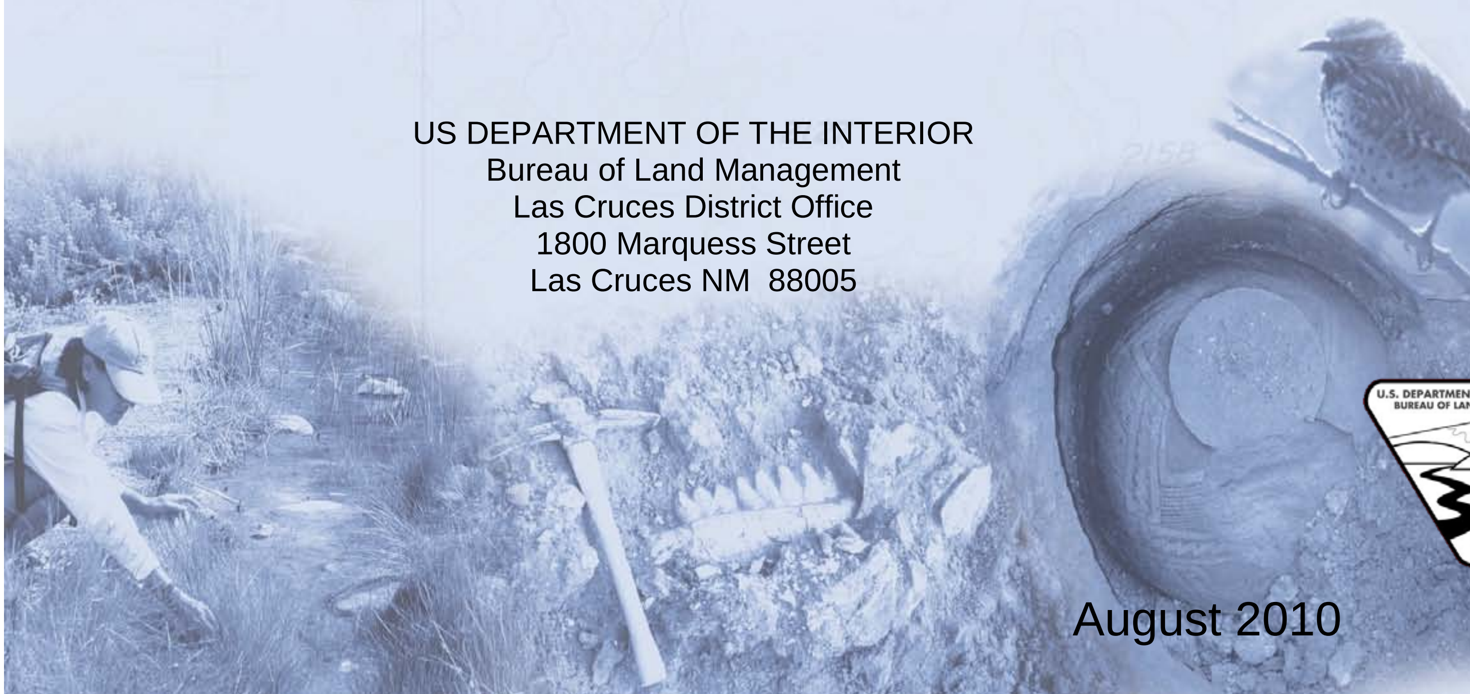
ALAMOGORDO REGIONAL WATER SUPPLY PROJECT DRAFT ENVIRONMENTAL IMPACT STATEMENT

VOLUME 1



US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Las Cruces District Office
1800 Marquess Street
Las Cruces NM 88005

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

August 2010

BUREAU OF LAND MANAGEMENT

The Bureau of Land Management is responsible for the balanced management of the public lands and resources and their various values so that they are considered in a combination that will best serve the needs of the American people. Management is based upon the principals of multiple use and sustained yield, a combination of uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources. These resources include recreation, range, timber, minerals, watershed, fish and wildlife, wilderness and natural, scenic, scientific, and cultural values.

BLM/NM/PL-10-02-1793

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Las Cruces District Office
1800 Marquess Street
Las Cruces, New Mexico 88005
www.blm.gov/nm

In Reply Refer To:
1793 (L0310)

August 2010

Dear Reader:

Enclosed for your review is the Draft Environmental Impact Statement (DEIS) for the Alamogordo Regional Water Supply Project. The Bureau of Land Management (BLM) has prepared the DEIS to assess the City of Alamogordo's proposal to develop a municipal potable water supply. The City has determined that the current water supply is not sufficient to meet current and future projected water demands and has submitted a right-of-way application to the BLM to construct and operate groundwater wells on BLM-managed land in Otero County, New Mexico.

The DEIS has been developed in accordance with the National Environmental Policy Act of 1969 (NEPA) and the Federal Land Policy and Management Act of 1976. A preferred alternative has not been identified by the BLM in the DEIS. Because there is not a preferred alternative at this time, Alternative B is used in the cumulative effects section since it includes the most complete combination of all the brackish water sources. A preferred alternative will be identified in the Final Environmental Impact Statement (FEIS) based on public comment.

The DEIS is open for a 60-day review and comment period beginning on the date the Environmental Protection Agency publishes the Notice of Availability in the Federal Register.

The DEIS is available both in hard copy and on compact disc (CD). The DEIS also is available electronically on the BLM web site: http://www.blm.gov/nm and for public inspection at the following locations:

- Bureau of Land Management, New Mexico State Office, 301 Dinosaur Trail, Santa Fe, New Mexico.
- Bureau of Land Management, Las Cruces District Office, 1800 Marquess Street, Las Cruces, New Mexico.
- City of Alamogordo Public Library: 920 Oregon Avenue, Alamogordo, New Mexico.
- Village of Tularosa Public Library: 515 Fresno Street, Tularosa, New Mexico.

The BLM will announce future meetings or hearings and any other public involvement activities at least 15 days in advance through public notices, media releases, and/or mailings. In addition, information on all public meetings or hearings will be posted on the BLM web site at http://www.blm.gov/nm. Written comments on the DEIS may be submitted using any of the following methods:

- MAIL:
  Bureau of Land Management
  Las Cruces District Office
  Lorraine Salas, BLM Project Manager
  1800 Marquess Street
  Las Cruces, New Mexico 88005

- FAX: (575) 525-4412 (Attention: Lorraine Salas, BLM Project Manager)

- EMAIL: nmlcdo_comments@blm.gov

Any public comments, including names and mailing addresses, will be available for public review at the Las Cruces District Office in Las Cruces, New Mexico during public room hours from 7:45 a.m. to 4:30 p.m., Monday through Friday, except Federal holidays and may be published as part of the Final EIS.

Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment–including your personal identifying information–may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

We appreciate your interest and encourage your continued involvement in this process.

Sincerely,

Bill Childress
District Manager

1- Enclosure

ALAMOGORDO REGIONAL WATER SUPPLY PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT

LEAD AGENCY: USDI, Bureau of Land Management (BLM)

COOPERATING AGENCIES: USDI, Bureau of Reclamation
Otero County, New Mexico

FOR FURTHER INFORMATION, CONTACT:

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1800 Marquess Street
Las Cruces NM 88005
(575) 525-4388
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COMMENTS:

BLM must receive written comments on the Alamogordo Regional Water Supply Project Draft Environmental Impact Statement within 60 days following the date the Environmental Protection Agency publishes this Notice of Availability in the Federal Register. You may use the following methods for sending comments:

- Email: nmlcdo_comments@blm.gov
- FAX: 575-525-4412
- Mail: Bureau of Land Management, Alamogordo Regional Water Supply Project, Attention: Lorraine Salas, Project Manager, 1800 Marquess Street, Las Cruces, NM 88005.

ABSTRACT:

The City of Alamogordo, New Mexico has submitted to the BLM an application for a right-of-way (ROW) for the construction and use of up to 10 groundwater wells in order to produce approximately 4,000 acre-feet per year of water with supporting infrastructure on BLM-managed public land in Otero County. Under the Federal Land Policy and Management Act of 1976, as amended, and supported by National Environmental Policy Act (NEPA) analysis, the BLM will decide whether to grant the ROW or grant the ROW with modifications, and, if so, under what terms and conditions.

The proposed action (Alternative B) by the City of Alamogordo includes obtaining unappropriated brackish groundwater from the Snake Tank Well Field, constructing and operating 10 groundwater wells at Snake Tank Well Field, installing water transmission lines to Alamogordo, and constructing a desalination facility and a booster pump station in Alamogordo to treat the brackish groundwater to drinking water standards. Alternative A is the “No Action” Alternative, as required by NEPA. The No Action Alternative describes conditions expected to occur if there would be no new well field development or additional water supply beyond the City’s current water supply.

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

INTRODUCTION

The Bureau of Land Management (BLM) has prepared the Alamogordo Water Supply Project Draft Environmental Impact Statement (EIS) to assess the City of Alamogordo's (City's) proposal to develop a municipal potable water supply. The City has determined that the current water supply is not sufficient to meet current and future projected water demands and has submitted a right-of-way application to the BLM to construct and operate groundwater wells on BLM-managed land.

This analysis has been carried out to meet requirements of the National Environmental Policy Act (NEPA). This Draft EIS evaluates two alternatives, a No Action Alternative and Proposed Action. The EIS has been prepared to: 1) analyze the environmental impacts of alternatives that would meet the proposed purpose and need, 2) assist the BLM in deciding whether to authorize rights-of-way to the City to develop well sites and associated pipeline infrastructure on land under the jurisdiction of the BLM, and 3) assist Reclamation in determining the viability of funding a desalination facility, should funds under Title XVI become available. The Draft EIS evaluates the potential biological, economic, and social consequences that would likely result from implementing each alternative.

Cooperating agencies include the U.S. Bureau of Reclamation (Reclamation) and Otero County. Reclamation is evaluating funding provisions for the construction and operation of a desalination facility. Otero County possesses special expertise with respect to environmental resources and potential impacts in the study area. The Draft EIS has been prepared in accordance with NEPA requirements for the BLM and Reclamation.

PUBLIC INVOLVEMENT

The BLM and Reclamation held two public scoping meetings prior to preparation of this EIS to identify key issues and concerns about the City's proposal. Key issues and concerns expressed during public and agency scoping affected the impact analysis and alternatives development. Issues of primary concern to the public at the Alamogordo public scoping meeting included water provision for projected growth in the region, groundwater drawdown, balanced growth with water use, and the City's accountability for any impacts to non-City groundwater wells. Additional key issues included watershed management, the location of the facilities, growth management, and economic impacts.

At the Tularosa public scoping meeting, issues of primary concern to the public included the proximity of wells to the Village of Tularosa and other residential wells outside Tularosa, the potential effects of the project on ranching and agriculture in the region, the potential for groundwater drawdown in residential wells, brackish water intrusion, and growth management in the region. Additional key issues included the potential effects on acequias (irrigation ditches) and surface water, economic impacts, and monitoring measures.

The Draft EIS will be available for public review for a 60-day period, during which public comment meetings will be held to solicit comments. Public comments received during this period will be responded to and incorporated into the Final EIS, as appropriate. Public notices will be distributed to inform the public of the availability of the Draft EIS and the public meetings.

PURPOSE AND NEED STATEMENT

The purpose of the action is to provide a right-of-way (ROW) across public land for the transportation of groundwater resources by allowing for the construction of a groundwater development and conveyance system to meet a municipal need. The need for the action is established by the BLM's responsibility under the Federal Land Policy and Management Act (FLPMA) to respond to requests for ROWs. It is the policy of the BLM to authorize all ROW applications that are in conformance with approved land use plans at the discretion of the authorized officer. The BLM's objective is to meet public needs for use authorizations such as ROWs, permits, leases, and easements while avoiding or minimizing adverse impacts to other resource values. The proposal to construct groundwater wells and associated infrastructure would be in accordance with this objective.

In order to develop the 4,000 acre-feet per year (afy) of water rights granted by the New Mexico Office of the State Engineer (NMOSE) to the City, the City has submitted a ROW application to the BLM for their proposal. The City's proposal includes the construction of 10 wells in the Snake Tank well field, an associated desalination plant (off-public land) and the necessary water distribution lines across BLM-managed and non-BLM managed lands. This proposal will assist in responding to the projected 2045 demands for potable water for the City of Alamogordo.

ALTERNATIVES

NEPA requires consideration of a reasonable range of alternatives that could accomplish the project's purpose and need. This Draft EIS provides an evaluation of the No Action Alternative and the Proposed Action Alternative. Several other alternatives have been initially considered and eliminated from detailed analysis.

TABLE ES-1 SUMMARY COMPARISON OF ALTERNATIVES

ALTERNATIVE	CURRENT CITY WATER SUPPLY			NON-CITY WATER SUPPLY	TOTAL (AFY)
	GROUNDWATER (AFY)	SURFACE (AFY)	SNAKE TANK (AFY)	PURCHASED/LEASED (AFY)	
Alternative A (No Action)	3,931	3,513	0	0	7,444
Alternative B (Proposed Action)	3,931	3,513	3,200	198	10,842

ALTERNATIVE A—NO ACTION

The No Action Alternative (Alternative A) describes conditions expected to occur if the City were to continue to rely on existing resources to meet current and future drinking water demands. Under the No Action Alternative, there would be no new well field development or additional water supply beyond the City's existing firm water supply. Alternative A assumes that the City would continue to enforce water conservation measures, use reclaimed water for irrigation of green spaces, and maintain existing groundwater wells and infrastructure.

ALTERNATIVE B—PROPOSED ACTION

The Proposed Action (Alternative B), consists of four components: 1) constructing and operating up to 10 brackish groundwater wells at Snake Tank Road, 2) installing water transmission lines to Alamogordo, 3) constructing a desalination facility in Alamogordo to treat 4,000 afy (3,200 afy potable) of water, and 4) constructing a booster pump station near the desalination plant to deliver the water into the City's municipal system. No new distribution system would be constructed, as the City would use the existing distribution system.

This alternative has been developed to incorporate the NMOSE hearing ruling on the City's initial request for 9,023 afy of unappropriated brackish water (Appendix A). The ruling, which has been recently upheld in district court (Appendix B), allows 4,000 afy of brackish water (approximately 3,200 afy of potable water) to be pumped from the Snake Tank well field. The remaining future water supply (198 afy) will have to be attained from other sources, such as the purchase of bulk water or additional water rights. Additional recent court rulings and settlement agreements are in Appendix C. These options are being pursued but are not a part of this Draft EIS.

The Proposed Action as described and analyzed in this EIS:

- Meets the City's identified water needs;
- Is within the BLM's permitting authority;
- Is economically and technically feasible, as well as meets necessary regulations;
- Meets the Purpose and Need of this EIS; and
- Constitutes the primary solution contemplated and approved by the NMOSE for the City to help meet the gap in its projected future water demand.

ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

Several alternatives were considered but eliminated from further evaluation. Alternatives were evaluated against the purpose and need identified. Those that did not meet the following requirements were eliminated from further analysis and are described below.

Three alternative well field sites were considered: Alvarado well field (increased environmental impacts), Grapevine Canyon well field (military conflicts), and White Sands Missile Range

Headquarters well field (military conflicts). Alternative sources of water were also considered, including aquifer storage and recovery (not sustainable source), additional water conservation (would not meet the demand), aquifer recharge (not reliable), importing water (increased environmental impacts), cloud seeding (not reliable), watershed management (not reliable), Tularosa Creek Reservoir (not reliable), and reclaimed water (would not meet potable demand). The City considered two options for modifying its current water rights program: maintaining the existing points of diversion (increased environmental impacts) and changing the points of diversion (would not meet demand). The City also considered purchase or lease of existing agricultural water rights from willing sellers (speculative nature and technical feasibility). An alternative siting location for the desalination facility on State trust land was evaluated and eliminated from further analysis. Alternative technologies for treating saline water were eliminated from further analysis because the environmental impacts would likely be the same as the evaluated alternatives.

ENVIRONMENTAL CONSEQUENCES

Environmental consequences, including cumulative effects, are described in detail in Chapter 4 of the Draft EIS. Table ES-2 summarizes the major impacts on each resource by alternative.

TABLE ES-2 SUMMARY COMPARISON OF IMPACTS BY RESOURCE		
RESOURCE	**NO ACTION ALTERNATIVE A**	**PROPOSED ACTION ALTERNATIVE B**
Water Resources – Surface Water	Reduction in downstream surface water flows and springs	Minimal effects on surface water
Water Resources – Groundwater	Groundwater Table drawdown by 45 to 90 feet	Groundwater Table drawdown by a few feet to more than 100 feet; potential for drying out of groundwater wells near Snake Tank well field
Geology	Potential local land subsidence	Increased potential for land subsidence, specifically near the Snake Tank well field
Soils	No impacts	Temporary soil disturbance (260 acres) and increased potential for wind and water erosion
Biological Resources – Plants	No impacts	Temporary disturbance of 111 acres of vegetation; permanent loss of 69.5 acres of vegetation; increased potential for spread of noxious weeds
Biological Resources – Wildlife	No impacts	Temporary and permanent habitat loss (see plants); temporary construction disturbance
Biological Resources – Special Status Species	No impacts	No affect to Sacramento prickly poppy (*Argemone pleiacantha* ssp. *pinnatisecta*) (endangered) and northern aplomado falcon (*Falco femoralis*) (endangered)
Cultural Resources	No impacts	Direct impacts to two properties recommended and determined eligible for listing on the NRHP
Socioeconomic Resources	No impact	Up to 638 acres of agricultural land fallowed
Transportation	No impact	Temporary construction traffic and pond cleaning traffic on U.S. Highway 54
Air Quality	No impact	Temporary construction emissions; long-term vehicle emissions

1.0 INTRODUCTION

1.0 INTRODUCTION

1.1 OVERVIEW

The City of Alamogordo (City), New Mexico, proposes to implement the Alamogordo Water Supply Project (project) to meet both current and future water demands for the City. The project would be located on a combination of Federal, state, and private lands, including land and rights-of-way managed by the U.S. Department of the Interior, Bureau of Land Management (BLM). The BLM is the lead Federal agency for preparation of this Environmental Impact Statement (EIS), and the U.S. Bureau of Reclamation (Reclamation) and Otero County serve as cooperating agencies. The City may request Federal funding for construction of certain project components from Reclamation, pursuant to the Reclamation Wastewater and Groundwater Study and Facilities Act, Public Law (PL) 102-575, Title XVI, as amended (Title XVI). To ensure the EIS meets the requirements for both the BLM and Reclamation, Reclamation is also reviewing and participating in development of the EIS.

The EIS complies with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code [USC] 4321–4347), and regulations adopted by the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] 1500 et seq.). The EIS also complies with the Federal Land Policy and Management Act of 1976 (FLPMA) (43 USC 1711–1712 and regulations in 43 CFR 1600).

The EIS has been prepared to: 1) analyze the environmental impacts of alternatives that would meet the purpose and need, 2) assist the BLM in deciding whether to authorize rights-of-way (ROWs) to the City to develop well sites and associated pipeline infrastructure on land under the jurisdiction of the BLM, and 3) assist Reclamation in determining the viability of funding a desalination facility, should funds under Title XVI become available.

This chapter describes the purpose of and need for the action in addition to the following items:

- General Location
- Background and History
- Scope of the EIS
- Decisions to be Made Following the EIS
- Description of Relevant Issues
- Regulatory and Permit Requirements

1.2 PURPOSE OF AND NEED FOR ACTION

This EIS was prepared in response to an application for ROW on Federal land, submitted by the City of Alamogordo. The purpose of this EIS is: 1) for the BLM to evaluate and disclose potential impacts of the proposed project and alternatives; and 2) to determine whether to issue a ROW grant.

1.2.1 AGENCY MANDATE

The BLM is required to evaluate and make decisions regarding the granting of ROWs in response to proponent applications. It is the policy of the BLM to authorize all ROW applications that are in conformance with approved land use plans at the discretion of the authorized officer. The BLM's objective is to meet public needs for use authorizations such as ROWs, permits, leases, and easements while avoiding or minimizing adverse impacts to other resource values. The proposal to construct groundwater wells and associated infrastructure would be in accordance with this objective.

1.2.2 PROPONENT NEED

Through extensive study, the City has identified a projected water demand of 10,842 acre-feet per year (afy) through 2045. The demand was determined through study of consumption rates and projected population levels.[1] New Mexico municipalities are statutorily given the ability to acquire additional water rights long before the actual demand for the water materializes based on its "reasonably projected additional needs" during a 40-year time period. Following development of a 40-year water plan, the City identified, and the Twelfth Judicial District Court agreed, that the City had 3,513 afy of reliable surface rights and 3,931 afy of reliable groundwater supplies from its existing wells, for a total of 7,444 afy in reliable water supplies (see Appendix B). Based on the projected demand, the City therefore has a need to obtain 3,398 afy in additional water supplies by the year 2045 (See Table 1-1).

In order to address this additional need, the City has been issued a permit by the New Mexico Office of the State Engineer (NMOSE) to divert up to 4,000 afy from the Snake Tank well field (Revised Permit No. T-3825). Since the water diverted from this well field is brackish groundwater, approximately 20 percent of the water volume is lost during the desalination process; the project will therefore provide approximately 3,200 afy of the City's additional need of 3,398 afy in the year 2045. The additional 198 afy will need to be attained from other sources, such as the purchase of bulk water or additional water rights, sources that are undetermined at this point in time and are not a part of this EIS. Additional recent court rulings and settlement

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[1] Future water demand is determined by a two-step process. First, a water consumption rate must be developed after which the municipality makes a reasonable calculation of its future population growth. Attempts to quantify domestic water use in American homes reveal that there is a wide range of values (New Mexico Office of the State Engineer 2003) (Appendix C). Under normal circumstances (no water rationing), the City concluded that 165 gallons per capita per day (gpcpd) or 7,140 afy was a reasonable consumption rate for use in the development of its 40-year plan. In reaching this conclusion, the City allocated 76 gpcpd for indoor use; 49 gpcpd to residential outdoor use, which included landscape irrigation needs; 25 gpcpd to non-residential water use; and 15 gpd for unaccounted-for water (NMOSE 1996) (Appendix D). In the proceedings to acquire the Snake Tank water rights, both the NMOSE and the Twelfth Judicial District Court found this consumption rate to be reasonable (see Appendix B). When the City originally developed its 40-year water development plan in 2003, it used the year 2000 as the starting point for the 40-year planning period. In 1992, the City's gpcpd rate was 261.28. As the result of an aggressive and highly successful conservation measures, the City had reduced its water consumption rate to 185.59 gpcpd by the year 2000. These measures have continued to be effective, as the City's per capita use in 2008 was approximately 125 gallons per day (gpd). Nevertheless, the Twelfth Judicial District Court found a consumption rate of 165 gpcpd to be reasonable and not contrary to the conservation of water within the State of New Mexico (Twelfth Judicial District Court 2008).

agreements associated with the amount of permitted rights and the associated stipulations are in Appendix C.

1.2.3 PURPOSE

The purpose of this action is to provide public land for well siting and transporting of groundwater resources by allowing for the construction of a groundwater development and conveyance system on public land managed by the BLM. This ROW will allow the City to develop the water rights granted by NMOSE.

TABLE 1-1. PROJECTED WATER DEMAND FOR ALAMOGORDO, 2005–2045

YEAR	POPULATION PROJECTION	DEMAND (AFY)	ADDITIONAL WATER NEEDED BY CITY (AFY)
2005	38,631	7,140	-301
2010	41,283	7,630	186
2015	43,822	8,099	655
2020	46,366	8,570	1,126
2025	48,702	9,001	1,557
2030	51,219	9,466	2,022
2035	53,710	9,927	2,483
2040	56,137	10,375	2,931
2045	58,663	10,842	3,398

NOTE: Demand assumes a per capita water use rate of 165 gpcpd or 0.1848237 afy. In 2005, per capita use was approximately 125 gpd as the result of water conservation efforts. The reliable water supplies for the City through 2045 are estimated at 7,444 afy.
SOURCE: Livingston and Shomaker 2006.

1.2.4 DECISIONS TO BE MADE

The BLM must decide whether, and if so, under what conditions it will grant ROW(s) to enable construction and operation of the proposed facilities on public land. The BLM uses a comprehensive process to determine whether ROWs on BLM-administered public land should be granted. This process includes compliance with the requirements of the NEPA and CEQ regulations, BLM planning regulations, manuals and handbooks, and applicable policy. The Bureau of Reclamation must decide whether to seek and approve funding of a portion of the project costs through Reclamation’s budget under Title XVI program.

1.3 GENERAL LOCATION

The study area for which Chapter 3 describes the affected environment is the southeastern portion of the Tularosa Basin in Otero County, south-central New Mexico (Figure 1-1). The Tularosa Basin is a topographically closed depression that encompasses approximately 6,500 square miles, bounded on the east by the Sacramento Mountains and on the west by the Franklin, Organ, and San Andres mountains (Orr and Myers 1986). The Tularosa Basin is roughly 155 miles from north-to-south and averages roughly 43 miles east-to-west (South Central Mountain Resource Conservation and Development Council, Inc. 2002). The surface divide near the New Mexico-Texas state line separates the Tularosa Basin from the Hueco Bolson, a fault-bounded structural depression associated with the Rio Grande Rift (Heywood and Yager 2003). Groundwater flow between the Tularosa Basin and the Hueco Bolson connects these basins and creates a combined source of groundwater, referred to as the Hueco-Tularosa aquifer (Texas Water Development Board and New Mexico Water Resources Research Institute [Texas and New Mexico] 1997). This basin-fill aquifer (Figure 1-2) represents the most important aquifer in the area in terms of the quantity of water available, achievable production rates, and the degree of historic development of these resources.

The study area is further broken down into two areas associated with project activities: 1) ground-disturbing activities, which would be limited to an area that extends from the City in the south to the site proposed for well production, approximately 10 miles north of Tularosa; and 2) potential groundwater drawdown, which could affect water resources along the eastern margin of the valley fill in the Alamogordo/Tularosa region. Chapter 3 provides a detailed description of the resources occurring in the affected environment.

1.4 BACKGROUND AND HISTORY

1.4.1 HISTORY

The City's decision to sponsor the project followed years of investigation, preparation, and individual resource studies that examined alternative sources for obtaining a sustainable potable water supply. Several historical milestones, described below, led to the City's decision to implement the project and prepare this EIS.

1983: Water Resources Study in the Tularosa Basin – Reclamation conducts a study that determines the City's water supply is inadequate and critical water shortages could occur should the region experience a prolonged drought (Reclamation 1983). The study concludes that the City should repair and improve the existing municipal water system and develop new water sources should the need arise.

1986: Alamogordo Municipal and Industrial Water Supply Study – The City-funded study shows the need for new or alternative water supplies to meet the City's rising demand for water.

1990–2001: Repair and Replacement Program for the City's Water System – A repairs program is adopted by the City to rebuild the municipal water system, which was installed in the 1950s. The program includes new piping, new boxes to collect spring water, and new collection points that are adjusted to correspond to the locations where spring water is captured.

1992: Reservoirs Constructed to Store Water – The City constructs two new reservoirs to increase storage capacity for surface water diversion. The total storage capacity with these new reservoirs is 180 million gallons.

1995: Municipal Water Rationing Program – The City adopts a Water Conservation and Rationing Ordinance (948). As a result, the City's per capita daily water use decreases.

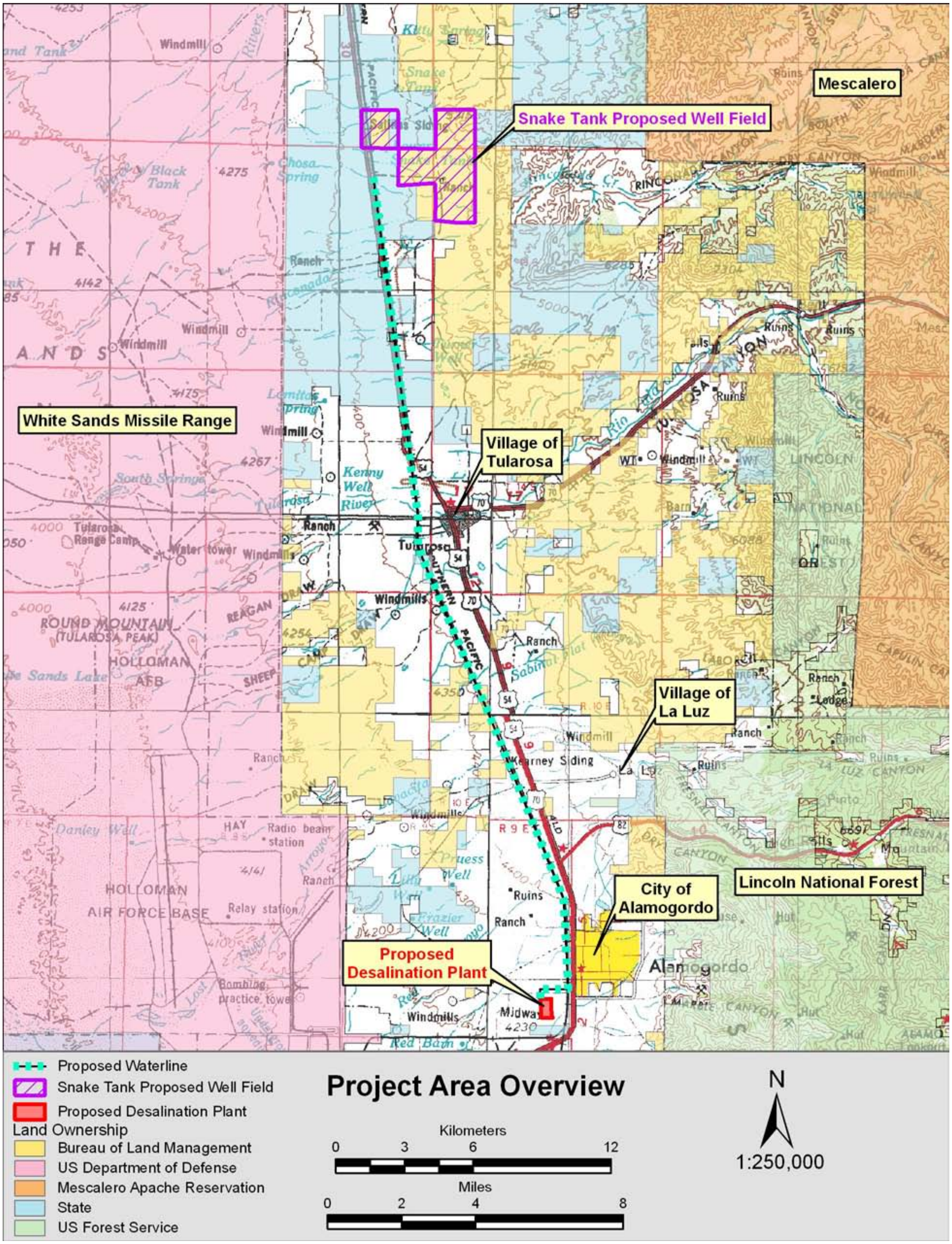

Figure 1-1. Study area overview.

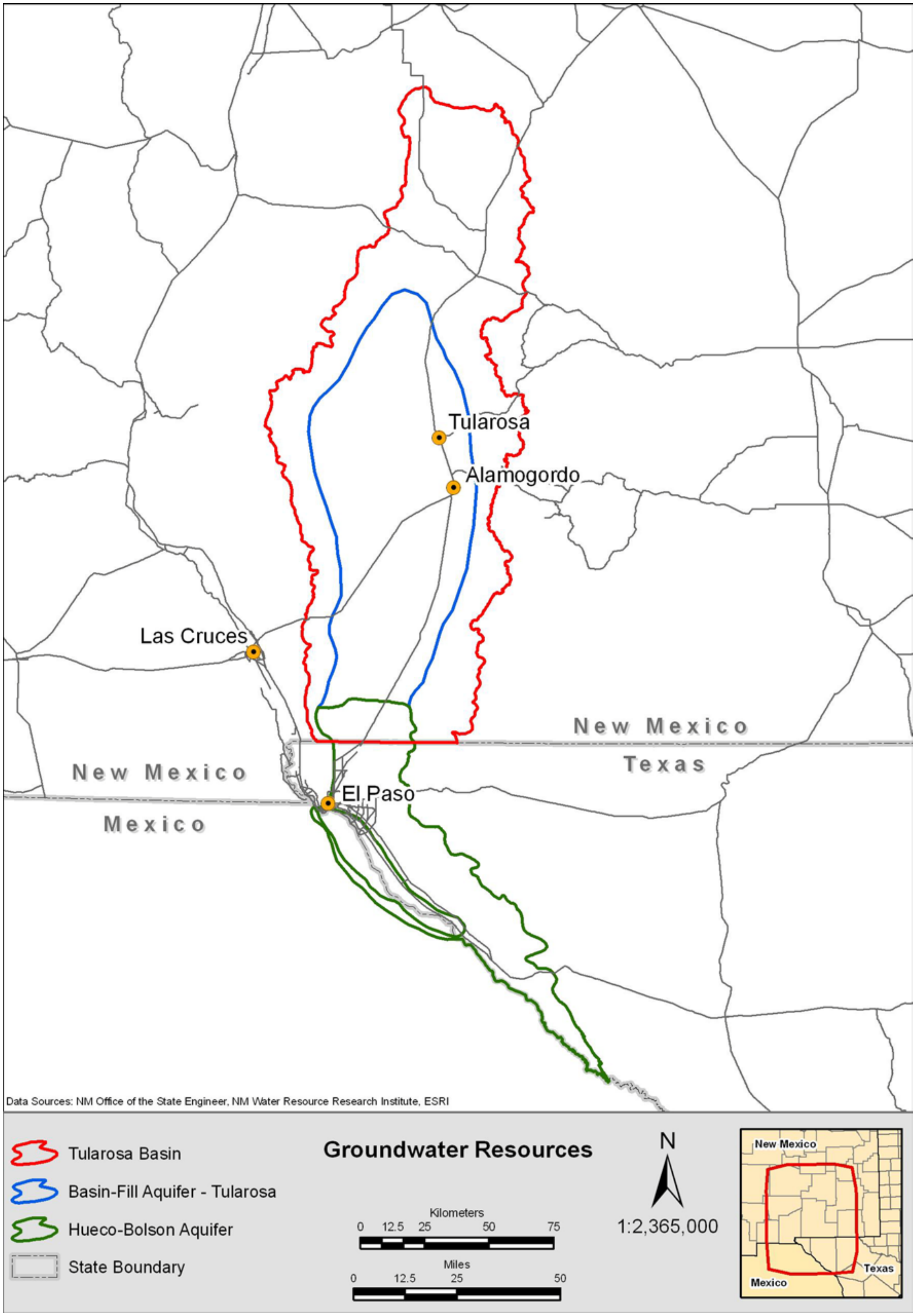

Figure 1-2. Groundwater resources.

1995: Bonito Pipeline Study to Explore Problems with the Line – The City conducts a study to identify sections of the waterline in need of repair and/or replacement for planning future pipeline improvement projects.

1996: Aquifer Storage and Recovery Feasibility Study – To evaluate the feasibility of storing water underground, the City commissions a study that evaluates the practicality of pumping surface water into the underground aquifer.

1998–2000: Drought Makes Aquifer Storage and Recovery Project Unfeasible – The lack of precipitation reduces surface flow and basin recharge. The Aquifer Storage and Recovery project is abandoned because of the limited amount of water that could be stored.

1998: Start of Reduced Surface Water Supply from the Sacramento Mountains – Following the 1997–1998 El Niño event, precipitation in the Sacramento Mountains decreases during the later months of 1998. Drought conditions persist throughout the United States in 1999, and recharge in the Sacramento Mountains continues to decrease.

1998: Rehabilitation of the City's La Luz Well Field – The City restores its La Luz well field to improve well production to deliver more groundwater as part of the municipal water supply.

1995: Reclaimed Water Program for the City's Public Spaces – The City implements water conservation measures and a reclaimed water program to reduce the potable water demands by more than 4 million gallons per day (mgd). Conservation measures include water restrictions, landscaping restrictions, and an aggressive water rate structure to reduce water consumption. An updated study is conducted in 2002, expanding the reclaimed water system.

1999–2003: The City Uses All Available Surface Water and Falls Short of Meeting Municipal Water Demand – Drought conditions force the City into Emergency Drought Status. Emergency rationing and conservation measures are taken to further reduce per capita municipal water use.

2000: Covering and Lining of Reservoirs – The City reduces evaporation loss by an estimated 500,000 gallons per day.

2001: BLM Grants the City a Three-year Temporary Right-of-Way on Public Land – Based on the results of an Environmental Assessment (EA), the BLM grants Right-of-Way NM 104116 to the City for a pilot project test-well site and a water treatment system facility on public lands near Snake Tank Road in Otero County.

2002: Tularosa Basin and Salt Basin Regional Water Plans – The New Mexico Interstate Stream Commission sponsors planning studies to provide a sufficient, sustainable water supply to meet water needs in the region for all uses, including agricultural, domestic, water association, municipal, industrial, and commercial. The goal is to make provisions to provide an economical water supply to support reasonable growth in the population and economy for the next 40 years.

2002: City Decides Against Using Agricultural Water Rights for Municipal Needs – The Alamogordo City Council decides not to pursue the purchase and lease of water resources from willing and able sellers in the Alamogordo/Tularosa region.

2003: Desalination Feasibility Study – To address the pressing need to obtain a sustainable potable water supply, the City conducts a study to explore the feasibility of using desalination technology to treat saline water.

2003: NMOSE Hearing No. 02-035 on the City's 10 Underground Waters Appropriation Applications Numbered T-3825 through T-3825-S-9 – The City applies for underground water rights in the Tularosa Basin, approximately 10 miles north of the Village of Tularosa.

2003: Agreement for Sale of Bulk Water to Village of Tularosa – The City agrees to sell bulk water at cost of production to the Village of Tularosa as a backup and/or emergency water supply of a maximum diversion of up to 1,200 afy by the year 2040. The Village of Tularosa also agrees to support the City's water rights application numbers T-3825 through T-3825-S-9 for the water supply project.

2003: City of Alamogordo 40-Year Water Development Plan – The City's 40-year water plan demonstrates the urgent need for new or alternative water supplies and management flexibility. The plan is updated in 2006 and contains numerous water development recommendations (Livingston and Shomaker 2006).

2004: BLM Approves the City's Right-of-Way Amendment Application – The BLM approves the City's amendment application, filed on December 19, 2001, proposing to install four additional test wells and extend the right-of-way for an additional 3 years. The new expiration date for the right-of-way is September 12, 2007.

2004: NMOSE's Underground Waters Appropriations Decision – The NMOSE partially approves the City's applications numbers T-3825 through T-3825-S-9. The City is permitted to divert underground water at the proposed locations up to 3,000 afy with the condition that the City's diversion in any year may be increased up to 4,500 afy, provided that the sum of annual diversions for any consecutive five-year period does not exceed 15,000 afy (NMOSE 2004a).

2004–2008: EIS for the Alamogordo Water Supply Project – The BLM and Reclamation determine that an EIS must be prepared for the project to comply with NEPA.

2008: District Court Judge James Waylon Counts Decision – The decision approves a permit issued by the NMOSE for the City to obtain water from the Snake Tank well field. The City can take up to 4,000 afy from the well field, with a potential increase up to 5,000 afy for any one year during drought, if circumstances warrant. The total cannot exceed 20,000 afy over a 5-year period (Twelfth Judicial District Court 2008).

2009: New Mexico Court of Appeals Decision – The court affirms the district court.

2010: New Mexico Supreme Court Decision – The court denies a petition for writ of certiorari appealing the court of appeals decision.

1.4.2 RELATED NEPA DOCUMENTS

This section describes the relationship between the EIS and related NEPA documents used as information sources for the EIS.

- The Final Environmental Impact Statement for the Proposed Leasing of Lands at Fort Bliss, Texas, for the Proposed Siting, Construction, and Operation by the City of El Paso of a Brackish Water Desalination Plant and Support Facilities (2004). Describes resources and anticipated impacts within the Hueco-Bolson aquifer.

- EA for the Amended Snake Tank Water Well Field Test Study Sites: T. 12 S., R. 9 E., Section 35; T. 12 S., R. 10 E., Section 31; T. 13 S., R. 10 E., Section 7; and T. 13 S., R. 9 E., Section 1, Otero County, New Mexico (2004). Describes resources and anticipated impacts within the Tularosa Basin, resulting from construction of four test wells and installation of a temporary trailer-mounted treatment system.

- EA for the Tularosa Basin Desalination Research and Development Facility (2003). Describes resources and anticipated impacts within the Hueco-Tularosa aquifer. Effects of this project in combination with existing regional water use are considered.

- EA for Alamogordo Test Well, City of Alamogordo, New Mexico: T. 13 S., R. 9 E., Section 1 (2001). Describes resources and anticipated impacts within the Tularosa Basin associated with the construction of a test well and installation of a temporary trailer-mounted treatment system.

1.5 RELATIONSHIP TO BLM POLICIES, PLANS, AND PROGRAMS

The White Sands Resource Area Resource Management Plan (WSRMP) (BLM 1986), approved September 5, 1986, will be used to guide land use decisions to ensure that all uses and activities conform with the decisions, terms, and conditions described in the WSRMP. The action, as proposed, conforms to the terms and conditions of the WSRMP.

1.6 SCOPE OF THIS ENVIRONMENTAL IMPACT STATEMENT

This EIS uses a planning horizon of 40 years and evaluates impacts of the No Action and Proposed Action Alternatives on water resources, geology, biological resources, cultural resources, Indian Trust Assets (ITAs), socioeconomics, land use, transportation, air quality, and visual resources. The 40-year planning period is used by the NMOSE and in the State of New Mexico’s water resources modeling. Other entities and agencies have ongoing or planned projects to pump water from the Hueco-Tularosa aquifer. The cumulative effects of these projects are analyzed in Chapter 4 (see Section 4.2.15).

The remainder of this section summarizes the public scoping process and issues raised during the scoping process.

1.6.1 PUBLIC SCOPING PROCESS

Two public scoping meetings were conducted by the BLM and Reclamation as part of the EIS process (Table 1-2). The purpose of these meetings was to provide information to all interested individuals about the proposed project as well as an opportunity to voice concerns or opinions. At each meeting, a series of 12 displays explained the NEPA process, the project history, the purpose of and need for the action, details about the area's hydrology, and potential methods for obtaining a regional water supply. In addition, attendees received a packet of project-related information that provided further details about the information shown in the presentation and on the display boards. The project management team, which includes representatives from both the BLM and Reclamation, was available to answer questions and participate in the public discussion (Appendix D).

TABLE 1-2. PUBLIC SCOPING MEETING INFORMATION

MEETING	LOCATION	TIME AND DATE
1	Alamogordo, New Mexico Willie Estrada Civic Center, 800 East First Street	Tuesday, October 5, 2004 6:00–8:00 p.m.
2	Tularosa, New Mexico Senior Center, 1055 Bookout Road	Wednesday, October 6, 2004 6:00–8:00 p.m.

Key issues and concerns expressed during public and agency scoping affected the impact analysis and alternatives development. Issues of primary concern to the public at the Alamogordo public scoping meeting included water provision for projected growth in the region, groundwater drawdown, balanced growth with water use, and the City's accountability for any impacts to non-City groundwater wells. Additional key issues included watershed management, the location of the facilities, growth management, and economic impacts.

At the Tularosa public scoping meeting, issues of primary concern to the public included the proximity of wells to the Village of Tularosa and other residential wells outside Tularosa, the potential effects of the project on ranching and agriculture in the region, the potential for groundwater drawdown in residential wells, brackish water intrusion, and growth management in the region. Additional key issues included the potential effects on acequias (irrigation ditches) and surface water, economic impacts, and monitoring measures.

In addition to the two public scoping meetings, issues of concern and comments on the proposed project were collected through comment cards, electronic mail, the project website, letters, and tribal consultation. An alternatives workshop was also held so that members of the public could participate in the alternatives development process.

1.6.2 ISSUES RAISED DURING THE PUBLIC SCOPING PROCESS

WATER RESOURCES

Predicted groundwater drawdown as a result of the project was a key issue raised during public scoping. Concerns were also expressed about residential, commercial, and industrial wells drying out; the timing and characteristics of potential land subsidence; effects on the interaction of groundwater and surface water; and the fair distribution of project water supply throughout the region. Related issues included potential adverse impacts to vegetation, livestock grazing, and wildlife from lowering the water Table and intrusion of saline water into residential, commercial, and industrial wells.

The location for project wells-approximately 10 miles north of Tularosa-concerned many members of the public living within the area. Consideration of alternative sites for the wells and project facilities was suggested to minimize impacts to the Tularosa area. Alternatives mentioned during public scoping were areas south of the City or land administered by the Department of Defense.

Another issue articulated during public scoping and tribal consultation is why the City has not developed all the City's existing water rights or used all currently held water rights to both surface water and groundwater. Members of the community in the Tularosa region expressed concerns about potential adverse effects on water rights to Tularosa Creek and springs in the region. One suggestion was purchasing private water rights rather than developing new wells.

GEOLOGY AND SOILS

Concern for the potential impacts to geology and soils associated with groundwater development were raised during the public scoping process. Specifically, land subsidence associated with aquifer drawdown and soil erosion due to construction activities were raised during scoping. Potential impacts to the White Sands National Monument were also raised. Several members of the public requested that the EIS consider the effects of developing groundwater resources in the Tularosa Basin on the dune system within the White Sands National Monument.

BIOLOGICAL RESOURCES

Concerns about biological impacts were raised during the scoping process. If the project were to deplete groundwater, the vegetation and wildlife within the study area could be affected. Of particular concern, the region supports an ecosystem of endangered plants and animals, including the White Sands pupfish (*Cyprinodon Tularosa*) and the Sacramento Mountains checkerspot butterfly (*Euphydryas anicia cloudcrofti*), both of which rely on the regional water supply in the mountains and on the basin floor. Diminishing the already limited habitat for these and other threatened and endangered species as a result of groundwater drawdown was a key concern.

A population of African rue (*Peganum harmala*) exists on Snake Tank Road within the study area. Management of this noxious weed species was a concern raised during the scoping process.

Cultural and Historical Resources

Concerns were raised regarding potential effects on cultural resources in portions of the study area where project infrastructure would be located. Areas of particular concern included State of New Mexico trust land (State trust land), the Tecalote Ruins, and the prehistoric rock art at the Three Rivers Petroglyph Site. The potential for damage to or depletion of historic acequias in the region was also a concern.

Indian Trust Assets

Concerns were raised regarding potential adverse impacts to Indian Trust Assets (ITAs) in the study area.

Socioeconomics

Issues raised during public scoping related to how the project could affect water rates, cost of living, and property values. The community in the Tularosa area is concerned that wells associated with the project would harm the value of property in the region and cause financial hardship to individuals who would be forced to re-drill wells. Concerns for how to compensate or assist individuals negatively affected by groundwater drawdown were raised, in addition to mitigation measures that would be implemented to minimize any economic impacts in the community.

Controlling future growth was also a key issue raised during the scoping process. Concerns focused on uncertainty about whether the project would limit or encourage population growth in the region. Managing responsible growth in line with the sustainable resources that are currently available within the region was also a topic of concern. The concern was that developing more water to accommodate more housing and growth would lead to increased population, changes in the economy, and changes in the social and cultural structure of the region.

Land Use

Members of the Alamogordo and Tularosa communities raised concerns regarding the development of groundwater wells near farming and ranching operations, as potential adverse effects on irrigation could affect the farming and ranching community within the region.

1.7 AUTHORIZING ACTIONS AND DECISIONS

1.7.1 APPLICABLE PERMITS, LICENSES, AND OTHER CONSULTATION REQUIREMENTS

The construction, maintenance, and operation of the project facilities would have to comply with a variety of Federal, state, county, and local environmental laws and regulations, including New Mexico Environment Department (NMED) requirements (Table 1-3). The primary Federal approval is the issuance of a permit and the BLM right-of-way grants for the development of wells and construction of a pipeline on BLM-managed land. Reclamation may also need to approve the project if Federal funding through Title XVI is required (see below for information on Title XVI). The NMOSE may grant additional water rights for the project.

Title XVI directs the Secretary of the Interior (Secretary) to develop a program to investigate and identify opportunities to reclaim and reuse wastewater, as well as naturally impaired groundwater and surface water. The general purpose of the Title XVI program is to provide supplemental water supplies by recycling and reusing agricultural drainage water, wastewater, brackish surface water and groundwater, and other sources of contaminated water. Construction funding is limited to projects for which feasibility studies have been completed and approved by the Secretary, for which the Secretary has determined the project sponsor is capable of funding the non-Federal share of project costs, and for which the local sponsor has entered into a cost-share agreement committing to funding its share.

Reclamation received funding in fiscal year 2004 through the Title XVI program solely to assist the City in conducting a desalination planning and environmental compliance study for the project; these funds do not cover project construction. The City would be responsible for construction, operation, and maintenance of the project, but Federal funding may be available through the Title XVI program. The Federal cost share is generally limited to a maximum of 25 percent of the total project cost, not to exceed $20 million. If funds are available, Reclamation may provide the funding for a portion of the costs of constructing, operating, and maintaining a desalination facility associated with the project. Reclamation, however, takes no position on whether such a project should be authorized.

TABLE 1-3. SUMMARY OF POTENTIAL PERMITS AND REGULATORY REQUIREMENTS

PERMIT OR APPROVAL	LEGISLATION	REGULATORY AGENCY
Section 404 Permit/Section 401 Water Quality Certification or Waiver	Clean Water Act	U.S. Army Corps of Engineers/NMED
Consultation with U.S. Fish and Wildlife Service	Endangered Species Act	U.S. Fish and Wildlife Service
Consultation with State Historic Preservation Officer (SHPO)	National Historic Preservation Act	New Mexico Historic Preservation Division
General Construction Permit	New Mexico Administrative Code (NMAC) 14.5.2	Construction Industries Division
National Pollutant Discharge Elimination System (NPDES) Construction General Permit	Sections 318, 402, 405 of the Clean Water Act and 40 CFR 122.1	U.S. Environmental Protection Agency (EPA)
Stormwater Pollution Prevention Plan (SWPPP)	Section 402 of the Clean Water Act	EPA
County Flood Control	County Flood Control Regulations	Otero County Flood Control Authority
Air Quality Construction Permit	Depends on plant design and concentrate management method	NMED
Drilling Permit and Water Allocation	NMAC 1.18.550	NMOSE
Groundwater Discharge Permit	NMAC 20.6.2	NMED Groundwater Quality Bureau

2.0 PROPOSED ACTION AND ALTERNATIVES

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter describes the alternatives considered for implementation of the project proposed by the City. It details the process used to develop alternatives, describes the alternatives that were considered in detail, identifies the alternatives that were eliminated from detailed analysis, and summarizes the alternatives and their potential impacts.

In October 2004, public meetings were held in Alamogordo and Tularosa, New Mexico, to gather public comments and concerns about the project and to consider all concepts and suggestions in developing alternatives. During these meetings, the primary public comment concerning alternatives was a recommendation that City identify alternative locations for groundwater wells other than the Snake Tank well field as a potable water resource for the City. Some of the other high-priority concerns raised in the public meetings included:

- The potential for drawdown of water levels in existing groundwater wells or springs;
- The potential adverse effects on farmers, ranchers, and residents of Tularosa;
- The need for strict conservation measures to reduce the need for an additional water resource; and
- The option of purchase and/or lease of existing water rights from willing parties to reduce the impact of the project on groundwater resources rather than developing new wells.

The City conducted a basin-wide analysis to identify locations within the Tularosa Basin for groundwater wells (see Appendix A). In addition, an analysis of the feasibility of purchasing and/or leasing existing water rights was completed to evaluate a water rights purchasing/leasing program. None of these options were considered feasible for the City as described in Section 2.3 Alternatives Considered but Eliminated from Further Analysis.

One action alternative was considered in detail because it was determined to meet the purpose of and need for the proposed project and is technically, financially, and legally feasible.

2.2 ALTERNATIVES CONSIDERED IN DETAIL

Table 2-1 summarizes the No Action Alternative and Proposed Action. The City has determined a need of 10,842 afy of potable water by the year 2045.

TABLE 2-1. SUMMARY OF WATER SUPPLY AND SOURCES BY ALTERNATIVE

ALTERNATIVE	CURRENT CITY WATER SUPPLY			NON-CITY WATER SUPPLY	TOTAL (AFY)
	GROUNDWATER (AFY)	SURFACE (AFY)	SNAKE TANK (AFY)	PURCHASED/LEASED (AFY)	
Alternative A (No Action)	3,931	3,513	0	0	7,444
Alternative B (Proposed Action)	3,931	3,513	3,200	198	10,842

2.2.1 ALTERNATIVE A – NO ACTION

The No Action Alternative describes what would occur if the proposed project is not implemented. This alternative serves as a basis for comparing the impacts of the action alternative. Under the No Action Alternative, the City would continue to rely on existing resources to meet current and future drinking water demands. The BLM would not need to grant a right-of-way to the City, and Reclamation would not need to provide funding for construction of a new facility.

This alternative would not involve the development of a new well field or the purchase or lease of additional water rights. The City would continue to enforce water-use conservation and rationing measures, use reclaimed water for non-potable uses (e.g., irrigation), and maintain existing groundwater wells and infrastructure. The current water supply source for the City is a combination of surface water from spring flows in the Sacramento Mountains and Bonito Lake, groundwater, and reclaimed water for irrigation (Livingston and Shomaker 2006).

The City's water conservation program encourages efficient water use by reducing the cost of water for customers who use less water. Through this program, the City has reduced its average consumption rate from 226.03 gpcpd in the 1990s to 149.69 gpcpd from 2000 to 2004. The No Action Alternative assumes that the City would continue to enforce the same conservation program, which has allowed the City to achieve regionally low per capita use rates compared to other municipalities in the southwestern United States (Table 2-2).

Relying on its existing current conservation program and its existing reliable water supplies, the City would not be capable of meeting the projected future water demands for the community in 2045. In addition, without developing brackish groundwater, the City, along with other existing water users within the Alamogordo region, would continue to pump the limited fresh water from the Alamogordo-Tularosa administrative area.

Under the No Action Alternative, the City would continue to rely on its existing surface water and groundwater rights to meet its water demands. In two separate proceedings, the City's combined reliable surface and groundwater supplies were found to total 7,444 afy (Settlement Agreement, Covenants No.'s 1-6, Appendix B; Appendix E). The No Action Alternative would therefore result in the City being unable to meet to projected water demands as early as the year 2010 (see Table 1-1).

TABLE 2-2. COMPARISON OF PER CAPITA WATER USE IN MAJOR CITIES IN THE SOUTHWESTERN UNITED STATES FOR THE YEAR 2001	
MUNICIPALITY	**PER CAPITA WATER USE (GPCPD)**
Santa Fe, NM*	143
Alamogordo, NM*	**155**
El Paso, TX*	167
Tucson, AZ*	170
Mesa, AZ*	194
Albuquerque, NM*	205
Denver, CO	205
Phoenix, AZ*	237
Las Vegas, NV*	302
NOTE: *Water conservation program in place during 2001 SOURCE: Data from Schmittle (2005); Western Resource Advocates (2005)	

As shown by Table 2-3, even assuming the City's current conservation measures would continue to result in a low per capita consumption rate, given its existing reliable water supplies of 7,444 afy, the inability of the City to meet to projected water demands would only be deferred to the year 2025. Under either scenario, the ability of the community to grow would be severely stymied and result in the need to implement growth control measures.

TABLE 2-3. CITY OF ALAMOGORDO ADDITIONAL WATER NEEDED BY CITY (AFY)				
YEAR	**POPULATION PROJECTION**	**DEMAND (AFY)**	**RELIABLE WATER SUPPLIES**	**ADDITIONAL WATER NEEDED BY CITY (AFY)**
2005	38,631	5907.13	7,444	-1,536.87
2010	41,283	6312.65	7,444	-1,131.35
2015	43,822	6700.90	7,444	-743.10
2020	46,366	7089.90	7,444	-354.10
2025	48,702	7447.11	7,444	3.11
2030	51,219	7831.98	7,444	387.98
2035	53,710	8212.89	7,444	768.89
2040	56,137	8584.00	7,444	1,140.00
2045	58,663	8970.26	7,444	1,526.26
NOTE: Demand used the 10-year average per capita water use rate of 136.51 gpcpd or 0.1529117 afy. The reliable water supplies for the City through 2045 are estimated at 7,444 afy.				

2.2.2 ALTERNATIVE B – PROPOSED ACTION

Alternative B-Proposed Action consists of four components: 1) constructing and operating up to 10 brackish groundwater wells at Snake Tank Road (Figure 2-1), 2) installing water transmission lines to Alamogordo, 3) constructing a desalination facility in Alamogordo to treat 4,000 afy (3,200 afy potable) of water, and 4) constructing a booster pump station near the desalination plant to deliver the water into the City's municipal system. No new distribution system would be constructed, as the City would use the existing distribution system.

The groundwater aquifer at Snake Tank well field contains slightly saline water (see Section 2.2.2.1 under "Groundwater Wells"), which would need to be treated before distributing to customers. Pilot testing shows that the desalination process would be capable of producing up to

80 percent potable water from the groundwater produced at the wells (Livingston and Shomaker 2006). This recovery rate means that the majority of the water that flows through the treatment facility would be distributed to customers as treated or potable water. The remaining 20 percent would not be of suitable quality to meet drinking water standards. To account for a 20 percent loss from the desalination process, the total quantity of water produced by the wells would need to be approximately 4,000 afy to achieve a total water supply goal of 3,200 afy from the well field. The Snake Tank well field would provide a substantial portion of the City's estimated water needs in the year 2045. An additional 198 afy would have to be obtained from other sources.

The Proposed Action as described and analyzed in this EIS:

- Meets the City's identified water needs;
- Is within the BLMs permitting authority;
- Is economically and technically feasible, as well as meets necessary regulations;
- Meets the Purpose and Need of this EIS; and
- Constitutes the primary solution contemplated and approved by the NMOSE for the City to help meet the gap in its projected future water demand.

GROUNDWATER PRODUCTION, TREATMENT, AND DISTRIBUTION FACILITIES

The 10 groundwater wells and pipelines would be located on BLM-administered and State trust lands.

The City would use its existing reliable water sources, which have been determined to equal 7,444 afy; supplement those sources with the brackish groundwater produced at the Snake Tank well field; and purchase/lease additional bulk water or water rights from other sources to meet its projected demand in the year 2045 of 10,842 afy.

A desalination facility would be constructed in Alamogordo to treat the brackish (slightly saline) water to meet drinking water standards. Water transmission lines would be constructed to deliver untreated water from the wells to the desalination facility. The treated water would then be distributed through the City's existing water distribution system. This section describes these facilities.

GROUNDWATER WELLS

The Snake Tank well field is located approximately 26 miles north of Alamogordo and east of U.S. 54 (Figure 2-2). Up to 10 groundwater wells would be drilled on approximately 20 acres of land administered by the BLM to produce brackish water from the Hueco-Tularosa aquifer. Access to these wells for construction and maintenance would be from Snake Tank Road, east of U.S. 54 and approximately 13 miles north of the Village of Tularosa.

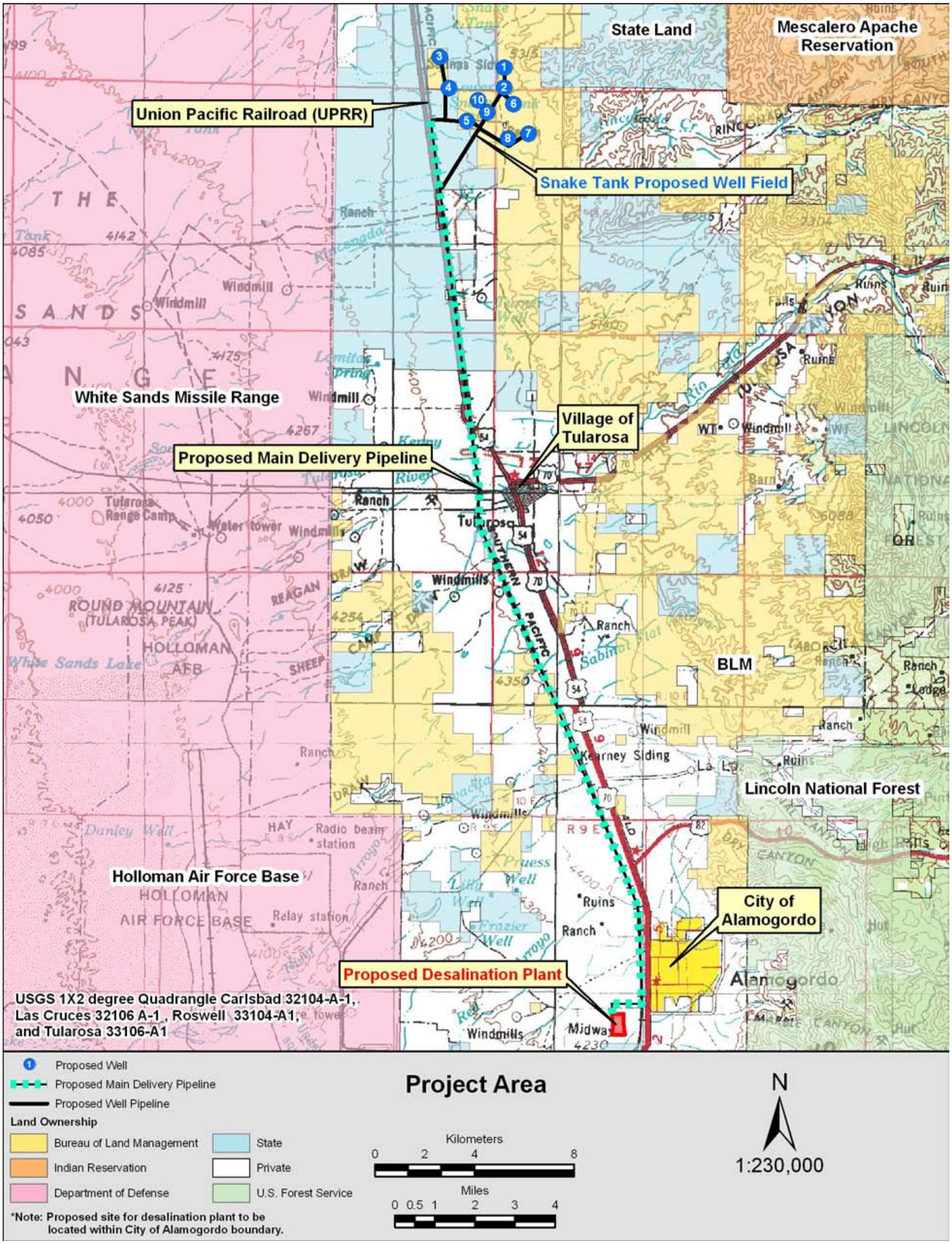

Figure 2-1. Alternative B Components.

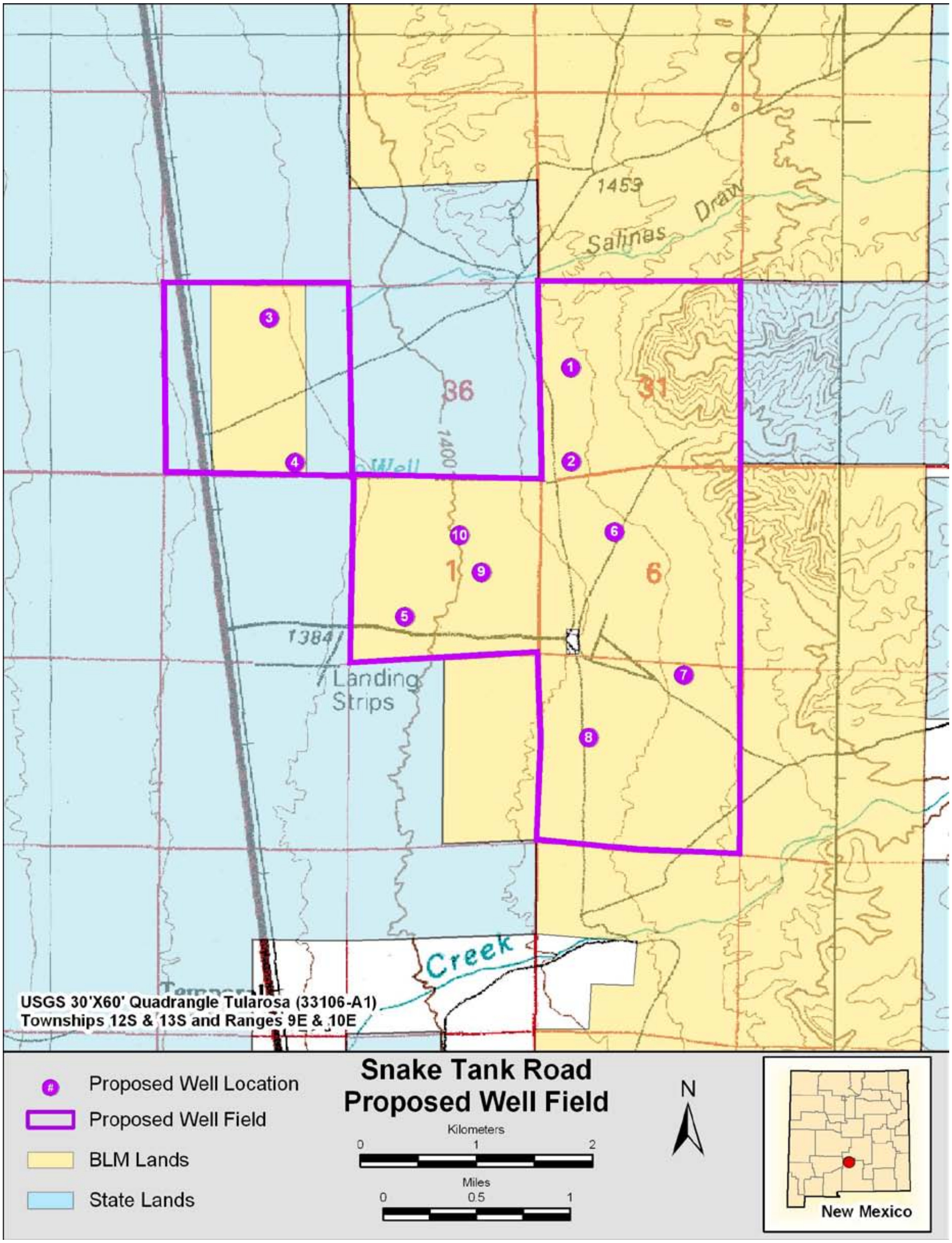

Figure 2-2. Proposed Snake Tank Well Field.

All 10 wells would be located on land administered by the BLM. The wells are spread over an area 2.5 miles long by 2 miles wide. Each well site right-of-way would consist of 2 acres and would be connected to one another by 50-foot-wide right-of-way. The collector lines constructed within the rights-of-way would be connected to two main collector lines that would in turn connect with the transmission line. The 10 well sites and the 50-foot right-of-way located on BLM-administered land would total approximately 60.08 acres.

This site was selected based on its location and the quality of the groundwater. The site is easily accessible from existing roads and is close to existing utilities that will serve as a power source. The groundwater aquifer at the site contains unappropriated brackish groundwater (an estimated TDS concentration of 1,000-3,000 milligrams per liter (mg/liter)) that is economically treatable based on its quality and that can supply a suitable volume in storage to meet long-term demands (Livingston and Shomaker 2003) (see Appendixes A and F). This site is also outside the NMOSE Administrative Area, and selecting a site south, east or west of the City was not feasible. The elevation of the site also allows gravity head-energy to help transmit water to the desalination facility.

Groundwater quality at the Snake Tank well field is in the slightly saline range of 1,500 to 5,000 milligrams per liter in total dissolved solids (mg/L TDS), which is typical of groundwater north of the City (Livingston and Shomaker 2006) (see Appendix F). The slightly saline unit occurs between approximately 500 and 2,000 feet below the current ground surface (bgs) in the area (McLean 1970). Wells would be drilled to a depth of approximately 800 to 1,000 feet bgs, which would fall within the range of slightly saline groundwater. This water would be treated at a desalination facility located in Alamogordo to meet the City's goal of 800 mg/L TDS for potable water.

The Snake Tank well field is in an area within the Tularosa Basin with an estimated potential yield between 300 to 700 gallons per minute (gpm), an aquifer yield favorable for developing municipal and industrial wells. The City's five test wells within the Snake Tank well field provided site-specific data regarding aquifer conditions and characteristics that confirm this estimate (John Shomaker and Associates, Inc. 2006). Pump tests performed on these test wells suggest potential pumping rates ranging from 200 to more than 1,500 gpm for full-scale production wells in the Snake Tank well field. Well pumping rates within this range are consistent with the well field extraction rates anticipated for this alternative.

The April 2008 decision by District Court Judge James Waylon Counts approved a permit issued by the NMOSE for the City to divert water from the Snake Tank well field. The City can take up to 4,000 afy (3,200 afy of potable water) from the well field, with a potential increase up to 5,000 afy for any one year during drought, if circumstances warrant. The total cannot exceed 20,000 afy over a 5-year period (Twelfth Judicial District Court 2008).

LEGAL PROCEEDINGS RELATED TO THE CITY OF ALAMOGORDO'S PERMITS

Below is a brief discussion of the legal proceedings pertaining to the City of Alamogordo's water rights permit including the various settlements that were reached. The settlements discussed below can be found in Appendixes A-C.

In September 2000, the City of Alamogordo (Alamogordo) filed applications with the NMOSE for water wells to divert a combined total not to exceed 13,450 acre-feet per year (AFY) of brackish water from the Snake Tank well field located on BLM land north of the Village of Tularosa. Alamogordo intends to transport the brackish water from the Snake Tank well field by pipeline to a desalinization plant to produce potable water for Alamogordo's water service area. In response to Alamogordo's applications, the NMOSE initially issued permits to allow diversions of only up to 3,000 AFY, with a provision that up to 4,500 AFY could be diverted in any one year, provided that the total diversion over any 5-year period did not exceed 15,000 acre-feet. Alamogordo and several protestants appealed the decision of the NMOSE to New Mexico state district court, which reviewed the permits *de novo*.

The protestants were represented by separate legal counsel in the following groups: (1) the Tularosa Community Ditch Corporation, Dan C. Abercrombie, Elsie I. Bailey, Laymon Hightower, David Rankin, and Allen (Bill) Trammel (the Tularosa Protestants); (2) David and Julia Christopher (the Christophers); (3) the Village of Tularosa; and (4) HFR Corporation and Three Rivers Cattle Ltd., Co. (HFR and Three Rivers). The Christophers are ranch owners with grazing allotments in the immediate vicinity of the Snake Tank well field. HFR and Three Rivers respectively own the surface estate immediately to the north and south of the Snake Tank well field. The Tularosa protestants are individual water well owners approximately 6 miles south of the Snake Tank well field in the vicinity of the Village of Tularosa.

Before the District Court ruled upon Alamogordo's Snake Tank well field water permits, the Christophers, the Village of Tularosa, the NMOSE, and HFR and Three Rivers all entered into separate settlement agreements with Alamogordo, leaving only the Tularosa protestants opposing Alamogordo's permits. On July 2, 2003, the Village of Tularosa and Alamogordo entered into an agreement under which Alamogordo agreed to sell bulk water to Tularosa "as a back-up and/or emergency water supply to the extent allowed" by whatever water permits the court would approve.[2] On January 23, 2007, the Christophers entered into a settlement agreement with Alamogordo in which they waived any claim to impairment[3] to their water rights caused by Alamogordo's permits in the Snake Tank well field and additionally agreed to "take all steps necessary to remove any and all objections or claims it may have under the Environmental Impact Statement (EIS) proceedings relating to the City's proposed Desalinization Plant and supporting pipeline structure."[4]

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[2] Stipulation between Alamogordo and Tularosa (Alamogordo Exhibit 19).
[3] There is no single definition of what constitutes "impairment of existing rights." Mathers v. Texaco, Inc., 77 N.M. 239, 245, 421 P.2d 771, 776 (1966). The New Mexico Supreme Court has stated that "the question of impairment of existing rights is one which must generally be decided upon the facts in each case, and …a definition of impairment of existing rights is not only difficult but an attempt to define the same would lead to severe implications." Accordingly, the NMOSE and New Mexico Supreme Court consider whether there is impairment on a case-by-case basis. *Montgomery v. Lomos Altos, Inc.*, 2007-NMISC-2 22, 141 N.M. 21, 28; see also Stokes v. Morgan, 101 N.M. 195, 202, 680 P.2d 335, 342 (1984) ("New withdrawals which cause a minimal acceleration in the rate of saltwater intrusion or a minimal increase in salinity do not constitute impairment as a matter of law….The determination of whether there is impairment mush be made on a case-by-case basis.") *Application of Brown*, 65 N.M. 74, 78-79, 332 P.2d 475, 478 (1958).
[4] Stipulated Agreement between Christophers and Alamogordo (Alamogordo Exhibit 20 at 3, 6).

On November 20, 2007, HFR and Three Rivers entered into a settlement agreement with Alamogordo which imposed monitoring and remediation requirements on Alamogordo for its potential use of water from the Snake Tank well field.[5] This agreement establishes "acceptable groundwater level declines and changes in water quality to protect HFR's and Three Rivers' water rights and associated wells from injury/damage that could result from [Alamogordo's Snake Tank well field permits]" as well as well setback requirements, water right and water use prohibitions, and quantitative restrictions.[6] The HFR and Three Rivers settlement agreement requires Alamogordo to construct three separate wells to regularly monitor groundwater decline and total dissolved solids (TDS). Of the three monitoring wells, one would be located approximately one mile north of the Snake Tank well field and two would be located approximately one mile south of it – between the Tularosa Protestants and the Snake Tank well field (Figure 2.3). All three monitoring wells would be located on State Land. These wells have not been drilled yet. The agreement requires Alamogordo to reduce or cease pumping from the Snake Tank well field if water levels or TDS levels breach certain defined parameters.[7]

After the District Court's hearing, but before the District Court issued its order, the NMOSE and Alamogordo entered into a settlement agreement that included a "revised permit" with several conditions of approval attached as Exhibit 1.[8] One of the conditions (condition 6) of approval requires that "[p]rior to the diversion of water under this permit, [Alamogordo] shall propose and implement a monitoring plan and system, acceptable to the [OSE] involving the monitoring of groundwater levels and water quality."[9] Another condition of approval provides that the OSE "may order temporary suspension of all or a part of groundwater diversions under this permit if the water levels or [TDS] reported … indicate that impairment to valid existing senior rights to divert water is likely to occur or that groundwater decline rates within the Tularosa Underground Water Basin Administrative Area are likely to exceed those allowed by the Tularosa Underground Water Basin Administrative Criteria … ."[10] On January 8, 2008, Alamogordo submitted its monitoring plan[11] to the OSE which the OSE approved on the same date.[12] At the district court hearing, the OSE Chief of the Water Rights Division, Jim Sizemore, had testified that granting Alamogordo's permit for up to 4,000 AFY, an amount greater than the 3,000 AFY originally permitted by the OSE, "promotes conservation of water," "is not adverse to the public welfare of the people of the State," and does not impair existing water rights.[13] Alamogordo's hydrologist, John Shomaker, had provided evidence that the "proposed pumping by Alamogordo … will not lead to impairment of any existing ground-water or surface-water right."[14]

In April 2008, after *de novo* hearing before District Court, the Court approved a permit issued by the NMOSE for the City to divert water from Snake Tank well field.[15] Under this court-

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[5] Settlement Agreement between Alamogordo, HFR, and Three Rivers (Alamogordo Exhibit 22).
[6] *Id*.
[7] *Id*. at 16-21.
[8] Settlement Agreement between OSE and Alamogordo (Alamogordo Exhibit 21).
[9] *Id*.
[10] *Id*.
[11] Letter from Brockmann to Teel (Alamogordo Exhibit 62).
[12] Letter from Teel to Brockmann (Alamogordo Exhibit 63).
[13] Direct Examination of J. Sizemore at 78, ll. 1-4, 14-18; 79, 1-8.
[14] Letter from Shomaker to Brockmann (Dec. 31, 2007).
[15] Minute Order (N.M. Dist. Ct. Apr. 22, 2003).

approved permit, the City can take up to 4,000 afy (3,200 afy of potable water) from the well field, with a potential increase up to 5,000 afy for any one year during drought, if circumstances warrant. The total cannot exceed 20,000 afy over a 5-year period (Twelfth Judicial District Court 2008). The District Court concluded that:

> *The Settlement Agreement entered into between the City of Alamogordo and the State Engineer, and the exhibit thereto, the Revised Permit, (Alamogordo Exhibit 21), are supported by the testimony of the witnesses called by the State Engineer and the City of Alamogordo, are based on sound hydrology, and represent a reasonable approach to satisfying the water planning needs of the City of Alamogordo, which does not cause impairment of other water rights and which is consistent with the public welfare of the State of New Mexico and would not be detrimental to the conservation of water in the state.*[16]

On November 3, 2009, after the Tularosa protestants appealed, the New Mexico Court of Appeals affirmed the District Court and found "substantial evidence" in support of the permits.[17]

On January 21, 2010, the New Mexico Supreme Court denied a petition for *writ of certiorari* appealing the Court of Appeals decision.[18]

WELL MONITORING

Revised permit T-3825 includes monitoring in the conditions of approval. Under condition 6 of the permit, the City shall propose and implement a monitoring plan and system that is acceptable to the NMOSE prior to the diversion of water under the permit. The monitoring includes measurements recorded in January and July of each calendar year for groundwater levels and the water quality parameter TDS. The wells will be monitored quarterly during the first two years of use and semi-annually thereafter. Reports are submitted to the NMOSE, in writing by January 31 and July 31. The NMOSE may suspend diversions of water if water levels or TDS levels reported indicate impairment of existing senior rights to divert water. Dedicated monitoring wells will be completed to depths specified by the NMOSE and drilled and equipped according to the monitoring plan for revised permit T-3825 approved by NMOSE.

The City is currently monitoring four wells within the Tularosa Basin. One well was drilled in 2001 and the other three in 2005. The depths of the wells vary between 710 feet and 1,147 feet from the surface. These wells will eventually be production wells and are located within the Snake Tank well field. The monitoring wells will be drilled once the production wells are being utilized.

Under condition 8 of revised permit T-3825 et al., the City must submit a formal Water Conservation Plan prior to the diversion of any water under this permit. The settlement agreement and conditions of approval are available in Appendix B.

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[16] *Id*. at 20-21.
[17] Memorandum Opinion (N.M. Ct. App. Nov. 3, 2009).
[18] Order (NM Supreme Ct. January 25, 2010

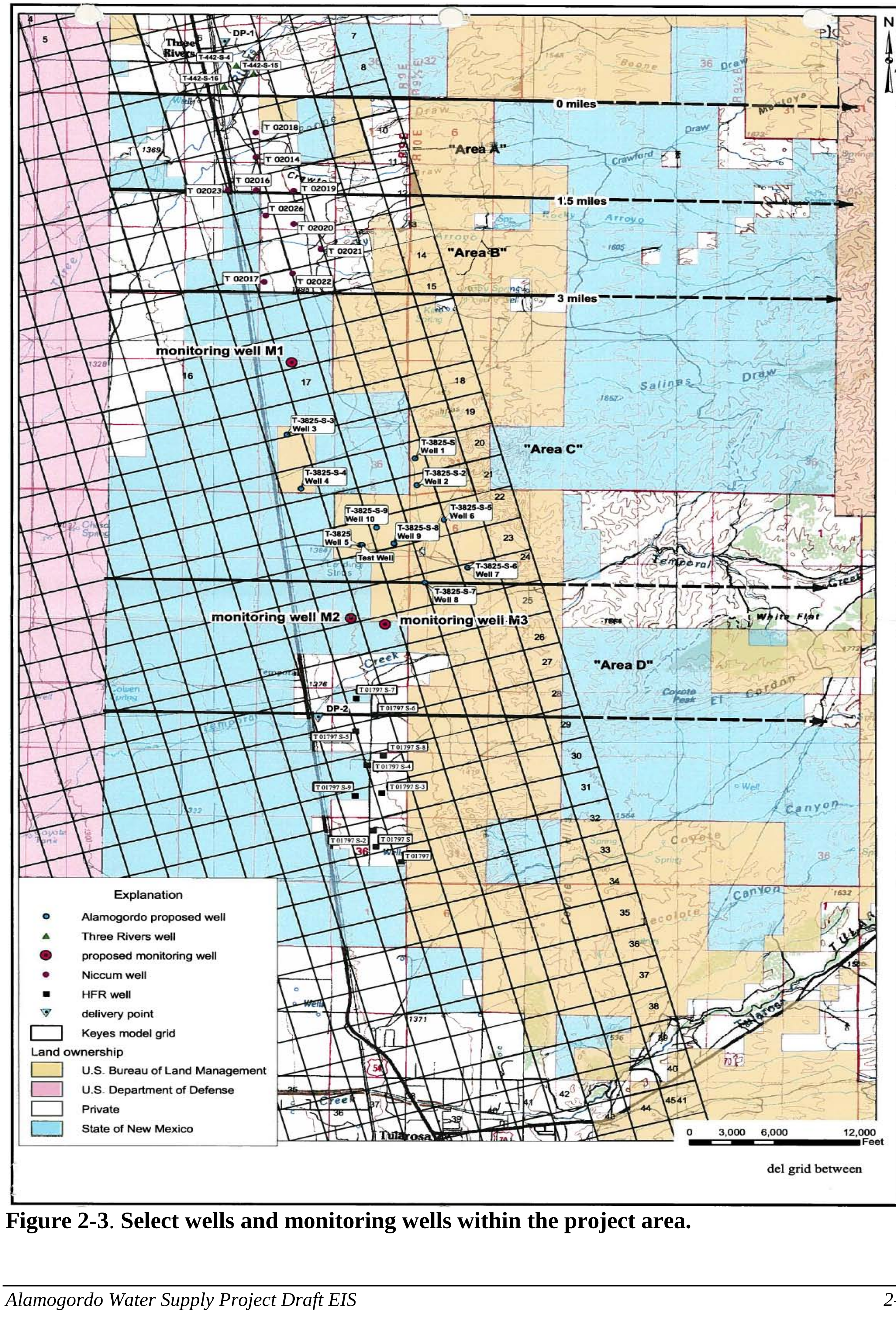


Figure 2-3. **Select wells and monitoring wells within the project area.**

DESALINATION FACILITY

Due to the salinity of the groundwater produced at the Snake Tank well field, the City would need to treat the water at a desalination treatment facility before delivery to Alamogordo residents. Water produced from the wells would be delivered to a desalination treatment facility located in Alamogordo through approximately 29 miles of high-density polyethylene (HDPE) or polyvinyl chloride (PVC) pipes of diameters ranging from 10 to 24 inches. This treatment facility would desalinate the water to acceptable total dissolved solids (TDS) levels to meet drinking water standards. The desalination facility would be located on lands owned by the City, directly across from the Tularosa Basin National Desalination Research Facility (Research Facility) on La Velle Road. Federal funding may be used for construction and operation of the facility through the Title XVI program.

A desalination facility would treat brackish well water using a process called reverse osmosis (RO) (Figure 2-4). RO produces fresh water by using pressure to force brackish water through a semi-permeable membrane. Under moderate to high pressure (100–200 pounds per square inch gauge [psig]), water is able to pass through the membrane, but dissolved solids (primarily salts) or other impurities in the water cannot. Depending on the porosity of the membrane, RO is able to remove particulate matter, dissolved solids, viruses, bacteria, suspended solids, or other ions in solution. Because the removed materials are in a much smaller volume of water, this treatment process produces two streams of water of different salt concentrations: the freshwater stream (or permeate) and the concentrated brine stream (or concentrate). To provide drinking water of acceptable taste, permeate, which is ultra-pure fresh water, would be blended with untreated brackish water to produce a blended product water, meeting acceptable drinking water standards (the City's goal of 800 mg/L TDS).

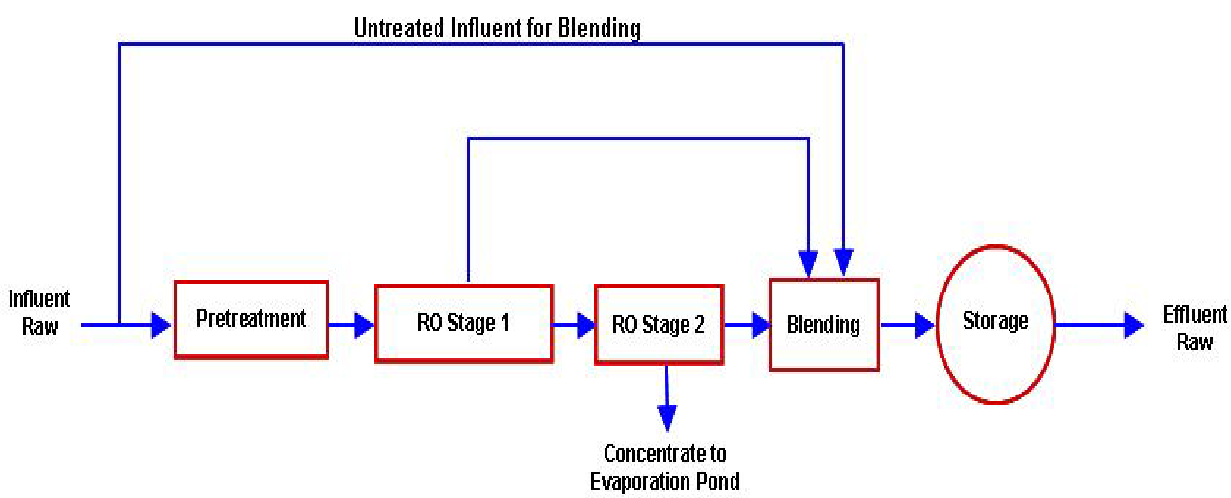


Figure 2-4. Reverse osmosis treatment process.

Figure 2-4 illustrates the steps of the desalination process, beginning with the brackish well (feed) water that would be pumped from the supply wells to the final treated fresh drinking water. First, brackish supply well water would be split into two streams. One small stream of brackish water would bypass the treatment process, and the other stream of brackish water would enter the RO system. The RO unit would remove the salt from the brackish stream and produce treated water. The water would be disinfected to meet water quality requirements and transferred to a storage tank to await distribution into the system.

The treatment facility would comprise several RO modules and structures containing pressure vessels for holding membranes, connected in parallel to produce freshwater permeate (see Figure 2-5). Figure 2-6 is a schematic footprint of the treatment facility buildings. The facility, including feed pumps, chemical feed pumps, cartridge filters, RO skids, cleaning equipment, electrical equipment and controls, and office space, would require approximately 12,000 square feet of floor space. The actual floor space would depend on the layout and workspace facilities provided at the facility. The RO building may also include facilities such as a conference room, locker rooms, a break room, a control room, a laboratory, a maintenance shop, and storage space.

Co-location With the Research Facility

The location of the Research Facility is a 99-acre site owned by and within the city limits of Alamogordo, northwest of the intersection of U.S. 70 and U.S. 54 on La Velle Road, at an elevation of about 4,290 feet. The Research Facility is under construction and will be operated as a partnership between Sandia National Laboratories and Reclamation. When complete, the facility will be used for a variety of research projects to test emerging desalination technologies, such as the effects of salinity of feed water, concentrate processing and salt use, desalination of surface water, and ways to reduce desalination cost.

Pre-treatment

The first phase of the RO system is a mild chemical pre-treatment to prevent the water from fouling or scaling the RO membranes. Fouling occurs when organic or biologic material collects on a membrane surface, decreasing permeate production (Zeiher et al. 2003). Scaling occurs when salts in the feed water concentrate on the membrane surface during the desalination process (Zeiher et al. 2003). The facility would use a typical pre-treatment process common to most RO systems: passing water through two or three 5-micron filter cartridges to remove sand, scale, and other large particles; introducing an anti-scaling agent at approximately 14 mg/L to prevent scaling from occurring; and adding a chemical buffering agent to increase pH to an acceptable level for introducing the water into the RO process.

Reverse Osmosis Unit

The final design of the RO unit would depend on the quantity and quality of feed water entering the system. Test-well data from the Snake Tank well field show TDS of the raw water at 2,220 parts per million (ppm) and chloride at 250 ppm (Livingston Associates 2003) (see Appendix F). For this EIS, a water quality in the range of 1,500 to 5,000 ppm TDS is assumed. The amount of raw water to be treated would be 4,000 afy and may rise to a maximum of 5,000 afy if warranted.

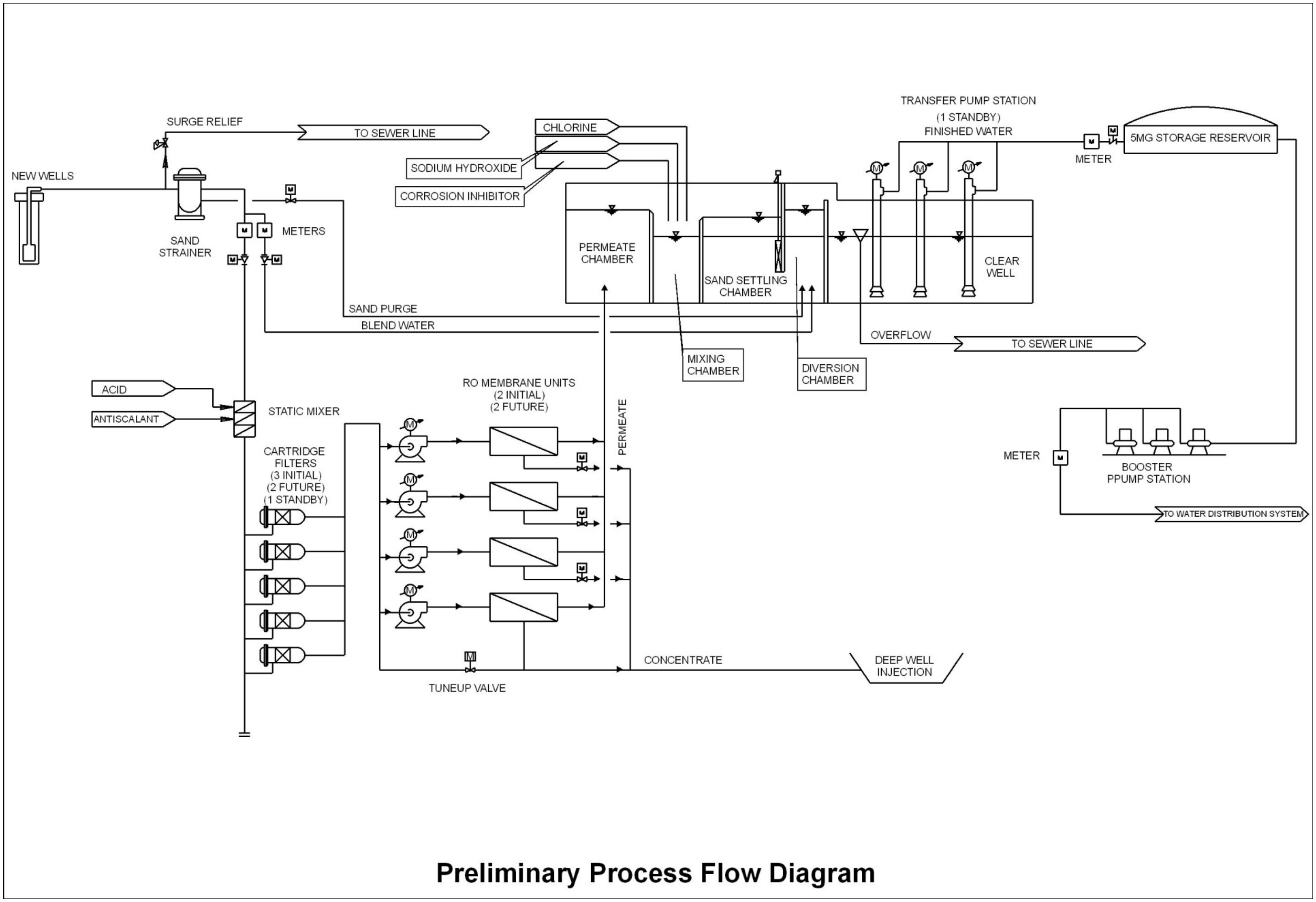


Figure 2-5. Preliminary process flow diagram.

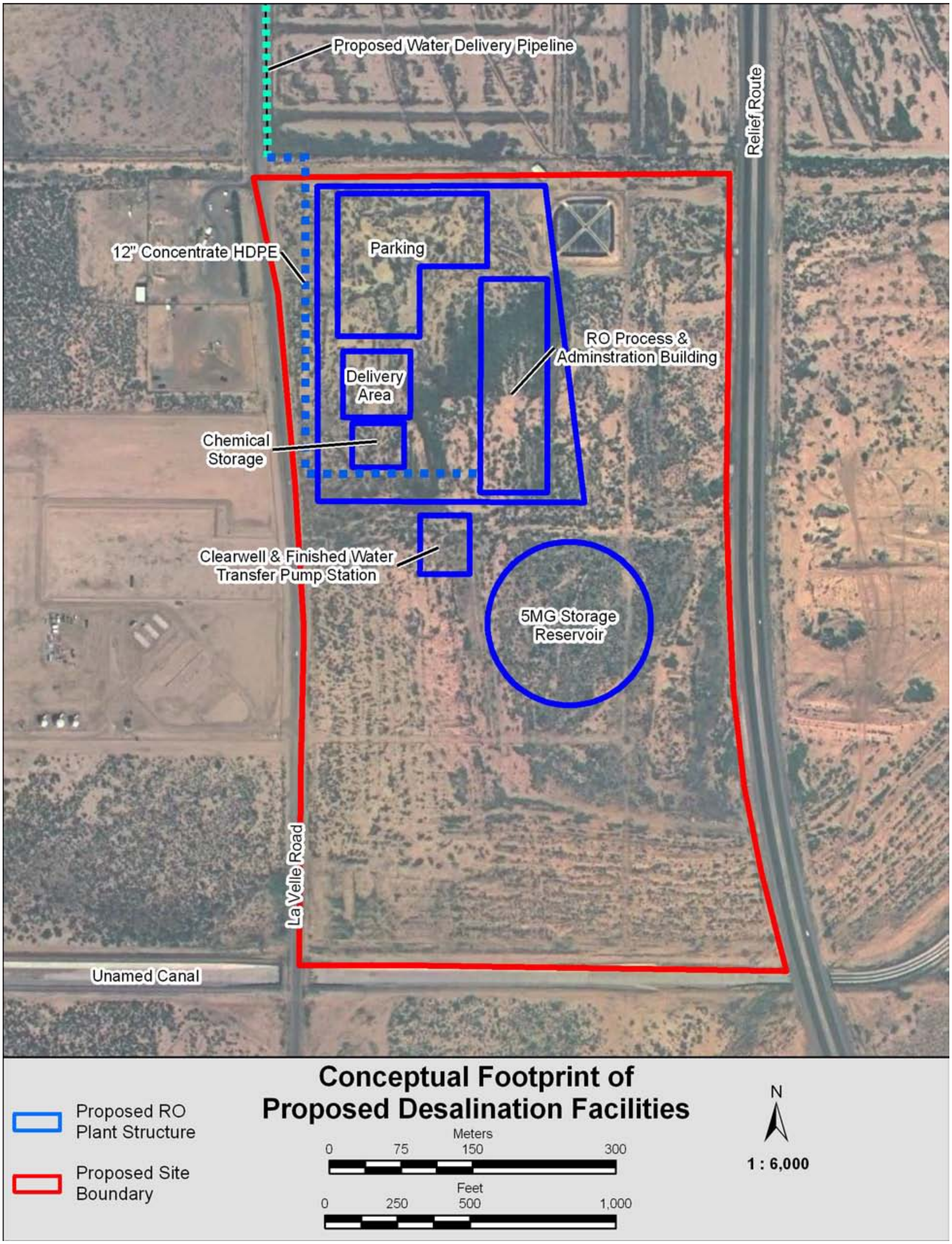


Figure 2-6. **Conceptual footprint of proposed desalination facilities.**

An RO unit comprises a series of membrane modules, each producing about 1.19 mgd. The modules would be required to treat the initial capacity of 2.9 mgd. The City would likely build for a maximum capacity of 5.8 mgd to accommodate for summer peaking and standby. Each module would contain pressure vessels—enclosed, tubular structures containing a series of RO membranes. RO membranes consist of thin-film composite/polyamides (TFC/PAs) in a spiral configuration that produces a series of layers that remove salt from the feed water passing through the membrane system. A standard RO membrane is 8 inches in diameter by 40 inches long.

Based on the pilot study feed water quality and antiscalant manufacturer's projections, a conservative estimate for the amount of fresh water to be recovered from the RO process is approximately 73 to 75 percent of the brackish feed water (Livingston and Shomaker 2003). The pilot study conducted by the City at the Snake Tank well field achieved a 69 to 72 percent recovery over a 45-day period, with an overall blended product recovery of 84 percent.

It is possible that not all RO modules would need to be in production at a given time. For example, per capita water use is lowest during the winter. During this decrease in demand, it would not be necessary to use all of the modules because the amount of treated water needed would be less, thereby reducing the cost of operation and prolonging the life of the modules.

PIPELINES

The well field pipeline system would receive flow from up to 10 wells through a 10-inch pipeline at a maximum rate of approximately 1,000 gpm per well, conveying water about 34 miles to the desalination facility located in Alamogordo. The transmission pipeline would move brackish well water directly to the desalination facility for treatment via a maximum 24-inch transmission line. There would be no well water storage; the entire flow would be processed directly from pipelines from the wells. The piping system would consist of American Water Works Association C-905 PVC, with 150 pounds per square inch (psi) service pressure rating. The well water transmission line generally follows the length of the Union Pacific Railroad (UPRR) tracks that run parallel to U.S. 54 to Alamogordo, and then follows the Relief Route to the desalination facility on La Velle Road. A breakdown of the distance the pipeline would travel based on land ownership can be found in Table 2-4.

TABLE 2-4. DISTANCE THE PIPELINE MUST TRAVEL THROUGH VARIOUS LANDS

LAND OWNERSHIP	DISTANCE (MILES)
UPRR	3.8
State Land	3.8
City of Alamogordo	1.1
BLM	5.2
Public Right-of-way	19.3
Private	1.1
TOTAL	**34.3**
SOURCE: Livingston 2003a.	

The blended water would be distributed into the City through existing distribution pipelines. A booster pump station at the desalination facility would be used to send the finished water from the facility site into the City water distribution system.

OPERATION AND MAINTENANCE

GROUNDWATER WELLS

The wells, well pumps, and pump power supply will require regular maintenance. Well maintenance activities will include monitoring of production and cleaning or periodic redevelopment of well screens. Monitoring wells are required by the NMOSE as a condition of the City's permit (condition 6). A supervisory control and data acquisition (SCADA) system will be used to automate operation and monitoring and minimize operator time. Pump maintenance activities may include cleaning, lubricating, replacing parts, or replacing pumps. Maintenance of pump housings, electrical enclosures and parts, and access roads may be necessary. Normal operation would require well pumps to be started and stopped depending on water supply needs, and start-up and blow-off will be required after a loss of power.

DESALINATION FACILITY

Desalination treatment facility operation and maintenance activities include monitoring the conductivity, pH, pressure, and other parameters of each flow stream to make sure that the desalination process is running properly and the membranes are not at risk of scaling or fouling. The cartridge filters used for pre-treatment must be changed and disposed of when the filters reach the maximum recommended pressure drop. The membranes will need to be cleaned at 6- to 12-month intervals and replaced approximately every 5 years. Cleaning the membranes consists of flushing them with cleaning solution at the manufacturer's recommended pressure, allowing the membranes to soak then flushing them with raw water to remove the cleaning solution. Pumps must be cleaned, inspected, and lubricated periodically and replaced approximately every 10 years. Other equipment, such as sensors and meters, must be maintained according to each manufacturer's specifications and periodically replaced. The system would require one or two certified water operators for operation, monitoring, and maintenance. Pump stations used for transport of finished water to distribution would also require some maintenance of pumps and related facilities.

The duration of operation of the groundwater extraction, treatment, and transfer facilities would vary in relation to the amount of surface water available for use. For example, during years when there is abundant snowpack in the mountains to feed the surface water supply, the facilities would not need to operate at full capacity. The ideal operation scenario is to continuously use the RO facility at some level as a supplement to the City's existing water supply.

PLAN OF DEVELOPMENT

The City prepared a plan of development to address appropriate authorizations, permits, and approvals; pipelines and trenching operations; roads; distribution of power; facility construction; staging areas; and preliminary maintenance and operations. The distribution of power would be required at each well site to run water pumps. The power lines would be constructed within the 50-foot grant area. All construction activities, including staging areas, are expected to be within the right-of-way. No temporary construction areas outside of the right-of-way are anticipated. Existing access roads would be used to access the work areas. Future maintenance activities on the roads would provide permanent access to the well sites. The roads would be flagged for the construction crews. The full plan of development is available in Appendix G. Figure 2-7 is a schematic of the proposed project easement based on the plan of development at the Snake Tank well field. Upon project authorization, necessary modifications would be made to the plan of development.

Concentrate Management: Deep-well Injection

Concentrate can be disposed of through deep-well injection, the process of pumping concentrate underground. Through the re-injection process, concentrate would be stored in a permeable layer or formation of porous rocks known as an injection zone. To avoid contamination of freshwater resources, a confining layer of impermeable rock or sediment would be required between the injection zone and the freshwater resource to act as a barrier. Figure 2-8 shows a cross-section of a deep-injection well, where the groundwater near the ground surface is fresh water and used as a water source. The well would have double casing in the freshwater aquifer to protect the aquifer from contamination.

The feasibility of the deep-well injection process largely depends on the geologic and hydrologic conditions of the area under consideration. For example, the presence of a zone beneath the surface that could receive and store concentrate and separate it from usable groundwater resources is required. The injection zone must have the proper porosity, permeability, and thickness to accommodate the projected rate of concentrate injection. A confining layer of rock or sediment is needed to ensure that concentrate is isolated from freshwater supplies.

Deep wells for brine concentrate disposal would be located at the desalination facility on La Velle Road or alternatively at the existing water reclamation (wastewater treatment) plant to the west. Groundwater conditions at both locations are suitable for deep-well disposal (JSAI 2009), and would help maintain groundwater levels in the area. This method conserves groundwater resources, as opposed to water loss by evaporation ponds. In addition, a portion of the concentrate may be blended with the reclaimed water and used for irrigation.

Energy and Resource Requirements

The power to operate the new facilities (including groundwater extraction, treatment, and transfer) would be supplied by the local power supplier, the Public Service Company of New Mexico (PNM). Power service to the desalination facility site and to wells and other pumping facilities would have to be provided as a part of this project. There are available sources of power near the proposed desalination facility that are readily accessible.

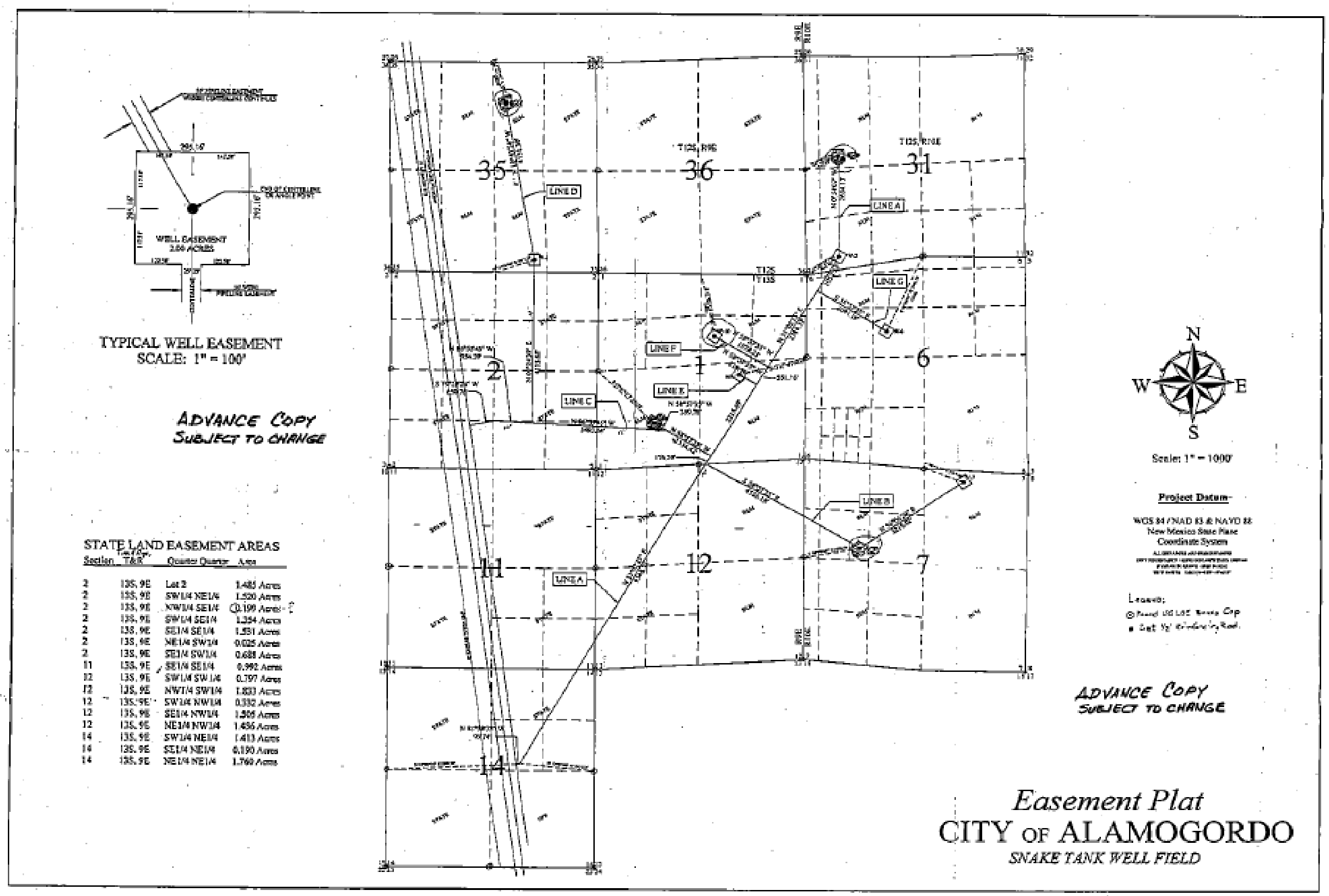


Figure 2-7. **Snake Tank Well Field plan of development schematic.**

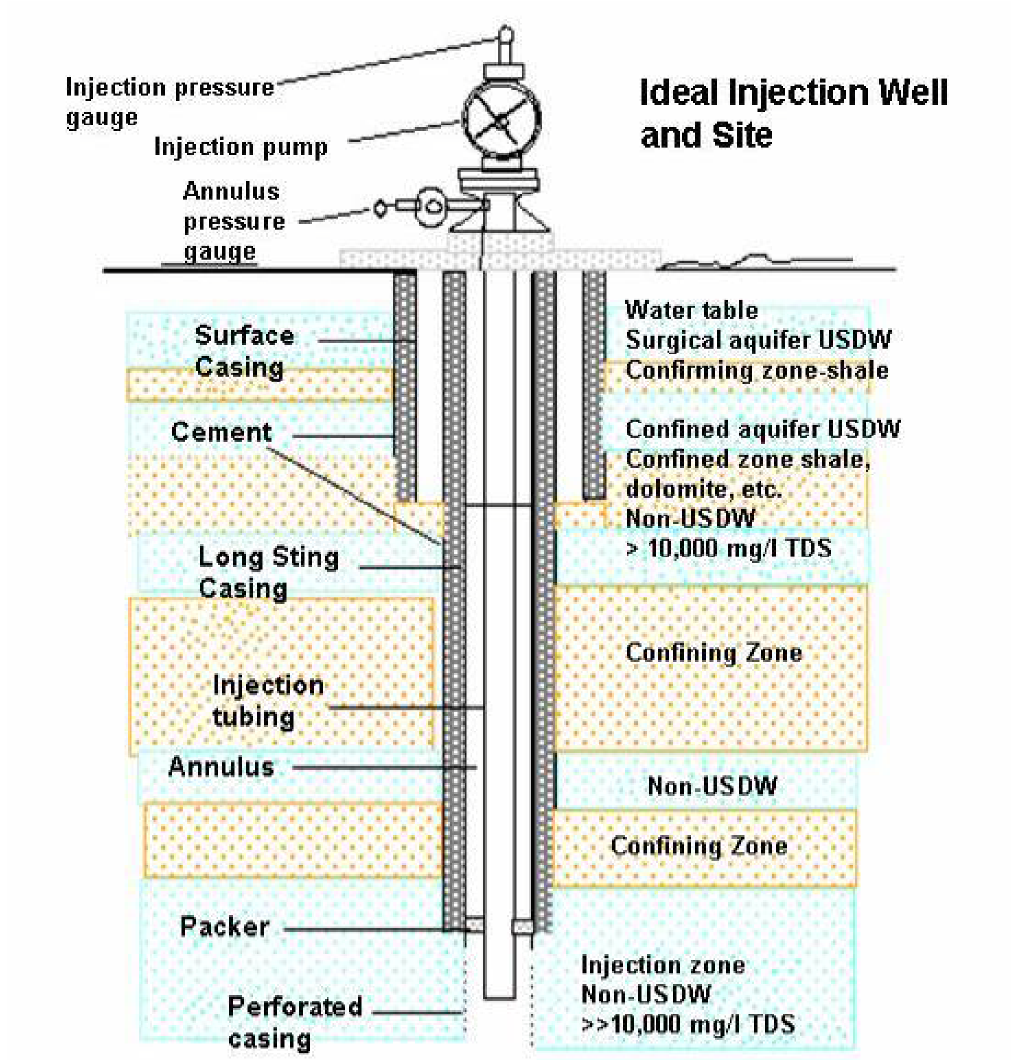


Figure 2-8. Deep-injection well schematic.

COST OF DESALINATION FACILITY AND PIPELINES

Capital costs have been estimated for construction of the RO facility, the 5-million-gallon water storage tank, and water conveyance from the wells to the facility and from the facility to Alamogordo. One facility and deep-well injection after 10 years is assumed in these cost estimates. The estimates, shown in Table 2-5, are in 2005 dollars. Recurring costs, including operation and maintenance, pond liner replacements, membrane replacements, and power costs, have been estimated and are shown in the Table as annual payments, also in 2005 dollars.

An amortized cost for facilities and pipelines has been derived based on a 40-year planning horizon for the initial facility construction and a 30-year planning horizon for the facility expansion (Table 2-6), using a discounting interest rate of 5.125 percent. This is the interest rate defined by the Water Resources Council (18 CFR 704.39) based on the average yield during the 2004–2005 fiscal year on interest-bearing marketable securities of the United States with terms of 15 years or more remaining to maturity (Natural Resources Conservation Service [NRCS] 2006).

TABLE 2-5. FACILITY COST ESTIMATES IN 2005 DOLLARS

ITEM	COST	COST BASIS
Phase 1 (Years 0–10)		
Capital Costs		
Raw Water Pipeline	$6,843,000	$12 per in-diameter per ft * 27 in * 21,120 feet
Finished Water Pipeline	$30,413,000	$12 per in-diameter per ft * 24 in * 105,600 feet
Finished Water Pump Station	$346,000	$2,000 per HP * 173 HP
Desalination Facility	$8,946,023	$2.00 per gpd permeate capacity * 4.76 mgd - $573,000 postponed membrane cost
5 MG Storage Reservoir	$1,800,000	5 MG steel tank, concrete slab, prime and paint
Concentrate Pipeline	$420,000	$168 per foot for 12-inch line * 2,500 feet
Deep-well Injection	$5,000,000	Two wells at $2.5 million each
Subtotal Phase 1 Capital Costs	**$53,768,023**	
Operation and Maintenance (O&M) Costs		
Desalination Facility	$476,000	$0.20 per year per gpd permeate * 2.38 mgd
Deep-well Injection	$150,000	
Finished Water Pump Station Energy	$140,200	$0.1241/KWH * 173 HP * 0.7457 KW/HP * 8760 hrs/yr
Finished Water Pump Station Maintenance	$40,000	$40,000 per year
Subtotal Phase 1 O&M Costs	**$806,200**	
TOTAL – Phase 1 Costs	**$54,574,223**	
Phase 2 (Years 11–40)		
Capital Costs		
Desalination Facility	$573,000	$240,700 per mgd * 2.38 mgd
Deep-well Injection	$2,500,000	One well at $2.5 million
Subtotal Phase 2 Capital Costs	**$3,073,000**	
Operation and Maintenance (O&M) Costs		
Desalination Facility	$952,000	$0.20 per year per gpd permeate * 4.76 mgd
Deep-well Injection	$225,000	
Finished Water Pump Station Energy	$140,200	$0.1241/KWH * 173 HP * 0.7457 KW/HP * 8760 hrs/yr
Finished Water Pump Station Maintenance	$40,000	$40,000 per year
Subtotal Phase 2 O &M Costs	**$1,357,200**	
TOTAL – Phase 2 Costs	**$4,430,200**	

NOTES: gpd = gallons per day; MG = million gallon; HP = horsepower; KW = kilowatt; KWH = kilowatt hour; mgd = million gallons per day.

Energy cost is the current cost of power for municipal use in Alamogordo from the Texas–New Mexico Power Company.

Pump station maintenance cost, pipe construction cost, and pump station construction cost are unit values according to cost history on previous Camp, Dresser, & McKee, Inc. (CDM) projects and adjusted for the Alamogordo area, according to a professional CDM cost estimator, assuming no rock excavation or expensive site work. Pipeline alignment is next to the highway, not through city streets.

Cost per gpd permeate for facility construction and facility and pond operation is based on cost history on previous CDM projects, including actual construction cost of City of El Paso–Fort Bliss Water Utilities Joint Desalination Facility.

TABLE 2-6. ANNUALIZED COST SUMMARY

ITEM	**AMORTIZED ANNUAL COST**	**PAYMENT PERIOD**	**FACTOR USED**
Phase 1 (Years 0–10)			
Capital Cost – Year 0	$3,551,900	40 years	(A/P, 5.125, 40) = 0.059242
O&M Cost – Years 0–10	$806,200	10 years	None
Subtotal – YEARS 0–10*	**$4,358,100**		
Phase 2 (Years 11–40)			
Capital Cost – Year 11	$775,500	30 years	(A/P, 5.125, 30) = 0.065981
O&M Cost – Years 11–40	$3,073,000	30 years	None
Subtotal – YEARS 11–40**	**$3,848,500**		
TOTAL – Phases 1 and 2	**$8,206,600**		

NOTES: *In year 10, the annual finished water production is estimated to be 1,307 million gallons. The cost per 1,000 gallons (excluding well construction and operating costs) is $3.43.
** In year 40, the annual finished water production is estimated to be 2,617 million gallons. The cost per 1,000 gallons (excluding well construction and operating costs) is $2.29.

CITY WATER RIGHTS TO TRANSFER

In New Mexico, a water right is a constitutionally protected property right that can be sold or moved. It is the legal right to place water to beneficial use for a specific purpose of use, at a specified place of use, in a specified amount, from a specified point of diversion, with a specific priority date. Surface water rights could be established prior to the first Water Code in 1907 by initiation and use of the water, but after 1907, the New Mexico State Water Code requires a permit to appropriate surface water or to transfer a surface water right, i.e., change the point of diversion, place of use, or purpose of use. With respect to groundwater, water rights could be established through the initiation and use of groundwater prior to the declaration of a groundwater basin by the NMOSE.[19] After the declaration of a groundwater basin, State law requires a permit for new appropriations of groundwater and for the transfer of groundwater rights. Applications for a new appropriation or transfer of surface or groundwater rights must be submitted to the NMOSE, provide a legal notice to the public by publication in a local newspaper of general circulation in the county in which the diversion or use occurs, be subject to objection and protests, and be evaluated pursuant to specified statutory criteria by the NMOSE either after an administrative hearing if the application is protested or without a hearing if there are no protests.

The City filed 10 applications (one for each well) for “Application(s) for Permit to Appropriate the Underground Waters of the State of New Mexico” with the NMOSE in September 2000. The wells were number T-3825 through T-3825-S-9 and sought a new appropriation of groundwater in the Tularosa Basin. The applications were amended in January 2002 and April 2003. The applications requested the right to drill 10 wells, producing up to 1,500 afy of brackish groundwater per well, that would be desalinated through RO with the resulting potable

[19] A surface water right can be perfected after 1907 and a pre-basin groundwater right can be perfected after the declaration of a groundwater basin by the NMOSE if the water right was initiated prior to the NMOSE’s jurisdiction and the appropriator proceeds with reasonable diligence to place the water to beneficial use.

water being used for municipal, industrial, commercial, or irrigation purposes. The applications were protested, and an administrative hearing was held in October 2003 (NMOSE 2005a). The NMOSE issued a decision and granted Permit No. T-3825 et al. on December 28, 2004, which was appealed. Trial *de novo* was held before the Twelfth Judicial District Court in January 2008 with the District Court issuing Revised Permit No. T-3825 et al. on April 7, 2008 (Twelfth Judicial District Court 2008). Protestants appealed the district court's decision. On November 3, 2009, the New Mexico Court of Appeals affirmed the District Court and found "substantial evidence" in support of the permits. The District Court's Revised Permit No. T-3825 et al., is a valid, exercisable permit. Pursuant to the District Court's Revised Permit No. T-3825 et al., the City has the right to divert up to 4,000 afy from the 10 wells in the Snake Tank well field, and divisions for any calendar year may be increased up to 5,000 afy, provided that the sum of annual diversions for any consecutive 5-year period does not exceed 20,000 acre-feet.

During the course of District Court litigation on Permit No. T-3825 et al., the City agreed to reduce its "paper water rights" on its groundwater sources to more closely reflect actual groundwater production from existing wells. The City agreed to file a Proof of Beneficial Use on the La Luz well field, NMOSE File No. T-32-S-2 through T-32-S-9, limiting the total number of groundwater rights from that groundwater source to 3,000 afy, down from a "paper water right" of 4,573 afy. The 3,000 afy approximates the City's maximum historical diversions from the La Luz well field and what the La Luz well field is able to produce hydrologically. For the same reasons, the City agreed to reduce the "paper water rights" on the Prather wells from 1,354 afy to 500 afy, the quantity that can actually be produced. With these agreements, the "paper water rights" on all existing City groundwater sources matches the production capability of the wells, meaning the City has no excess groundwater rights beyond what is currently being used.

With respect to surface water rights, the City primarily has rate rights to take a specified number of cubic feet per second (cfs) of surface water if and as long as it is available. The City fully utilizes whatever surface water is available on an annual basis and the City has no excess surface water rights available for transfer.

MAXWELL SPRING

Maxwell Spring is a tributary of Temporal Creek and is located approximately 1.75 miles east of the proposed Snake Tank well field on the High Nogal Ranch (Figure 2-9). The owners of the ranch have filed an application for a permit to appropriate 1,613.0 afy from Maxwell Spring. The City filed a protest to the application. The City and the ranch owners subsequently reached a settlement whereby the City agreed to purchase water from the Maxwell Spring in the event the ranch owners' application was approved. A final decision on the application has yet to be rendered. The settlement provides in part that in the event the application is approved, provided the permitted amount is 300 afy or more and the Maxwell Spring produces this minimum amount (subject to the approval of the NMOSE), the City will purchase up to the permitted water amount before utilizing the water obtained from the Snake Tank well field. No plans have been developed for the transmission of this water. The likely route would necessitate the construction of a pipeline and associated 50-foot easement that would at some point intersect with the pipeline and easement connecting existing wells.

ENVIRONMENTAL MANAGEMENT

All applicable permits would be obtained separately by the City prior to implementation of the project. All vehicles involved in project activities would have emission control equipment that has passed state emissions tests. A fugitive dust permit would be obtained from local municipalities if necessary, and Best Management Practices (BMPs), such as wetting down disturbed areas to minimize dust, would be followed during project activities.

Each individual operator would be briefed on and would sign off on local environmental considerations specific to the project tasks, including a Storm Water Pollution Prevention Plans (SWPPPs). SWPPPs would be prepared after project approval and prior to construction. Following submittal of the SWPPP to the EPA, a notice of intent (NOI) form under a construction general permit (CGP), would be provided for certification. Following construction, a notice of termination (NOT) would be completed.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

This section describes several alternatives that were eliminated from detailed analysis in this EIS. Some of these alternatives were considered as a result of public scoping. Alternatives were evaluated against the purpose and need identified. Each of these alternatives was eliminated because they do not meet the City's identified water needs; are not within the BLM's permitting authority; do not meet the NMOSE's granting of groundwater withdrawal to the City, or do not meet the Purpose and Need of this EIS.

2.3.1 ALTERNATIVES FOR WELL FIELD LOCATIONS

Comments received during the public scoping period suggested that the City identify groundwater wells to be located at sites other than the Snake Tank well field. A basin-wide analysis was undertaken to identify alternative locations within the Tularosa Basin where well fields could be located that would meet the identified purpose and need of the project (Appendix H).

Actions connected to the proposed project but outside the BLM jurisdiction include the location of groundwater diversions and amount of groundwater permitted by the NMOSE; grant approval and funding from Bureau of Reclamation; and groundwater monitoring and management agreements between the city and the NMOSE. Although the BLM is not a party to these agreements, the BLM has, and will continue to work closely with these agencies to ensure the proposed project is compatible with the regulatory requirements and jurisdictional responsibilities of each.

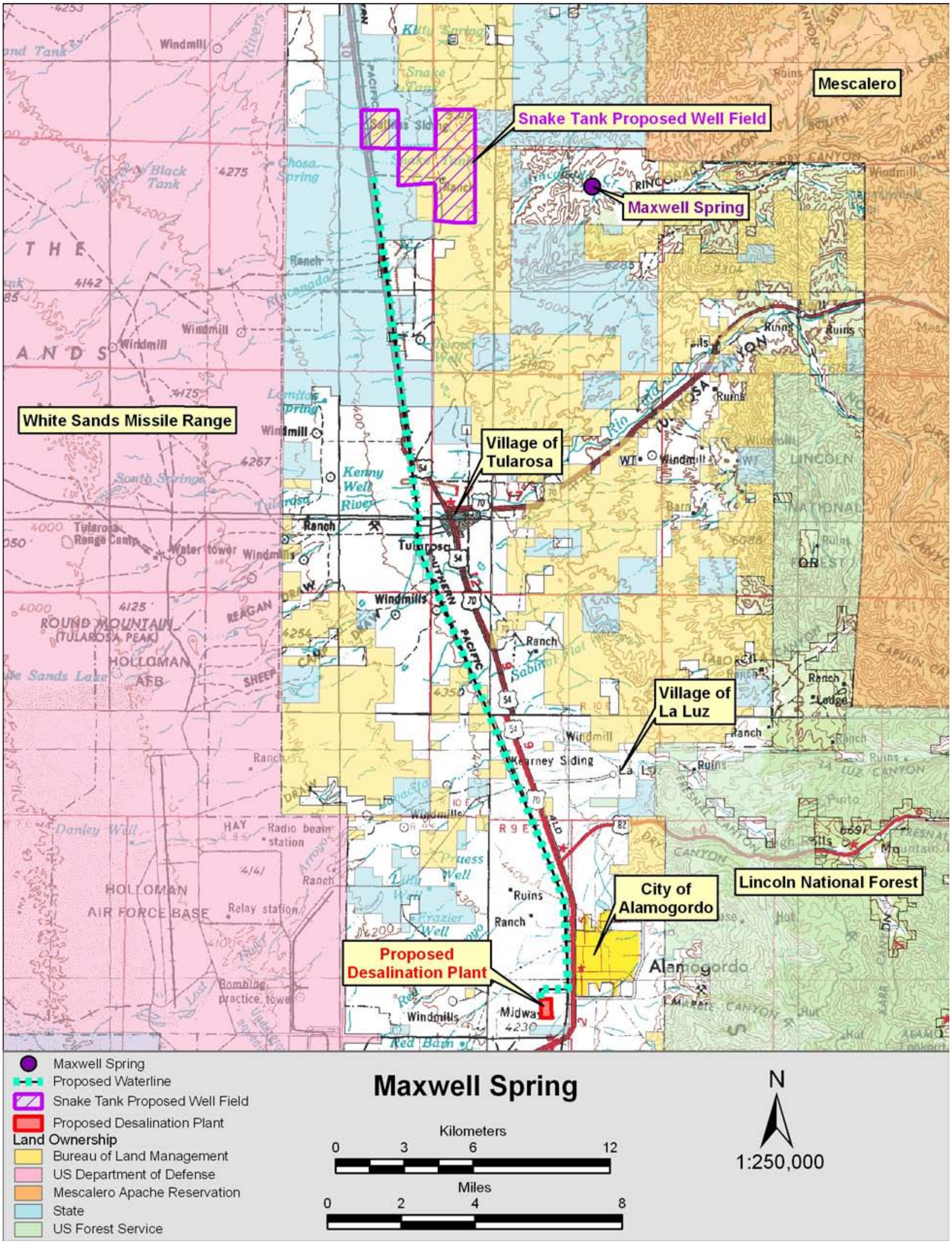


Figure 2-9. Maxwell Spring Ranch.

Four criteria were used to screen potential locations to develop a drinking water resource within the area of evaluation: the quality, quantity, accessibility, and recoverability of groundwater. Using a geographic information system (GIS), these data were combined to identify locations within the Tularosa Basin that would be favorable for developing a water resource through the installation of groundwater wells. In addition to the Snake Tank well field, three other potential sites were identified (Figure 2-10):

- Alvarado well field
- Grapevine Canyon well field
- White Sands Missile Range (WSMR) Headquarters well field

These sites were evaluated by the City as alternative well sites; however, they were eliminated from further analysis following the NMOSE granting of water rights at the Snake Tank well field location.

2.3.2 ALTERNATIVE WATER RESOURCES

The City of Alamogordo analyzed a variety of alternative water resources to determine which options would meet the 2045 water demand. The following options were analyzed by the City prior to obtaining the 4,000 afy water rights granted by the NMOSE. The BLM has eliminated these alternatives from further analysis based upon the conclusions of the study that show these alternatives would not meet projected demand and the fact that some of the alternatives would be beyond the decision-making authority of the BLM.

AQUIFER STORAGE AND RECOVERY

Underground aquifer storage and recovery (ASR) is a method of storing excess surface water underground and recovering the stored water when needed. ASR would enable the City to divert excess off-peak water stream flow to a special well for injection into the aquifer for storage (Resource Conservation and Development Council [RCDC] 2002). During winter months when the demand for water is relatively low, this process would allow the City to store water underground for later use when demand for water is higher.

The City conducted an ASR study to evaluate the feasibility of this alternative (Livingston 1996). The purpose of the study was to evaluate the potential for using excess spring flows for re-injection into the underground aquifer for future extraction and use. Approximately 78 percent of the City's water supply comes from surface water, resulting in the need to store as much as 8,932 afy of excess spring water through ASR. A 30-day pilot ASR well injection program was implemented, and approximately 21 million gallons of treated surface water were injected into the aquifer using the City's La Luz Well No. 6 (Livingston and Fitch 1998). A groundwater flow model was developed to simulate conditions for storing water near the City's La Luz well field. The model estimated that the City could recover 58 percent of the water stored through ASR (Livingston 1996).

These preliminary results assumed that excess water would be available for storage. However, a period of below-average rainfall later showed that this approach would not be viable because excess water would not always be available to store underground (Figure 2-11). The absence of a dependable supply of water to store for future use caused the City to abandon ASR as an option for providing more water. ASR was eliminated from further analysis because the method would not provide a sustainable drinking water resource for the City of Alamogordo.

CONTINUED CONSERVATION

Conserving water from the City's current water system was suggested during public scoping as an alternative. As explained in the No Action Alternative, the City has adopted an aggressive program to conserve water from its existing water supply system. As defined in the City's 40-year water plan, educational programs, rebates for replacing existing plumbing fixtures, landscaping restrictions, change in the water rate structure, and other strategies would help the City maintain its per capita water use goal of 165 gpcpd (Livingston and Shomaker 2006). However, because this ongoing practice of managing water resources uses existing water supplies, continued conservation would not provide the additional water needed to meet the projected demand, nor would it reduce the demand on the current surface water source. Therefore, this alternative was eliminated from detailed analysis.

FLOOD CONTROL AQUIFER RECHARGE

The City is currently developing flood control projects in the north and south parts of town. The $55 million Alamogordo Flood Control Project, expected to be completed in 2009, would consist of three diversion channels (South Channel, McKinley Channel, North Channel) designed to divert runoff from the Sacramento Mountains. Water collected in this system would be directed to a detention basin, which could help recharge the aquifer by allowing the water to infiltrate the ground surface.

According to the Tularosa Basin and Salt Basin Regional Water Plan (Livingston and Shomaker 2002a, 2002b), a rough estimate indicates that about 500 to 1,000 afy could be recharged. This small amount of water would not be sufficient to meet the Alamogordo/Tularosa water demand, but a flood control aquifer recharge option could be one component of a larger watershed management strategy. However, as with other watershed management approaches, drought could limit the effectiveness of this option and compromise the ability to recharge the water supplies. Therefore, this alternative was eliminated from further analysis.

IMPORTING WATER

Importing water from another municipality or state could allow the City to obtain potable water and minimize the impacts to resources within the study area. One suggestion during public scoping was that the City could import water from Texas, where other municipalities or entities could supply up to 10,000 afy of water to the City. An inter-basin transfer would be required for the City to obtain water from outside of the Tularosa Basin.

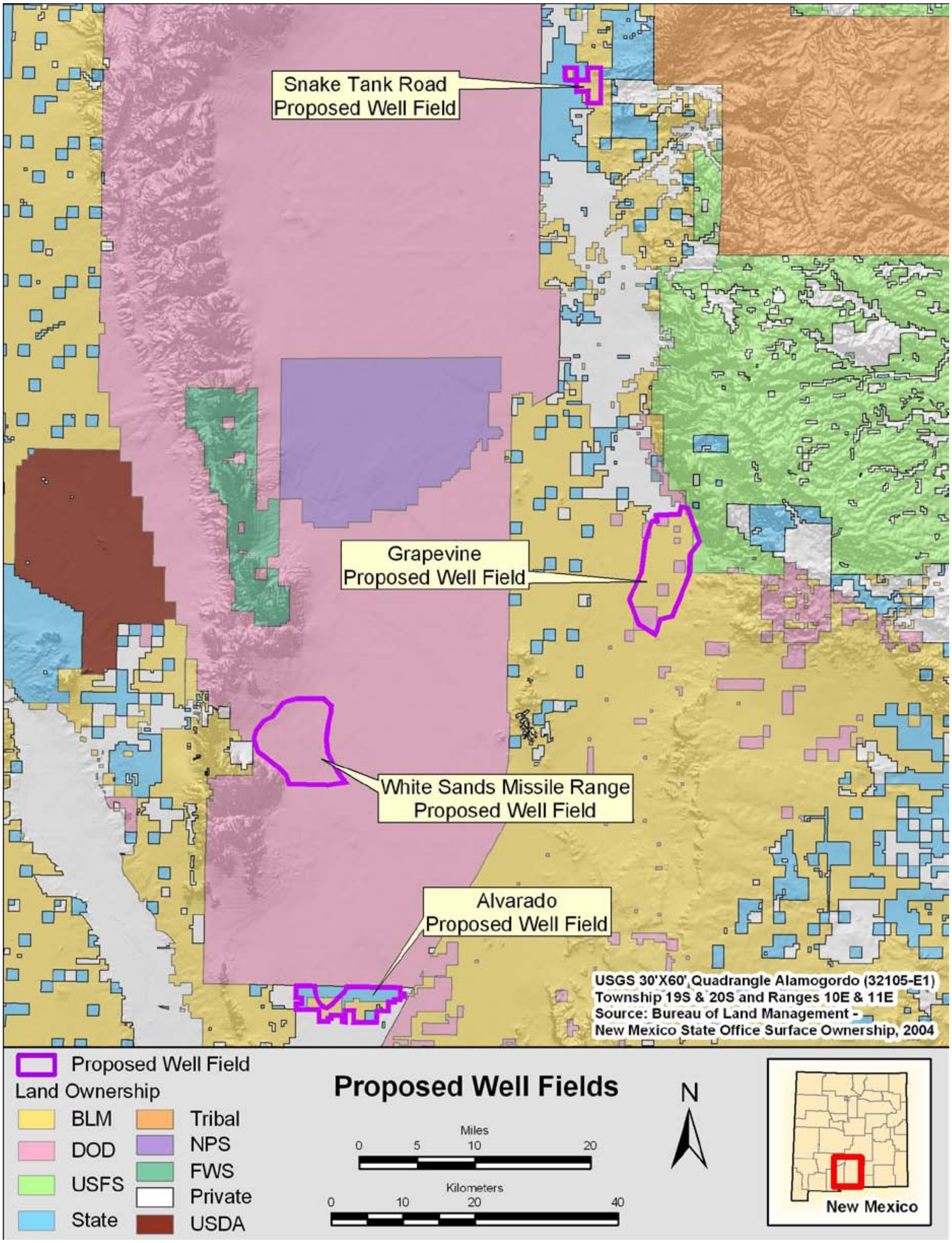


Figure 2-10. Well field locations.

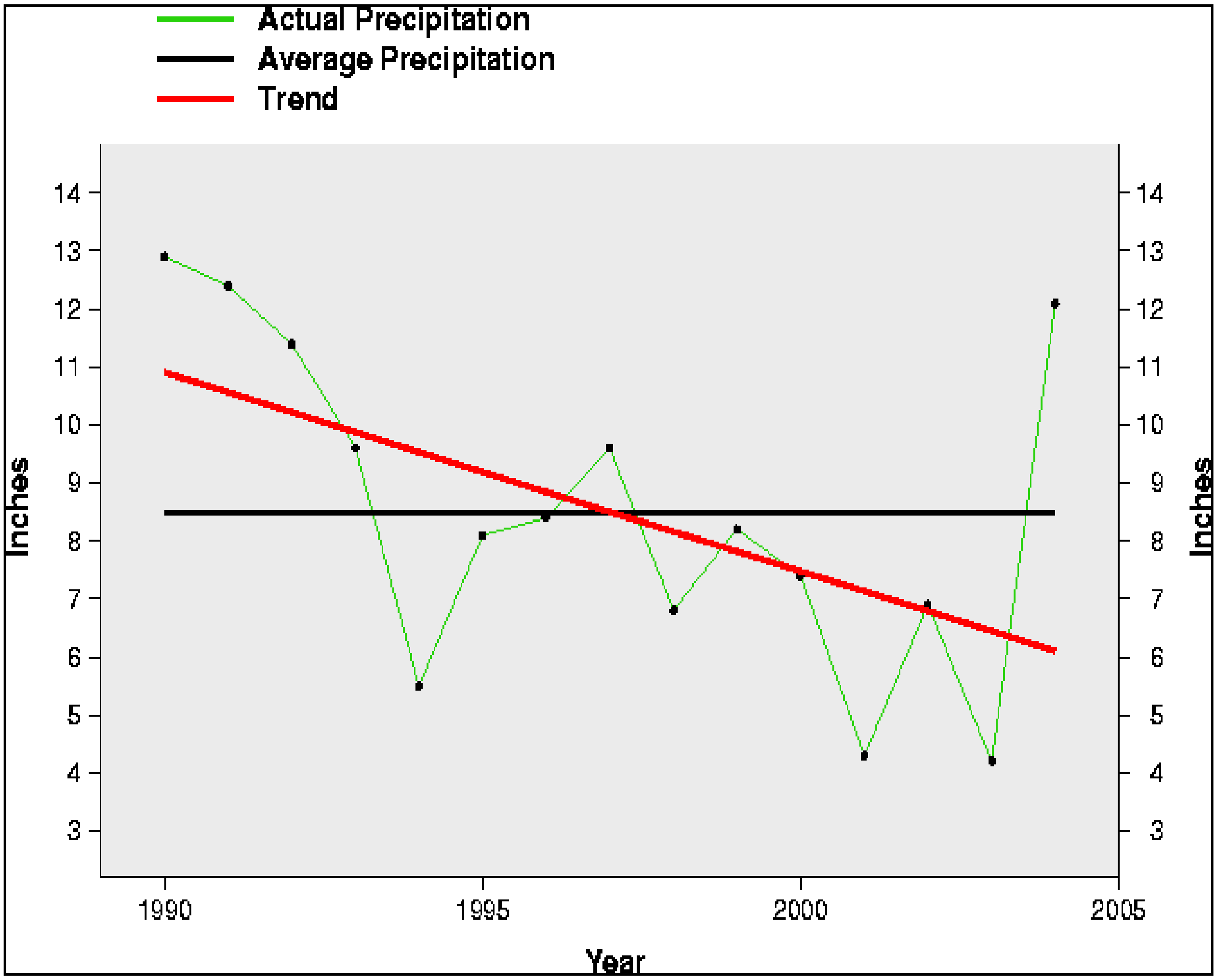


Figure 2-11. **Annual precipitation, El Paso, Texas, 1990–2005 (Source: National Oceanic and Atmospheric Administration [NOAA] 2005).**

By obtaining water from a municipality in Texas, such as the City of El Paso, the City would be able to obtain drinking water and reduce the impact on groundwater resources within the Tularosa Basin. However, to deliver this inter-basin supply, the City would need to transport the water by truck or rail or construct a water transmission pipeline. Constructing an inter-basin water delivery pipeline to import water from outside the Tularosa Basin would disturb a larger portion of land than the alternatives being evaluated. Further, transporting water by car or by rail would not be a reliable method of delivery. As a result, the inter-basin transportation or transmission of water from communities outside the Tularosa Basin, including communities in the state of Texas, would not be a feasible alternative and was eliminated from further analysis.

CLOUD SEEDING

Cloud seeding is an attempt to increase the amount or type of precipitation released from clouds by dispersing a substance into the air that allows condensation droplets or ice crystals to form more easily. Cloud seeding has been used in the United States and internationally as a water management tool to enhance precipitation or winter snowpack in mountainous regions. Since the 1960s, Reclamation has been conducting weather modification research, including the effectiveness of cloud seeding.

As described in the Tularosa Basin and Salt Basin Regional Water Plan (Livingston and Shomaker 2002a, 2002b), pilot studies for cloud seeding have yielded mixed results. Over several decades of research, most cloud seeding experiments have shown variable results and inconclusive evidence of increased precipitation on the ground. According to a policy statement on planned and inadvertent weather modification by the American Meteorological Society, "*Precipitation augmentation through cloud seeding should not be viewed as a drought relief measure*" (American Meteorological Society 1998). As a result, weather modification in the form of cloud seeding was eliminated from further analysis because the actual available water supply gained from using this technology is not expected to be sufficient to meet the City's water need.

WATERSHED MANAGEMENT

For the purpose of this EIS, the term "watershed management" applies to methods that serve to enhance the recovery of surface water runoff within a given drainage area for use as a drinking water resource. Methods identified during public scoping included eradicating invasive salt cedar (*Tamari ramosissima*) trees, which use an abnormally high amount of water per tree, and harvesting surface water runoff following storm events. This alternative includes the removal, replacement, and control of vegetation on land surrounding the City to increase the amount of surface water that recharges the groundwater aquifer. Because the types of vegetation, soils, geology, and topography in forested areas affect surface water recharge to the groundwater aquifer, modifying these conditions within a watershed could make water available to the City for drinking water purposes but could reduce the water source for vegetation. The adverse effects on vegetation could be substantial and result in unnecessary impacts. In addition, surface water would be subject to drought conditions and would not provide a reliable source of water for the City. Therefore, this alternative was eliminated from further analysis.

TULAROSA CREEK RESERVOIR

The Tularosa Community Ditch Corporation (TCDC), a nonprofit corporation that provides water to agricultural users in the Tularosa area, and the Village of Tularosa have been working on plans to divert water from the Tularosa Creek through a pipeline to a reservoir (the Tularosa Creek Reservoir) for storage and later use as a water supply source (Livingston and Shomaker 2002a, 2002b). Original plans by the NMOSE to construct a reservoir date to 1957, and the TCDC owns approximately 87 percent of the water rights in the creek. Tularosa Creek drains a portion of the western slope of the Sacramento Mountains, and the Village of Tularosa obtains its municipal water supply almost entirely from this creek and often purchases water from the TCDC (Livingston and Shomaker 2002a, 2002b). Diverting water from Tularosa Creek would not provide a reliable water resource due to the unreliability of surface water resources in the region; therefore, this alternative was eliminated from further analysis.

RECLAIMED WATER

Reclaimed water is treated wastewater that is recycled for use as a non-potable water supply, typically for irrigation purposes. Public comments suggested that reclaimed water be used by the City to offset or replace the need for additional water resources. The City has had a reclaimed water program in place since the mid-1990s. Recognizing that potable water was too scarce, the City installed pipelines and pump stations to deliver treated wastewater to the City's golf course, recreation fields, zoo, and other public parks (Schmittle 2005). The reclaimed water system includes 16.2 miles of pipeline, 2 booster stations, and a future 1-million-gallon storage tank (Schmittle 2005). An increase in reclaimed water for non-potable uses would not help the City meet the demand for potable water; therefore, this was not considered an option.

Although the City currently uses reclaimed water for public areas to offset water used for landscaping and irrigation, one public comment suggested treating effluent water from the City sewage treatment facility to drinking water standards and delivering the treated effluent as potable water to municipal customers. The NMED has not identified state standards to regulate such systems. Without current standards, this alternative is not considered feasible.

WATER RIGHTS

The City considered three options for modifying its current water rights program: 1) maintaining the existing points of diversion; 2) changing the points of diversion; and 3) transferring Agricultural water rights to municipal use. These alternative approaches are discussed below and were all eliminated from detailed analysis.

MAINTAIN EXISTING POINT(S) OF DIVERSION TO EXISTING CITY WELL FIELD(S)

Maintaining the existing point(s) of diversion would include acquiring both water rights and property easements, or the right to use land, for the purpose of constructing and maintaining water transmission pipelines. These pipelines would connect existing wells to a municipal water delivery system. This approach assumes that an adequate amount of water rights would be obtainable within a reasonable geographic area to minimize the number of distribution lines. For example, wells closer to one another would require fewer pipelines to connect them to a main delivery system compared to a series of wells spread far apart. The feasibility of this approach was examined by identifying the highest concentration of groundwater diversions per unit area within the Alamogordo region using information from the Water Administration and Technical Engineering Resource System (WATERS) from the NMOSE (NMOSE 2005b) (Figure 2-12). This analysis indicated that the highest concentration of water rights per square mile within the Tularosa Basin occurs near the Village of Tularosa, within the NMOSE Administrative Area.

To implement this approach, the City would have to retire approximately 340 individual existing water rights in this roughly 54-square-mile area and develop infrastructure to connect each existing well to a main delivery system. This approach is likely not a feasible alternative due to the anticipated environmental impacts of constructing a large network of pipelines as well as obtaining additional approval from NMOSE to retire the water rights and was therefore eliminated from detailed analysis.

CHANGE POINT(S) OF DIVERSION TO EXISTING CITY WELL FIELD(S)

Changing the point of diversion to an existing City well field would allow the City to use existing City water wells and pipelines and avoid developing additional infrastructure. This alternative assumes that sufficient water would be available at an existing well field to put additional water rights to beneficial use. As part of this approach, the City would need to make any necessary improvements to existing wells. For example, the City could transfer water rights to its existing La Luz, Prather, Golf Course, Landfill, or Cemetery irrigation wells, assuming that additional water could be produced at those locations.

Although transferring unused water rights to existing wells would help the City meet interim water supply needs, this approach would not provide enough water to meet the anticipated demand in 2045. Moreover, per the District Court Order (Twelfth Judicial District Court 2008), this alternative cannot be pursued. Therefore, this alternative was eliminated from detailed analysis.

TRANSFER OF AGRICULTURAL WATER RIGHTS TO MUNICIPAL USE

This alternative would involve the purchase or lease of existing agricultural water rights from willing sellers to meet the projected demand of 10,842 afy by the year 2045. The City would not use the NMOSE-approved 4,000 afy of groundwater rights at Snake Tank well field. Instead the City would purchase and/or lease 3,398 afy of water rights from willing sellers to meet the total demand of 10,842 afy by the year 2045. This may involve construction of additional groundwater wells and pipelines to distribute the water to a water treatment facility and eventual customers. It would also require approval from NMOSE for conversion of purchased and/or leased water rights from irrigational use to municipal use.

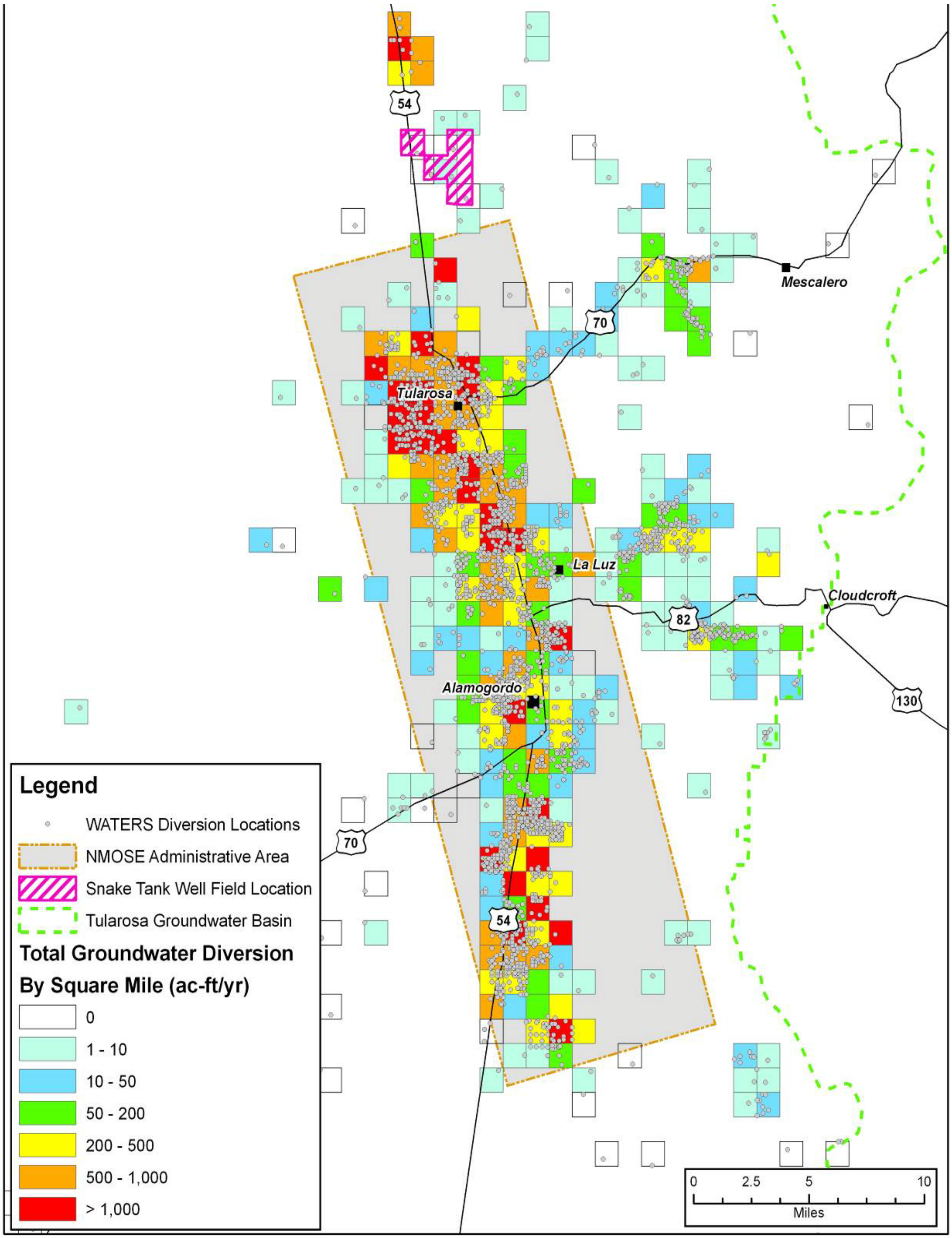


Figure 2-12. Groundwater diversions near Alamogordo.

This alternative was not further analyzed due to its speculative nature and technical feasibility. The implementation of this alternative is speculative due to the unknown availability and location of willing sellers of existing water rights. Due to the uncertain location, quantity and quality of the existing water rights, it would not be possible to determine the locations of groundwater wells, pipelines and other necessary facilities or the associated impacts of their development. It is also unknown whether the available water rights would necessitate the construction of a desalination facility due to a TDS level above 800 mg/L. The potential impact to the regional economy would also be speculative due to the lack of information on current use of existing water rights. It is also uncertain whether there are adequate existing and available water rights to meet the 2045 demand. Therefore, this alternative cannot be fully developed and it is unknown if it would meet the identified purpose and need.

This alternative may also be technically infeasible due to the particulars of transferring agricultural water rights to municipal use. Many of the existing water rights that might be available for sale or lease would be identified as irrigational use. When water rights are transferred from irrigation use to municipal, industrial, or other non-irrigation uses, only the consumptive portion of that right is calculated as the transferable amount. Because only the consumptive portion of the water right is convertible for municipal use, about 40-percent of the right is lost (non-convertible). For example, if the assumed diversion requirement for 1 acre of land is 4.17 afy per acre (afy/ac), then the consumptive irrigation requirement (CIR) is 2.50 afy/ac. Therefore, the consumptive portion is about 0.6 (2.5 afy/ac ÷ 4.17 afy/ac = 0.6). With the approval of the NMOSE, a water rights holder with 1,000 acres of irrigated land with water rights that have been put to beneficial use would have a water right of 4,170 afy. If converted to municipal, industrial, or other non-irrigation use, that water right would represent 2,500 afy. In order for the City to acquire the accurate amount of water to meet the expected future needs, it would be necessary to either purchase or lease an amount of water that is 1.6667 times the actual amount required (1.6667 represents the inverse of 0.6) if the water being leased or purchased is currently being put to beneficial irrigation use. The amount of land fallowed as a result of the lease or purchase of this water would remain the same. To supply the entire additional water requirements of the City, most of the farmland (approximately 3,000 acres) from Tularosa to Alamogordo would need to be removed from production and their water rights converted. Because of the distances between farms and the need for water treatment, this alternative is currently considered impractical and not feasible for a long-term City supply. (Information derived from Regional Water Plan 2002).

2.3.3 ALTERNATIVE WATER TREATMENT TECHNOLOGIES

Alternative technologies for treating saline water were eliminated from further analysis because their environmental impacts are expected to be essentially the same as the evaluated alternatives. Each of the number of water treatment technologies available for treating saline water to drinking water standards shares the same basic principle of removing materials from the water that do not meet drinking water standards.

Other water treatment technologies were also considered for treating mildly brackish water. As part of a pilot study, the City evaluated the feasibility of several desalination technologies for treating mildly brackish water to drinking water standards. The Desalination Feasibility and

Pilot Project Phase 1 and Phase 2 Report (Livingston and Shomaker 2003) (see Appendix F) provide more information about this pilot test and the other technologies that were considered.

2.3.4 ALTERNATIVE SITES FOR TREATMENT FACILITIES

The siting of the desalination facility with the research facility, as described under Alternative B, was selected based on available land area and location along a practical pipeline route from the Snake Tank well field to Alamogordo. Alternative locations for the treatment facility were also evaluated, but were eliminated from detailed analysis as they offered no environmental advantage to the proposed project and for the reasons described below.

SNAKE TANK FACILITY LOCATION ON STATE LAND

A site on the west side of U.S. 54, just south of the well field was considered for location of the desalination facility. The land is under the jurisdiction of the State of New Mexico (Figure 2-13). Land management and ownership were reasons for eliminating the Snake Tank Facility site from further consideration. By considering but eliminating this location from further consideration, the City preserves numerous archaeological sites that would have been disturbed and avoids potential threatened and endangered species habitat that is not found at the co-location site near the Research Facility.

SCHOLLER SPRING FACILITY LOCATION

The Scholler Spring Facility site is on the west side of U.S. 54 north of Tularosa Creek. The land is mostly privately-owned, with a small portion under State jurisdiction (see Figure 2-13). This site was identified in the City's Draft Fatal Flaw Analysis Report (McKinney and Martinez 2002).

The Scholler Spring Facility site would require booster pumps to pipe the groundwater from the Snake Tank well field to the site. Costs of pumps would be substantial and would make this site economically infeasible. Land management and ownership were additional reasons for eliminating the Scholler Spring site from detailed analysis. The site is on private land that may not be available for purchase or lease and could require lengthy negotiations with the owners.

ALLEN DRAW FACILITY LOCATION

The Allen Draw Facility site is located just west of U.S. 54 and south of Tularosa Creek with its eastern boundary along the UPRR tracks. The land is mostly privately-owned, with some portions under State trust land and BLM-managed land (see Figure 2-13). This site was identified in the City's Draft Fatal Flaw Analysis Report (McKinney and Martinez 2002).

The Allen Draw Facility site would result in similar booster pump needs as the Scholler Spring Facility site. Furthermore, about 2 miles of additional piping would be needed from this site to reach customers to be served in the Village of Tularosa, making this alternative site economically infeasible. Finally, the private ownership of the Allen Draw Facility site could require lengthy negotiations with the landowners before it could be leased to the City.

2.4 SUMMARY COMPARISON OF ENVIRONMENTAL IMPACTS

This section provides a comparison of the environmental effects of each alternative that is evaluated in this EIS. A summary comparison of the impacts is provided in Table 2-7 at the end of this section.

2.4.1 ALTERNATIVE A – NO ACTION

The No Action Alternative describes what would occur if the proposed project was not implemented and serves as a basis for comparing impacts of the alternatives. Under the No Action Alternative, no change is assumed from the current supply of water resources, which does not imply a static level of water use within the region of influence. Rather, the No Action Alternative describes conditions that would be expected to occur, with reasonable certainty, if the City were to continue to rely on existing resources to meet current and future drinking water demands.

As a baseline for comparing alternatives, the No Action Alternative assumes that the City would continue to enforce water use conservation and rationing measures, reclaim non-potable water supplies, and maintain existing groundwater wells and infrastructure.

Continued use of fresh groundwater resources under the No Action Alternative would be expected to continue to cause aquifer drawdown. Without developing saline water, the City would continue to pump the limited fresh water from the aquifer.

Continued conservation and use of limited freshwater resources would not supply the City with an additional 3,398 afy of water by the year 2045. Therefore, the City would continue to be susceptible to drought and would be expected to fail to supply sufficient drinking water to meet current or future demand. Under the No Action Alternative, the City would continue to use their existing surface water and groundwater rights. However, these water rights would continue to be directly affected by variability in precipitation and inevitable periods of drought. These water sources would continue to be inadequate to satisfy the present or future demands of the City. As a result, the City would likely need to seek emergency drought relief assistance, perhaps from the Federal or the State government, to provide water to community members.

2.4.2 ALTERNATIVE B—PROPOSED ACTION

Pumping from the Snake Tank well field would increase drawdown by more than 100 feet in the immediate area of the Snake Tank well field. Model-predicted drawdown after 40 years at the nearest wells is approximately 190 feet for the Christopher Well (T-04316) and 73 feet for the HFR Well (T-01797-S6) (JSAI 2006). This pumping would increase the potential for loss of water column within existing groundwater wells, impairing the existing groundwater rights more likely than if the well field is not developed. Some wells in the vicinity of the Snake Tank well field may require deepening in order to maintain constant pumping rates after groundwater levels decline in response to the pumping. Brackish water intrusion or the increasing presence of salts in fresh water could also increase with pumping. Pumping mildly brackish water at the Snake Tank well field could draw more saline water into the area, which could elevate the concentration of salts in existing wells. In addition, drawdown from pumping could cause subsidence in the area surrounding the well field because groundwater would be removed from the saturated subsurface. Reduced pumping in other regions would have the beneficial effect of decreasing groundwater drawdown near the original place of use of water rights sold or leased to the City.

Construction of the desalination facility would occur on 99 acres of previously disturbed City-owned land within the City's limits. The site has been used as a dumping ground in the past and is co-located with the Research Facility. Concentrate can be disposed of through deep-well injection, the process of pumping concentrate underground. Through the re-injection process, concentrate would be stored in a permeable layer or formation of porous rocks known as an injection zone. Target injection zones should have TDS concentrations equal to or greater than the injected brine. Additionally, injection zones should be permeable enough to accommodate excess water and be separated from aquifers with fresh water by a confining layer (JSAI 2009). The local hydrogeologic setting provides a confining layer that is suitable for injection of concentrate (JSAI 2009) (Appendix I).

To avoid contamination of freshwater resources, a confining layer of impermeable rock or sediment would be required between the injection zone and the freshwater resource to act as a barrier. The well would have double casing in the freshwater aquifer to protect the aquifer from contamination.

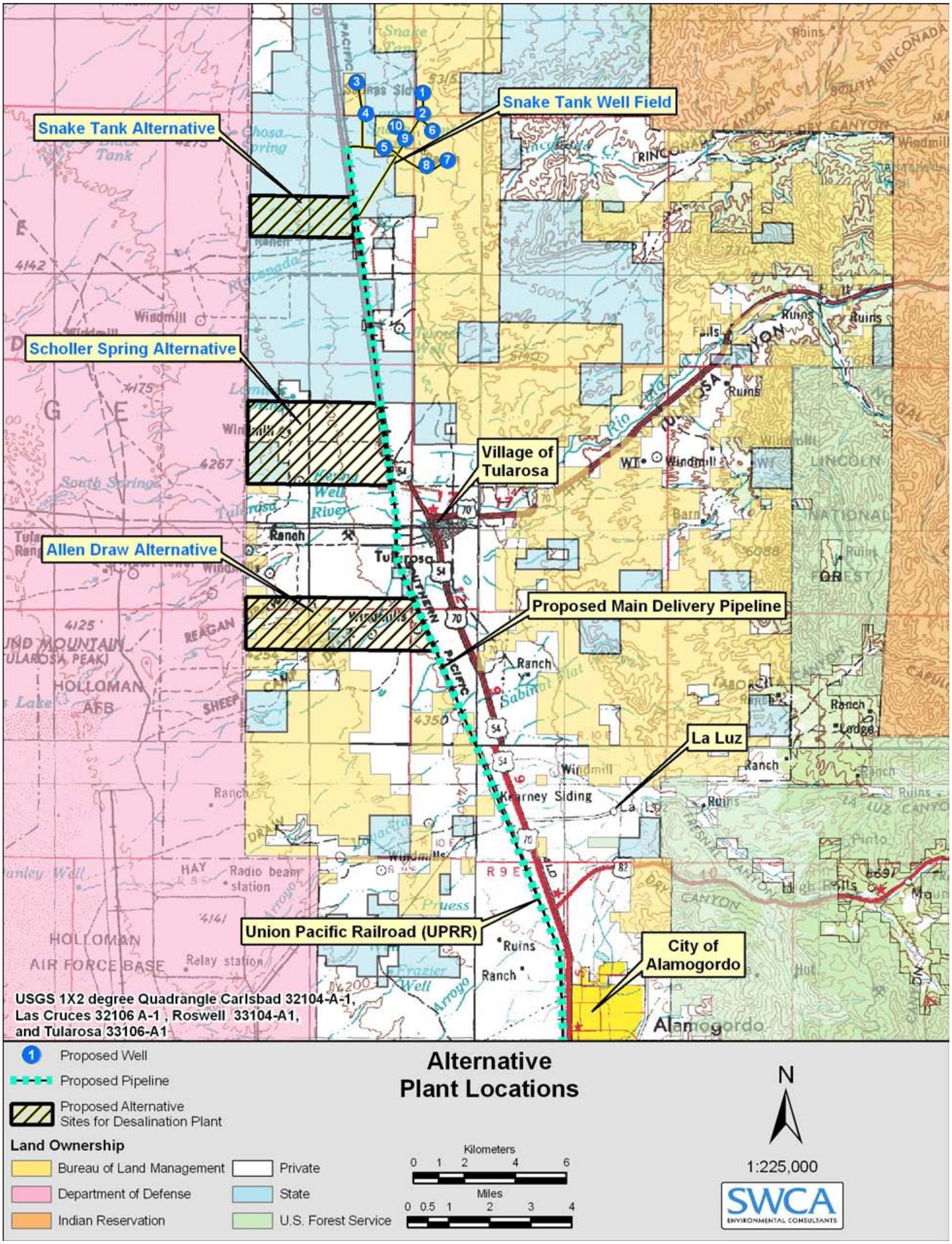
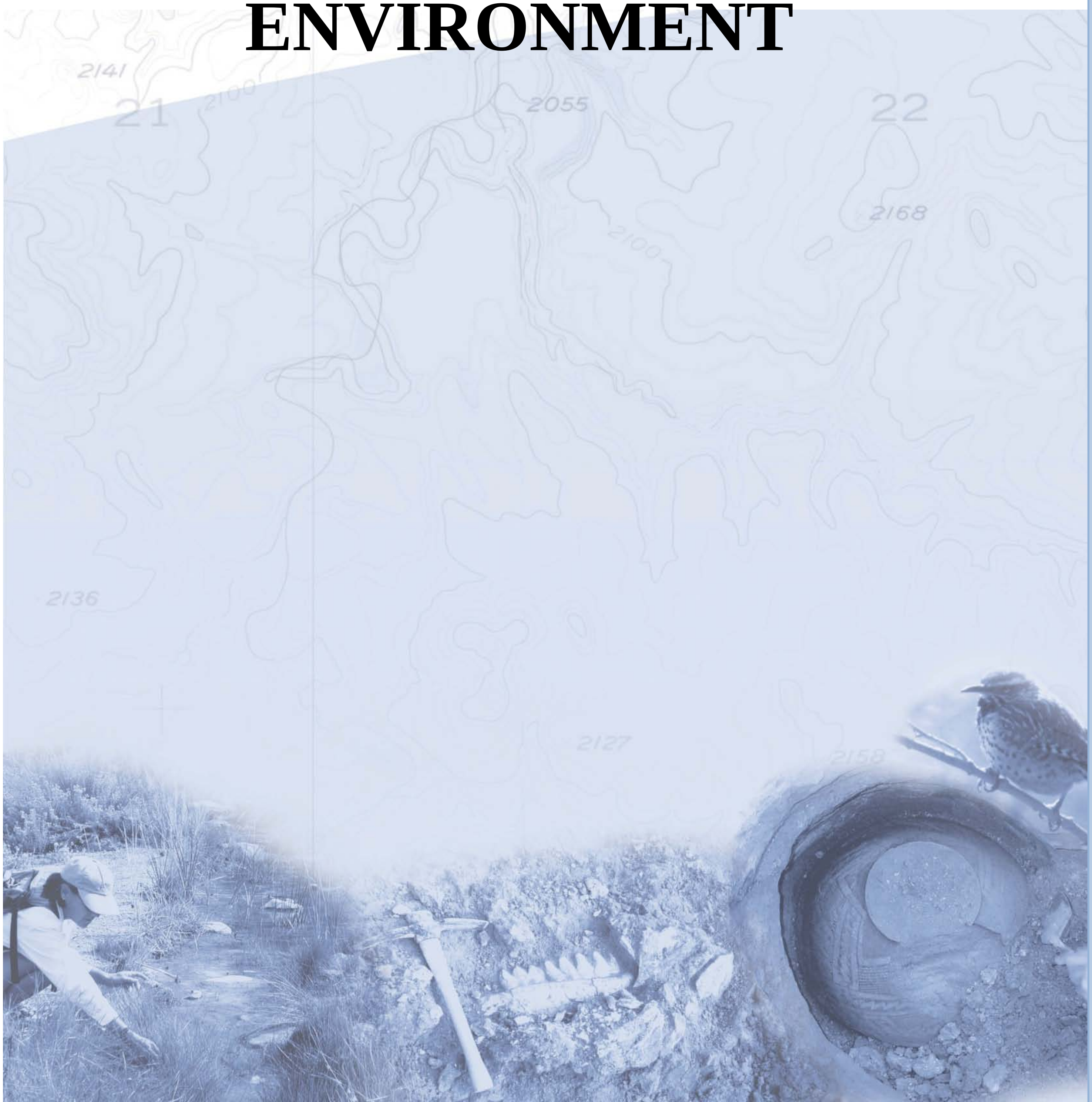


Figure 2-13. Alternative facility locations for desalination facility.

TABLE 2-7. IMPACTS SUMMARY		
RESOURCE	**ALTERNATIVE A – NO ACTION**	**ALTERNATIVE B – PROPOSED ACTION**
Water Resources – Surface Water	Reduction in downstream surface water flows and springs	Minimal effects on surface water
Water Resources – Groundwater	Groundwater table by 45 to 90 feet	Groundwater table drawdown by a few feet to more than 100 feet – JSAI Model; potential for depletion of groundwater wells near or at Snake Tank well field over time (Appendix H); extreme drawdown would only occur at or within a foot or two of the pumped well.
Geology	Potential local land subsidence	Increased potential for land subsidence, specifically near the Snake Tank well field
Soils	No impacts	Temporary soil disturbance (260 acres) and increased potential for wind and water erosion
Biological Resources – Plants	No impacts	Temporary disturbance of 111 acres of vegetation; permanent loss of 69.5 acres of vegetation; increased potential for spread of noxious weeds
Biological Resources – Wildlife	No impacts	Temporary and permanent habitat loss (see plants); temporary construction disturbance
Biological Resources – Special Status Species	No impacts	No affect to Sacramento prickly poppy (*Argemone pleiacantha* ssp. *pinnatisecta*) (endangered) and northern aplomado falcon (*Falco femoralis*) (endangered)
Cultural Resources	No impacts	Direct impacts to potentially eligible properties
Socioeconomic Resources	No impacts	Up to 638 acres of agricultural land fallowed
Transportation	No impacts	Temporary construction traffic and pond cleaning traffic on U.S. 54
Air Quality	No impacts	Temporary construction emissions; long-term vehicle emissions
Climate Change	No impacts	Temporary construction emissions contribute hydrocarbons to the atmosphere; long-term pumping and treatment works emit greenhouse gasses

3.0 AFFECTED ENVIRONMENT



3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter describes the general setting of the study area in 2006 and the resources that would be affected by implementation of any of the alternatives. The affected environment described in this Chapter provides a baseline for the analysis of environmental consequences in Chapter 4. Resource categories discussed in this Chapter were identified through public scoping and agency input.

The affected environment includes two areas: 1) the immediate Alamogordo and Tularosa area and 2) the region within the Tularosa Basin (Figure 3-1). The immediate area includes the well field north of Tularosa, the desalination facility location in Alamogordo, and the associated corridor along the Union Pacific Railroad tracks and U.S. 54. While the focus of this EIS is on the Alamogordo to Tularosa corridor, some alternatives may lead to regional impacts outside of the immediate geographic area or throughout the Tularosa Basin.

3.2 RESOURCES NOT AFFECTED

The following resources would not be affected by implementation of the proposed project:

- **Fire Management.** Some fire management activities have been implemented in the study area, but ongoing or future fire management would not be affected by either of the alternatives.
- **Recreation Resources.** The study area does not contain any recreation facilities and offers minimal opportunities for recreation. Neither of the alternatives would affect recreation facilities or opportunities in the Alamogordo/Tularosa region.
- **Timber Resources.** There are no known timber resources in the study area. Neither of the alternatives would affect timber resources or production.
- **Wind Resources.** This resource category refers to wind availability as it relates to renewable energy production. Wind power is the kinetic energy of wind or the extraction of this energy by wind turbines. The study area has a Wind Power Class rating of 1 (the lowest), with a poor wind resource potential. Neither of the alternatives would affect wind resources.
- **Wild Horses and Burros.** This resource category refers to BLM land where known and managed populations or herds of wild horses or burros occur. There are no wild horses or burros currently within the study area. Burros in this area were removed more than 10 years ago under the White Sands Resource Management Plan. Neither of the alternatives would affect wild horses or burros.
- **Wild and Scenic Rivers.** This resource category consists of rivers that have been designated wild and scenic under the National Wild and Scenic River Act. There are no wild and scenic rivers within or adjacent to the study area. Neither of the alternatives would affect wild and scenic rivers.
- **Prime or Unique Farmlands.** Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and/or

oilseed crops, and is also available for these uses. Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as soybeans or sorghum. No prime or unique farmlands were identified within the study area. Neither of the alternatives would affect prime or unique farmland.

- **Wetland or Riparian Areas.** Wetlands include permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions. Riparian areas are locations where land and water form a transition from aquatic to terrestrial ecosystems along streams, lakes, and open water wetlands. No wetland or riparian areas were identified within the study area. Neither of the alternatives would affect wetland or riparian areas.
- **Wilderness Areas.** This resource category includes land formally designated as wilderness or managed as wilderness under the Wilderness Act of 1964. No lands in the study area have been designated as wilderness. Neither of the alternatives would affect wilderness areas.
- **Caves.** The study area does not contain any known caves or cave resources. Neither of the alternatives would affect caves.
- **Fossils.** Although fossils are known to occur in the region (Pray 1961), none are expected to be affected by either of the alternatives.
- **Seismicity.** Seismicity is not expected to be affected by the extraction, treatment, or distribution of groundwater. Neither of the alternatives would affect seismicity.
- **Mineral Resources.** The study area has potential to contain oil and gas resources (New Mexico Bureau of Geology and Mineral Resources 2006). Neither of the alternatives would affect the extraction or production of mineral resources.

3.3 AFFECTED RESOURCES

This section describes the existing environmental conditions in the study area for resources that could be affected by the proposed project. These resources include water resources, geology, biological resources, cultural resources, Indian Trust Assets (ITAs), socioeconomics, land use, transportation, air quality, and visual resources. A list and description of Federal laws pertinent to each resource is found in Appendix J.

3.3.1 WATER RESOURCES

This section describes surface water and groundwater resources in the study area, with a focus on the eastern margin of the Tularosa Basin. This discussion includes both surface water and groundwater sources used by the Villages of Tularosa and La Luz, the City, Holloman Air Force Base (AFB) and White Sands Missile Range (WSMR), and surrounding portions of north-central Otero County.

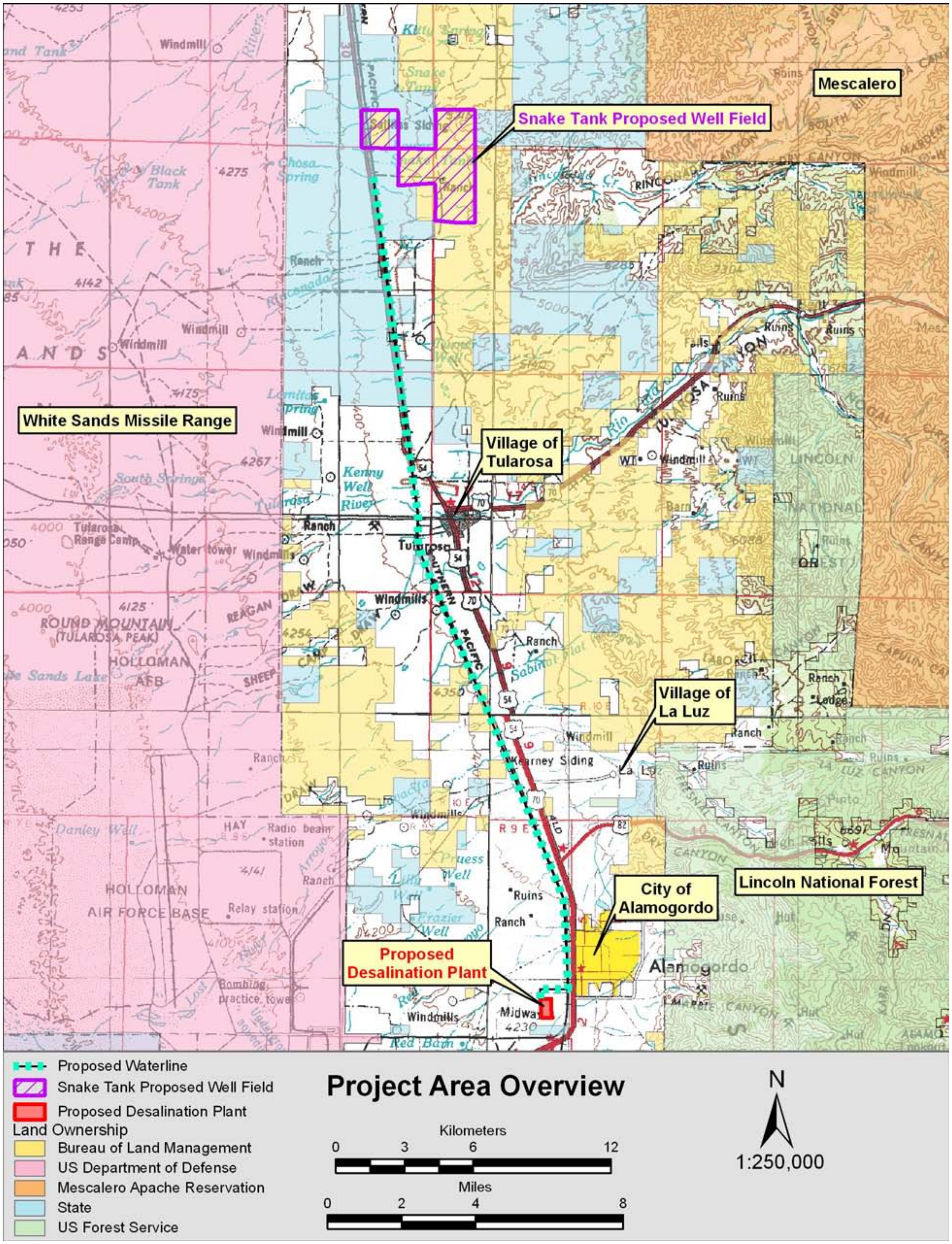


Figure 3-1. **Affected environment location.**

SURFACE WATER

Surface water includes any permanent or temporary body of water or drainage that collects and holds or transports water. Surface water sources can originate from groundwater, such as springs, aquifers, and seeps, or can be generated after a rain or storm water event as surface runoff. Intermittent ponds and streams, and ephemeral arroyos in particular, contain water only for limited periods of time following storms. Perennial surface water bodies, containing water year-round, tend to be larger.

Surface water enters the Tularosa Basin from the surrounding mountain ranges through intermittent, ephemeral, and perennial streams that drain toward the basin's center. The Tularosa Basin is a closed basin with respect to surface water flow, meaning that surface water does not flow into adjoining basins. The largest drainages entering the Tularosa Basin originate in the Sacramento Mountains, which form the eastern border of the study area. These drainages include Three Rivers, Rinconada Canyon, Tularosa Creek, La Luz Creek, and Alamo Creek (Figure 3-2).

Streams in the Tularosa Basin typically originate at springs in the surrounding mountains. As the perennial streams exit the canyons and flow onto the alluvial fans and basin fill, much of the water is diverted for agricultural or municipal uses or infiltrates the bottom of stream channels to recharge shallow groundwater. Some surface water collects near the center of the basin in a series of playas, or shallow, short-lived salt lakes, where it evaporates and leaves behind an accumulation of minerals, including gypsum, halite, and potassium salts.

There are reports of historic springs in the Tularosa Basin, most of them identified during a 1911 survey. Figure 3-3 shows the locations of these springs. Springs found in the canyons of the western Sacramento Mountains serve as an important source of water for communities along the eastern margin of the Tularosa Basin. Examples include the La Luz, Fresnal, and Alamo Canyon springs (and springs tributary to these drainages), which are important sources of water for Alamogordo. Tularosa Creek, on which the community of Tularosa and some irrigators depend for water, also originates at several springs in the western Sacramento Mountains. Similar bedrock springs are found in the mountains on the western side of the Tularosa Basin, including Rhodes Canyon in the northern San Andres Mountains and Aguirre Spring in the Organ Mountains. However, there are fewer large springs on the western side of the basin.

A number of smaller springs are located on or near the floor of the Tularosa Basin, some of which originate from bedrock (limestone, shale, and sandstone) near the contact with basin-fill materials. The majority of these springs are located in the northern portion of the Tularosa Basin. Examples of bedrock springs in the northern portion of the basin include Carrizozo Spring near Carrizozo and Jakes and Milagro springs near Oscura. Malpais Spring is at the southern edge of a Quaternary basalt flow in the northern basin, at the contact with underlying basin-fill deposits. A few springs originate within the unconsolidated basin-fill deposits, including Mound Springs, west of the Quaternary basalt, and Salt Springs on White Sands National Monument.

Precipitation varies significantly within the basin, with the lower elevations receiving about 40 percent less than the surrounding mountain regions (Garza and McLean 1977). Records for Alamogordo show an average of 11.39 inches of annual precipitation, compared to 29.81 inches per year at a higher elevation in Cloudcroft, New Mexico (Western Regional Climate Center [WRCC] 2008). Much of the surface water in the basin originates as runoff from the mountains in the form of winter and spring snowmelt and summer runoff from intense thundershowers. The amount of runoff from the Sacramento Mountains to the east is approximately twice the runoff received from the San Andres and Organ mountains to the west, owing to differences in altitude and precipitation patterns (Waltemeyer 2001). Rain events tend to be sporadic, localized, and in some cases severe. Sudden rainstorms can cause soil erosion and affect water quality of the surface waters in the basin.

Surface water quality in the basin is affected by the seasons and the volume of flow in the drainage, deteriorating to some degree at lower flows. Surface water quality in the upper Three Rivers drainage is among the best in the eastern Tularosa Basin, with low quantities of TDS (678 mg/L) and sulfate (299 mg/L) in the upper reaches (RCDC 2002), rising to more than 1,000 mg/L TDS and 651 mg/L of sulfate downstream (Hood and Herrick 1965). This water-quality pattern is likely due to the low solubility of the igneous rocks in most of this drainage basin.

Perennial springs in La Luz and Fresnal canyons provide water of good quality to La Luz Creek. Water quality declines as water flows downstream (RCDC 2002). Little water quality data are available for the smaller tributaries and springs of the eastern or western Tularosa Basin, but similar downstream water quality patterns can be expected based on the bedrock types found within the drainage basins. Springs located near or on the basin floor are typically higher in TDS than those found in the mountains.

Most of the Tularosa Basin communities occur along the foothills of the Sacramento Mountains (RCDC 2002). These communities divert and use surface water for commercial purposes, irrigated agriculture, livestock grazing, and public supply. Table 3-1 shows surface water use in Otero County for the year 2000.

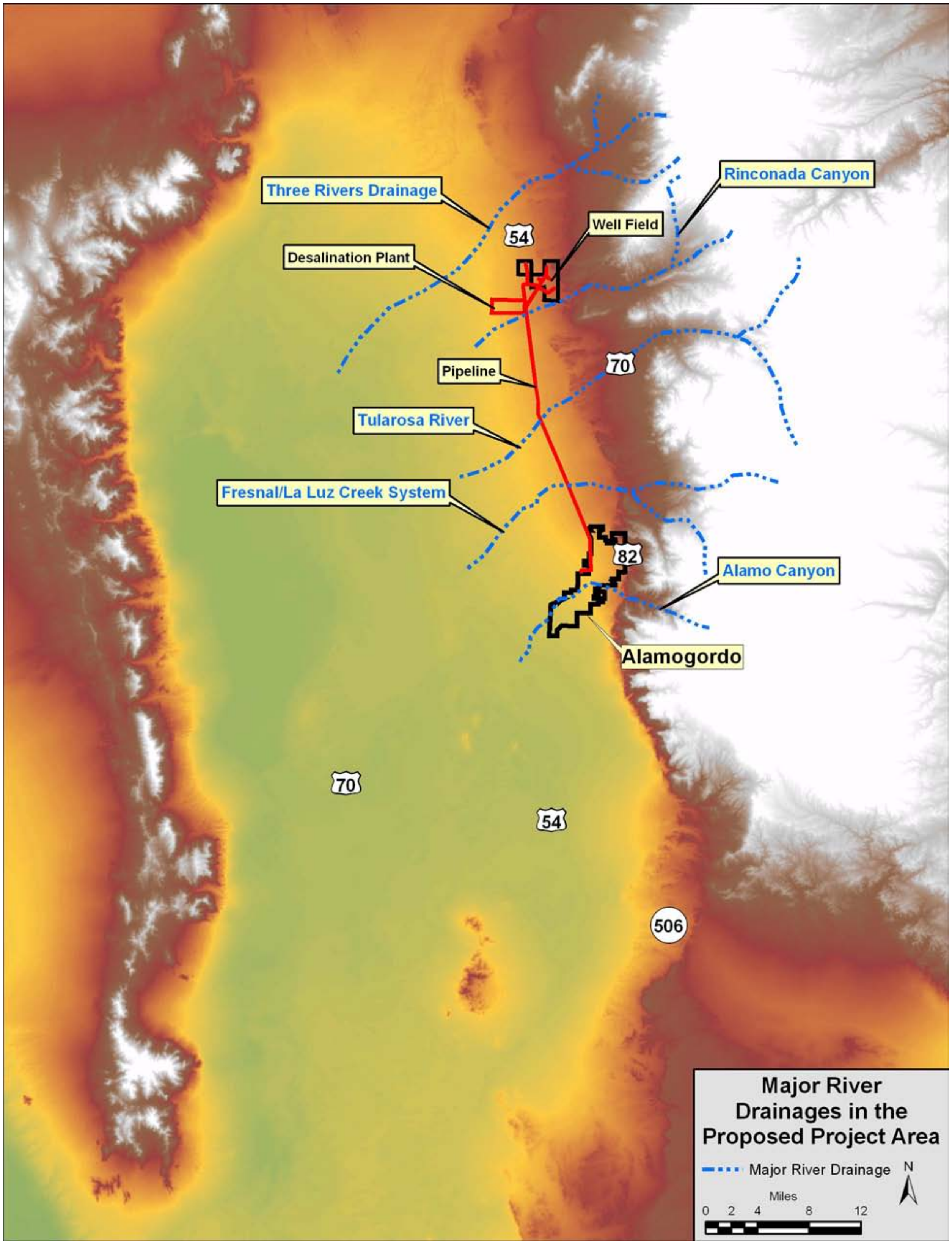


Figure 3-2. Major drainages in Tularosa Basin.

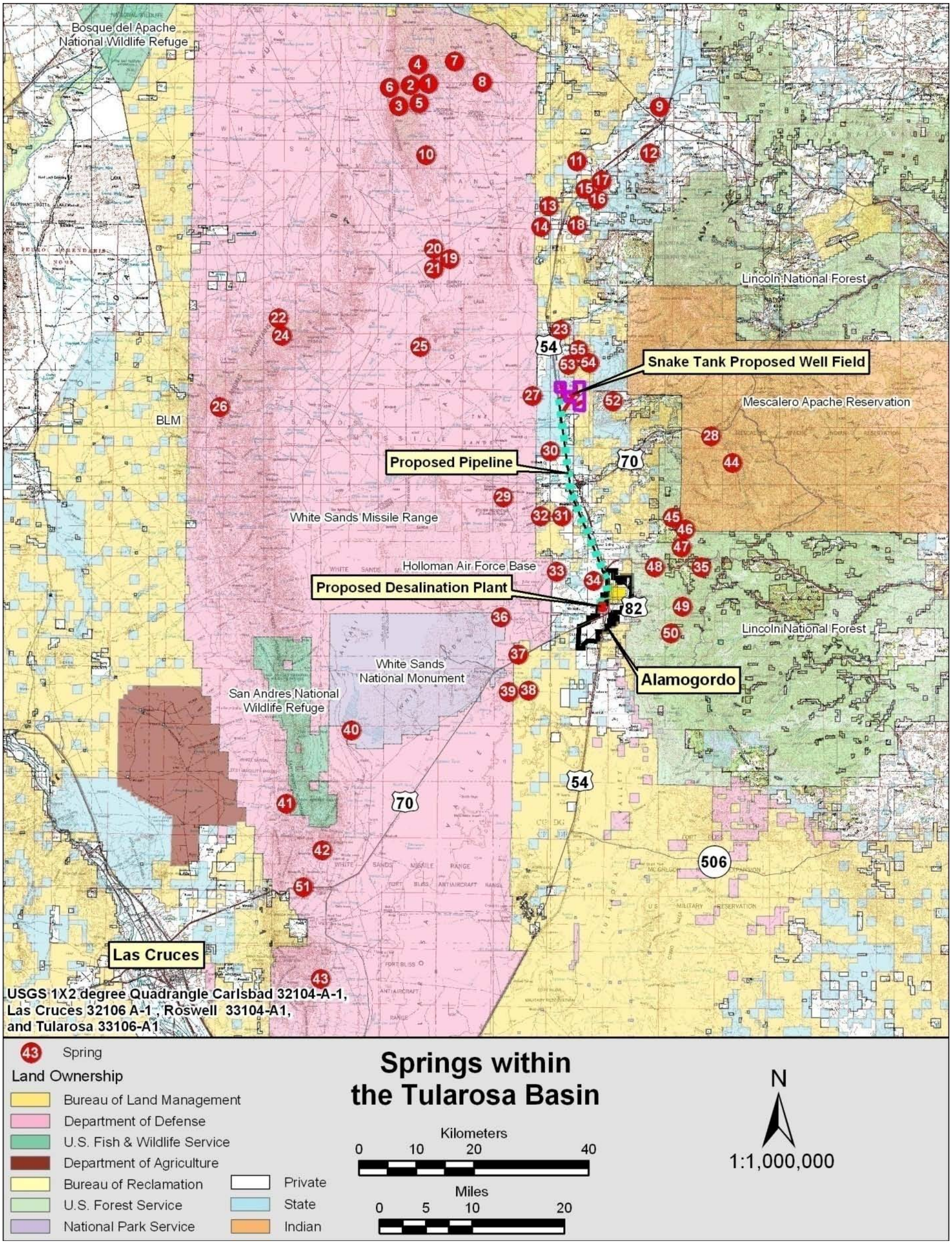


Figure 3-3. Major springs in Tularosa Basin.

TABLE 3-1. SURFACE WATER USE IN OTERO COUNTY, 2000

CATEGORY	SURFACE WATER WITHDRAWAL	SURFACE WATER DEPLETION	SURFACE WATER RETURN FLOW
Commercial	746.35	680.2	66.2
Domestic	0.0	0.0	0.0
Industrial	0.0	0.0	0.0
Irrigated Agriculture	9,793.0	4,695.0	5,098.0
Livestock	93.7	93.7	0.0
Mining	0.0	0.0	0.0
Power	0.0	0.0	0.0
Public Water Supply	6,843.9	3,423.4	3,420.5
Reservoir Evaporation	0.0	0.0	0.0
TOTAL*	**17,477.0**	**8,892.3**	**8,584.7**

NOTE: * Values are rounded.
SOURCE: NMOSE 2006.

Currently, water use trends in the area immediately surrounding Alamogordo are dependent on four sources of water supply. Average diversion in afy from each of these sources for the period 1990 through 2002 is:

- Bonito Lake – 539 afy
- La Luz Canyon – 4,486 afy
- Alamo Canyon – 1,299 afy
- La Luz well field – 1,422 afy

The Village of Tularosa diverts surface water from Tularosa Creek, one of the two perennial streams in the Tularosa Basin and the largest nearby surface water body, for storage in a 3-million-gallon reservoir and distribution to the Village of Tularosa for its primary water supply. In the past, the Village of Tularosa's demand has periodically exceeded the amount of water it can legally divert. During these shortages, the Village of Tularosa has leased additional water from the TCDC, an acequia corporation that owns a majority (87 percent) of the flows in Tularosa Creek and provides water to irrigators in the area (Livingston and Shomaker 2002a, 2002b).

GROUNDWATER

Groundwater is water that infiltrates into the ground and slowly seeps downhill below the surface. Groundwater is stored below the ground surface in aquifers, or layers of saturated rock. Within aquifers, groundwater flows from high areas to low areas, forming a flow network. Groundwater flow from the Tularosa Basin into the Hueco Bolson is estimated at 5,640 afy

(Heywood and Yager 2003). Because the two basins are connected by groundwater flowing between them, the two sources are referred to as the Hueco-Tularosa aquifer (Texas and New Mexico 1997).

The occurrence and quality of groundwater in the Tularosa Basin, which contains one of the largest saline water aquifers in the United States (Derr 1981), are dependent on the geologic conditions in the basin. The Tularosa Basin is a broad, north-trending valley that extends approximately 170 miles north from the New Mexico-Texas border and is bounded by the Sacramento Mountains on the east, Sierra Blanca Peak to the north, and a series of mountain ranges that defines the western extent of the basin from the Franklin Mountains in the south to the Organ and San Andres mountains in the central and northern portions of the basin. Much of the Tularosa Basin is divided into two north-trending sub-basins (Figure 3-4).

Within the basin, groundwater has developed from both bedrock and basin-fill aquifers (RCDC 2002). The basin-fill deposits represent the most important aquifers in the area in terms of the quantity of water available, achievable production rates, and degree of historic development. Groundwater in the basin-fill aquifers generally originates in the mountains as precipitation then moves into coarser material in the basin.

Estimates of groundwater quality in the aquifer vary wildly as a result of geography, quality of recharge, presence of soluble salts in the formation, flow rates through rocks and depth of the groundwater cache (JSAI 2009). Saline water is formally defined as water containing more than 1,000 mg/L TDS (U.S. Public Health Service 1962). The saltiest classification for water is seawater, with 35,000 mg/L or more of TDS. Brackish water is saline water with TDS content higher than 1,000 mg/L and lower than that of seawater.

The quality of existing water resources for the City ranges from about 300 mg/L TDS from Bonito Lake to as much as 1,400 mg/L TDS from groundwater pumped from the La Luz well field (Livingston 2003b). The average TDS value of water in the distribution system is around 800 mg/L in the wintertime, rising to about 1,100 mg/L during the summer months when the wells are being pumped extensively. For any future water supply, a delivered water quality goal of 800 mg/L TDS, the same quality as the surface water, has been established by the City. A detailed discussion of the distribution of groundwater quality in the Tularosa Basin is included in the Water Resources Technical Report (see Appendix H).

Significant volumes of fresh water (TDS of less than 1,000 mg/L) are present in basin-fill aquifers in two main areas: one along the southern Sacramento Mountains and the second adjacent to the southern San Andres and Organ Mountains (Figure 3-5). The area of fresh groundwater along the southern Sacramento Mountains, as mapped by McLean (1970), is about 20 to 25 miles long, extending from Alamo Canyon south of Alamogordo to about 10 miles beyond Grapevine Canyon. The width of this zone varies from 2 miles to a maximum of about 4 miles opposite Grapevine Canyon. Near the mountain-front the freshwater zone is up to 1,200 feet thick, thinning to an irregular edge westward where it is underlain by more saline water.

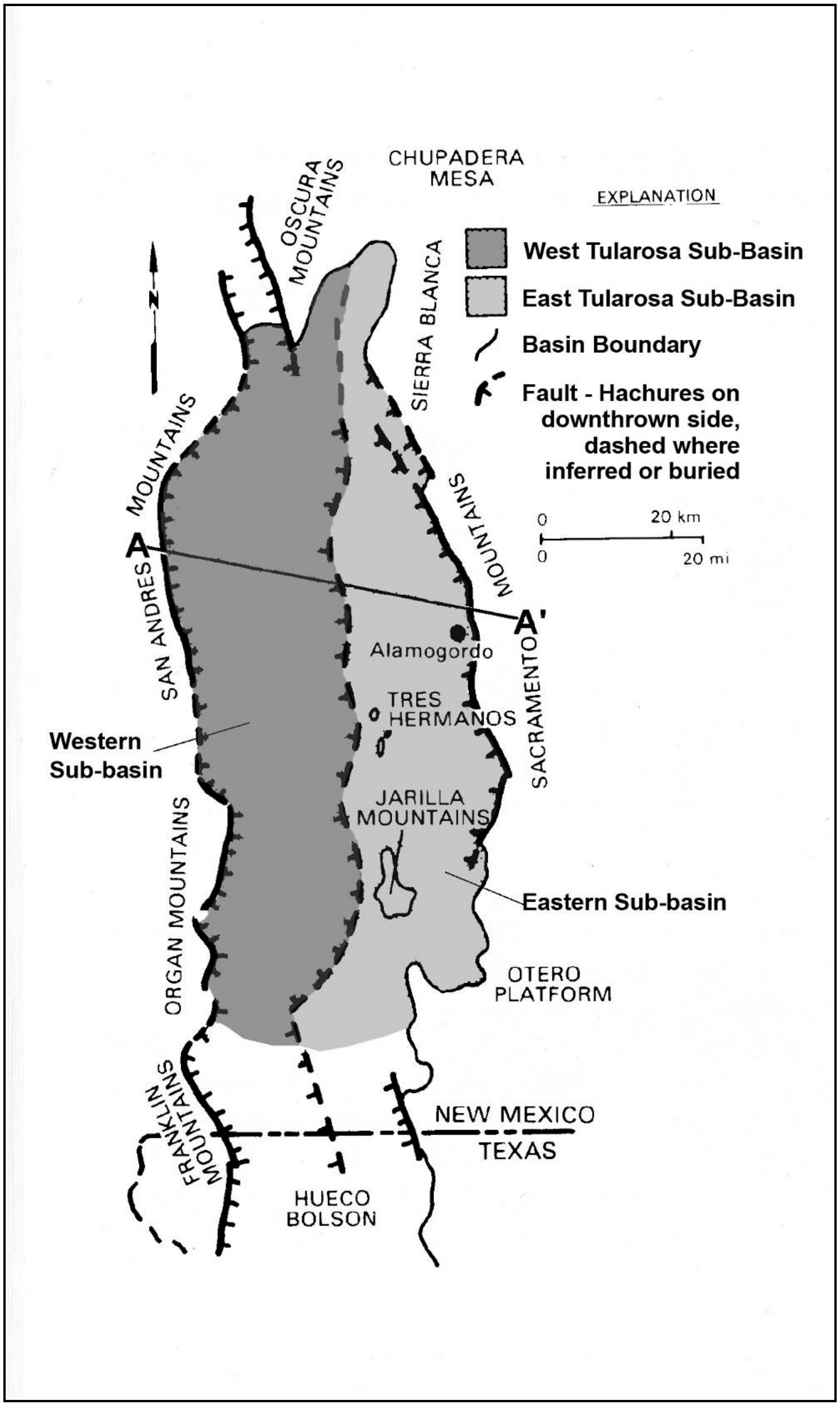


Figure 3-4. Tularosa Basin sub-basins (Huff 2005).

This freshwater zone has been extensively developed by Holloman AFB and by private irrigation and domestic users. McLean (1970) estimates that approximately 3 to 4 million afy of fresh water is present in this zone.

The area of freshwater resources adjacent to the south San Andres and Organ Mountains extends over 50 miles, from Ash Canyon in the north to south of the Texas border. An area in the mountain-front at WSMR Headquarters contains over 1,800 feet of basin-fill sediments saturated with fresh water, which serves as the water supply for the WSMR. The remainder of this zone is elongated north-south along the mountain-front, is 200 to 1,000 feet thick, and ranges in width from 2 miles in the north to nearly 10 miles in the south near the Franklin Mountains. An estimated 7 million afy of fresh water is present in this area (McLean 1970).

Slightly saline water, containing TDS concentrations between 1,000 and 3,000 mg/L, is found generally around the margins of the Tularosa Basin and also exists as a transition zone between the freshwater areas described above and the saline water that characterizes most of the basin (Figure 3-6). Slightly saline groundwater is present as a band around the basin margin, about 2 to 5 miles in width and up to a few hundred feet in thickness, with the notable exception of two areas, in the northeastern and southeastern portions of the basin (McLean 1970). The slightly saline zone in the northeastern basin extends about 30 miles from Alamogordo in the south to Three Rivers in the north, with its widest expression (10 miles) in the south and the narrowest (4 miles) in the north. The salinity of the groundwater in this area is likely due to soluble minerals in the aquifer sediments and recharge from groundwater flowing through sedimentary rocks rich in sulfate materials (Hood and Herrick 1965). In the southeastern portion of the basin about one-third of the water, or approximately 13 million afy, is in the slightly saline range (JSAI 2003; RCDC 2002).

The central portion of the basin is saturated with water that ranges from moderately saline to brine. In places, groundwater of the central basin contains dissolved solids in excess of 100,000 mg/L.

Water resources within a basin are generally evaluated by assessing the amount of water being added to the basin (the recharge) and the amount of water withdrawn from the basin (the groundwater use). Recharge to the Tularosa Basin is based on estimates of the total annual stream flow, which varies from 68,800 to 86,390 afy for a year of average precipitation (Waltemeyer 2001; RCDC 2002). The lower recharge estimate is based on stream flow only (Waltemeyer 2001), while the higher estimate considers both stream flow and subsurface flow entering the basin from bedrock below the ground surface (RCDC 2002). Nearly 70 percent of the recharge for the Tularosa Basin enters the eastern portion of the basin from the Sacramento Mountains, with the remainder from the San Andres and Organ Mountains to the west.

Water use in the Tularosa Basin is estimated at approximately 46,951 afy (RCDC 2002). Approximately 75 percent of the total is from groundwater supplies, and about 25 percent is from surface water supplies. Irrigated agriculture accounts for 57 percent of the groundwater use, and public water supply systems account for 29 percent. Approximately 116 water wells used primarily for irrigation and domestic consumption occur in the study area. Table 3-2 shows groundwater use in Otero County for the year 2000.

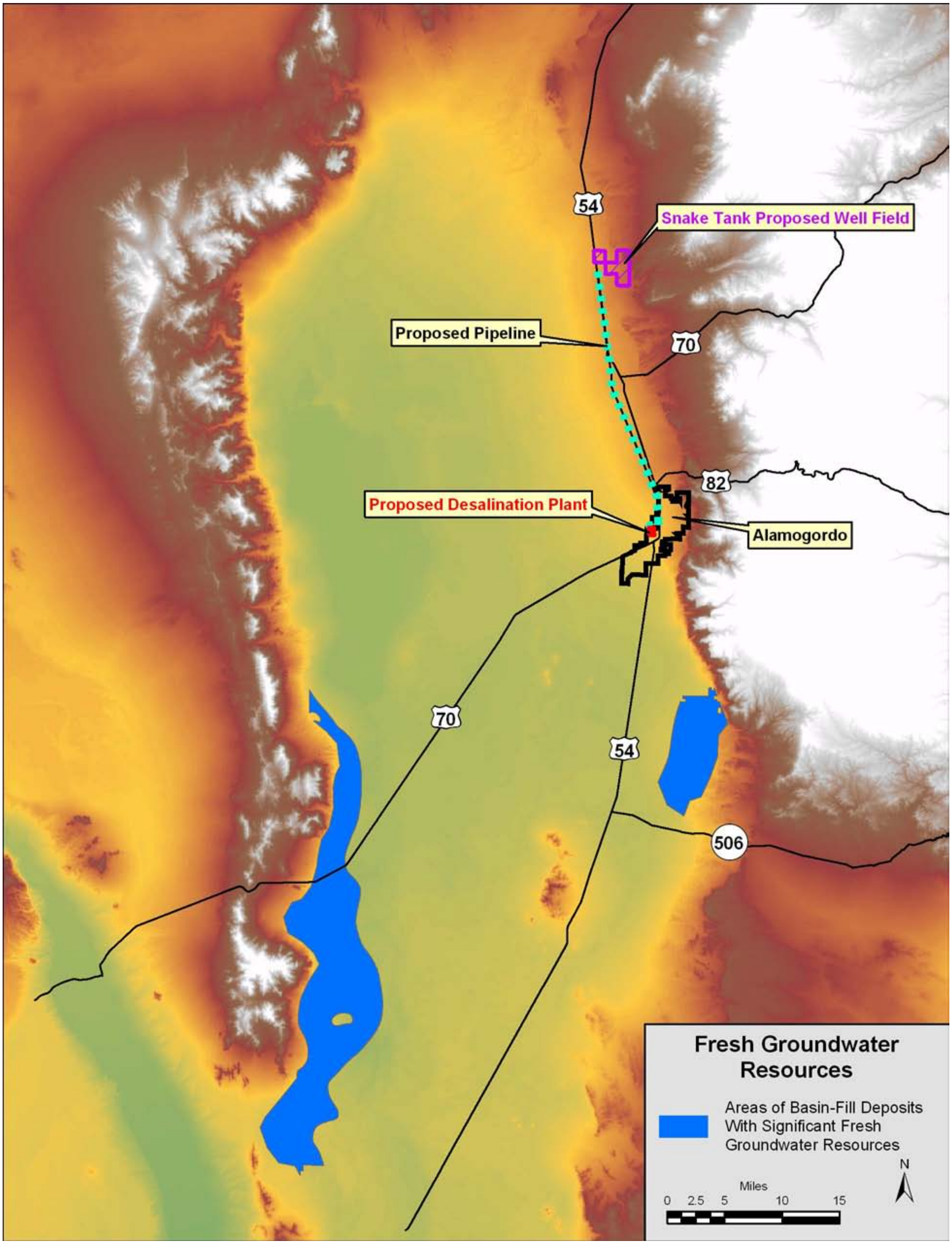


Figure 3-5. Fresh groundwater resources in the Tularosa Basin.

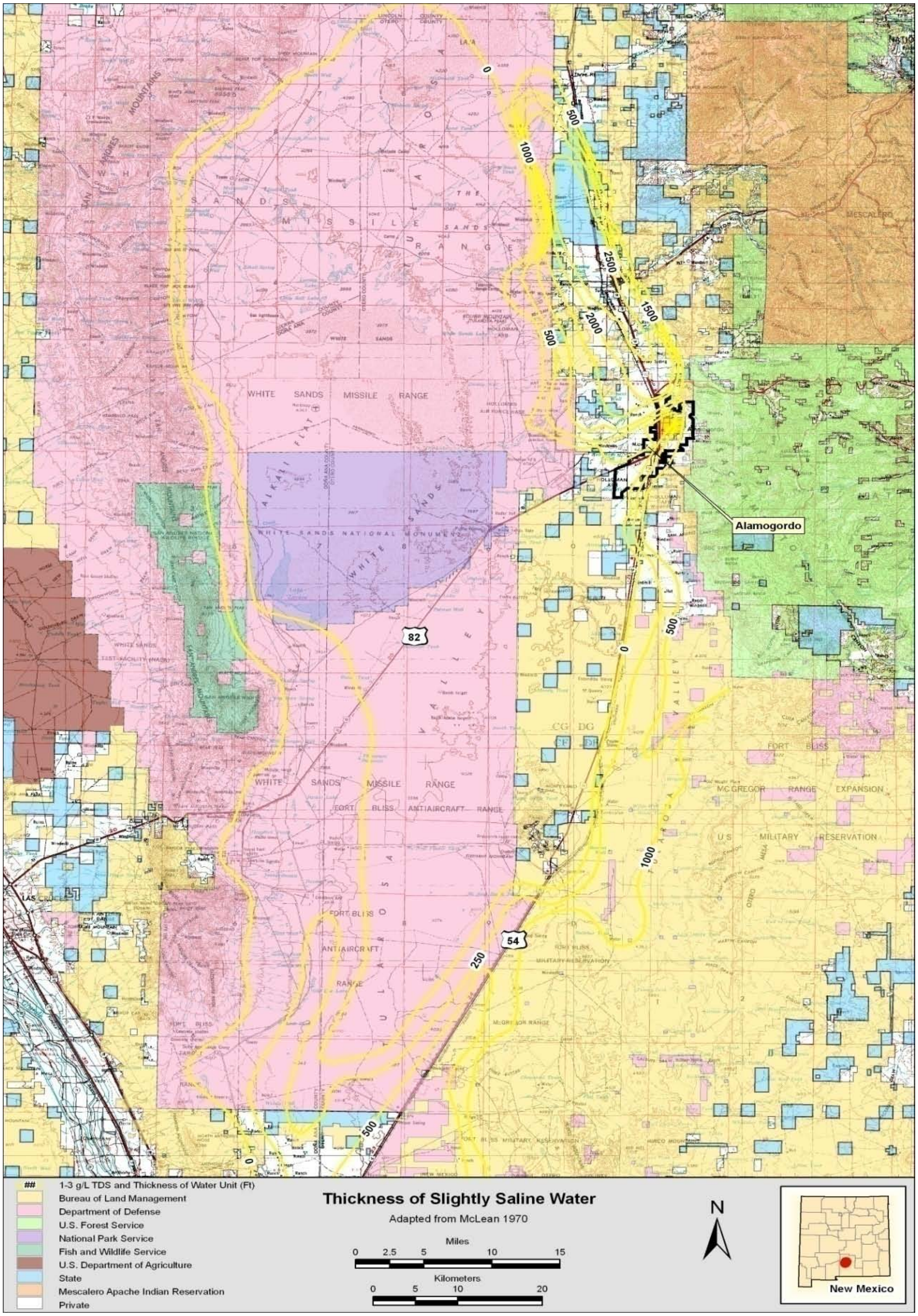


Figure 3-6. Slightly saline groundwater resources in Tularosa Basin.

Of the 4,911 water rights currently held within the Tularosa Basin, agricultural water rights make up 58 percent of the total water diverted. Given this distribution of water rights (Table 3-3), it is assumed for this analysis that agricultural water rights would be purchased or leased.

Groundwater sources for the City include the La Luz wells, Prather wells, Golf Course well, Landfill well, and Cemetery irrigation (NMOSE 2004b). Although the City has existing surface water and groundwater rights and permits to divert from its wells and surface diversions, the average water supply the City has historically diverted, from a combination of surface and groundwater sources, has been 3,887 afy (NMOSE 2004b):

- 5,686 afy, surface water, 1967–2001
- 2,088 afy, groundwater, 1998–2003

FLOODPLAINS

Floodplains are low-lying areas that experience periods of "ponding" or surface water inundation. These areas are normally adjacent to existing surface water resources, and flooding can occur at various depths and lengths of time depending on weather or storm severity. Historical records and topography are used to estimate the frequency and area of flooding (flood zone) that can be expected in any given watershed.

The New Mexico Office of Emergency Management does not maintain flood zone maps for the state. Instead, flood insurance rate maps (FIRM) from the Federal Emergency Management Agency (FEMA) provide flood zone designations for each state in the U.S. The majority of the study area is within Zone X (outside the 100-year and 500-year floodplains). Temporal and Tularosa Creeks within the study area are in Zone A (chance of flood once every 100 years). FEMA maps show Zone A designations within these drainages at the ordinary high water mark (or upper confines of the water body).

TABLE 3-2. YEAR 2000 SUMMARY OF GROUNDWATER USE IN OTERO COUNTY

CATEGORY	GROUNDWATER WITHDRAWAL*	GROUNDWATER DEPLETION*	GROUNDWATER RETURN FLOW*
Commercial	168.6	166.2	2.3
Domestic	1,127.1	1,127.1	0.0
Industrial	10.6	10.6	0.0
Irrigated agriculture	23,980.0	19,343.0	4,637.0
Livestock	204.9	204.9	0.0
Mining	0.0	0.0	0.0
Power	0.0	0.0	0.0
Public water supply	5,486.1	2,877.9	2,608.2
Reservoir evaporation	0.0	0.0	0.0
TOTAL	**30,977.3**	**23,729.7**	**7,247.5**

SOURCE: NMOSE 2006.*Measured in acre-feet.

TABLE 3-3. TOTAL DIVERSION AND ESTIMATED CONSUMPTIVE WATER USE WITHIN THE TULAROSA BASIN

USE TYPE	NUMBER OF WATER RIGHTS	DIVERSION TOTAL (AFY)	ESTIMATED CONSUMPTIVE USE PORTION	PERCENT OF TOTAL DIVERSION
Agricultural	1,216	92,562	53,686*	58
Commercial	128	6,149	6,149	4
Municipal	41	19,278	19,278	12
Residential	3,083	14,570	14,570	9
Military	6	26,046	26,046	16
Other	437	248	248	1
TOTAL	**4,911**	**158,853**	**119,977**	**100**

SOURCE: NMOSE 2006.
NOTE: *Consumptive use for agriculture is 58 percent of diversion total for each water right.

3.3.2 GEOLOGY

This section describes unique geologic resources in the Tularosa Basin, including the basin itself and the White Sands National Monument.

THE TULAROSA BASIN

The Tularosa Basin was formed as the result of faulting, which is the process of fracturing and displacement of the earth. The formation of the basin was part of a large-scale tectonic event that began approximately 30 million years ago and continues today. This tectonic event stretched and pulled apart large portions of the earth's crust in the southwestern U.S., forming the Basin and Range, a geologic province that extends from southern Oregon down to northern Mexico. A linear arm of the Basin and Range, known as the Rio Grande Rift, extends from southern New Mexico into central Colorado. As the crust separated in the Basin and Range, numerous fault zones developed. Large blocks of crust subsided thousands of feet along these faults, forming basins between fault-bounded mountain ranges. The Tularosa Basin, at the southern end of the Rio Grande Rift, is just one of the many basins in the Southwest that formed in this manner (Machette et al. 2000).

The Alamogordo fault, at the base of the Sacramento Mountains, extends about 83 miles from the northern end of Phillips Hills through Tularosa and Alamogordo and south into the McGregor Bombing Range. Along the base of the San Andres Mountains is the San Andres Mountain fault, which extends about 90 miles. Although no detailed studies of these faults have been conducted, the latest movement of the faults was between 10,000 and 15,000 years ago (Machette et al. 2000).

WHITE SANDS NATIONAL MONUMENT

The largest pure gypsum dune field in the world is located at White Sands National Monument in the Tularosa Basin. This region of glistening white dunes ranges in elevation from 3,890 to

4,116 feet above sea level. There are approximately 275 total square miles of dune fields, with 115 square miles (about 40 percent) located within White Sands National Monument. The remainder is on military land that is not open to the public.

The gypsum that makes up White Sands is ultimately derived from marine rocks. Much of this gypsum is found in the 1,500-foot-thick Yeso Formation, which outcrops in the San Andres and Sacramento mountains surrounding the Tularosa Basin. ("Yeso" is Spanish for gypsum). Heavy rainfall flushed large quantities of soluble gypsum from the San Andres and Sacramento mountains down to the lake, which became saturated with dissolved gypsum. The Tularosa Basin is essential to the existence of the White Sands National Monument. With no drainage outlet, this basin traps and concentrates all the dissolved gypsum that comes down from the marine rocks in the surrounding mountains, gypsum that would normally be carried away by rivers or streams. The gypsum particles are light enough to be moved by wind, which creates the dunes.

3.3.3 SOILS

Tularosa Basin soils include a variety of types, each formed by a process that is controlled by climate, organisms, topography, parent material, and time. Figure 3-7 shows the distribution of soil types throughout the Tularosa Basin. Most of the soils within the basin are classified as Aridisols, which are soils of dry regions, or Entisols, which are recently formed soils.

Major soil units in the study area include the Prelo-Tome-Largo complex of nearly level to gently sloping, deep, well-drained sediments dominated by reddish brown silt, clay, and calcareous deposits. The dominant soil complex is a Prelo-Tome-Largo, which is characterized as deep, well-drained soil found on level to gently sloping alluvial fans, valley floors, and pediments (Derr 1981). Three soil units within the Prelo-Tome-Largo complex occur in the Snake Tank well field and vicinity: Alamogordo-Gypsum Complex (AEC), Holloman-Gypsum Land-Yesum Complex (HOB), and Tome Silt Loam (TDB). Table 3-4 and Appendix J show the general characteristics associated with each of these units. A complete list of all of the soil types found in the study area is provided in Appendix J1.

The soils in Otero County along the U.S. 54 corridor are composed predominantly of the AEC unit, which occurs on toe slopes and fill valleys (Derr 1981). Typically, these soils have approximately 0.5 inch of desert pavement on the surface, are very fragile, and cannot withstand intensive surface disturbance (Derr 1981).

The TDB and AEC complex soil units are located on floodplains and side slopes of major streams and basins (Derr 1981). Used primarily for grazing and to a lesser extent for irrigated crops, these soils are highly susceptible to water and wind erosion when surface cover is removed.

TABLE 3-4. CHARACTERISTICS OF DOMINANT SOIL UNITS IN STUDY AREA

SOIL TYPE/CHARACTERISTIC	ALAMOGORDO-GYPSUM COMPLEX (AEC)	HOLLOMAN-GYPSUM LAND-YESUM COMPLEX	TOME SILT LOAM (TDB)
Drainage class	Well drained	Well drained	Well drained
Soil erodibility (K) factor*	0.55	0.55	0.43
Minimum depth to water Table	> 6 feet	> 6 feet	> 6 feet
Depth to restrictive feature	> 60 inches	> 60 inches	> 60 inches
Water capacity**	Moderate	Very low	High
Permeability**	Moderately rapid	Moderate	Moderately slow
Annual flooding or ponding	None	None	None
Hydric soil	No	No	No
Potential for wildlife habitat	Low	Low	Moderate
Potential for farming	Low	Very low	Moderate
Potential for grazing	Low to moderate	Low	Moderate

DATA SOURCE: Derr 1981.
NOTES: *Values range from 0.10 to 0.64; soils with the highest values are the most erodible.
**Within 60 inches of the soil surface.

3.3.4 BIOLOGICAL RESOURCES

LAND COVER AND VEGETATION

The Southwest Regional Gap Analysis Project (SWReGAP) subdivides the study area into 13 land cover types. Chihuahuan Mixed Desert and Thorn Scrub constitutes over 80 percent of the land cover in the study area. This vegetative type is characterized by the abundance of creosotebush (*Larrea tridentata*) with a mixture of thornscrub and other desertscrub (SWReGAP 2005). Apacherian-Chihuahuan Semi-Desert Grassland and Steppe occurs in the study area and is the second most common habitat type. This habitat type is found on gently sloping bajadas and is characterized by diverse perennial grasses; however, much of this cover type has been converted to Chihuahuan Mesquite Upland Scrub through intensive grazing and other land uses. The remaining 11 habitat types occur over less than 2 percent of the study area.

Table 3-5 lists the SWReGAP land cover types, their locations within the study area, and the approximate acreage at each facility site.

Land cover descriptions are provided in Appendix J2 and a representative map of land cover types in relation to project features is provided in Appendix J. The information provided in these appendices is summarized in the following sections.

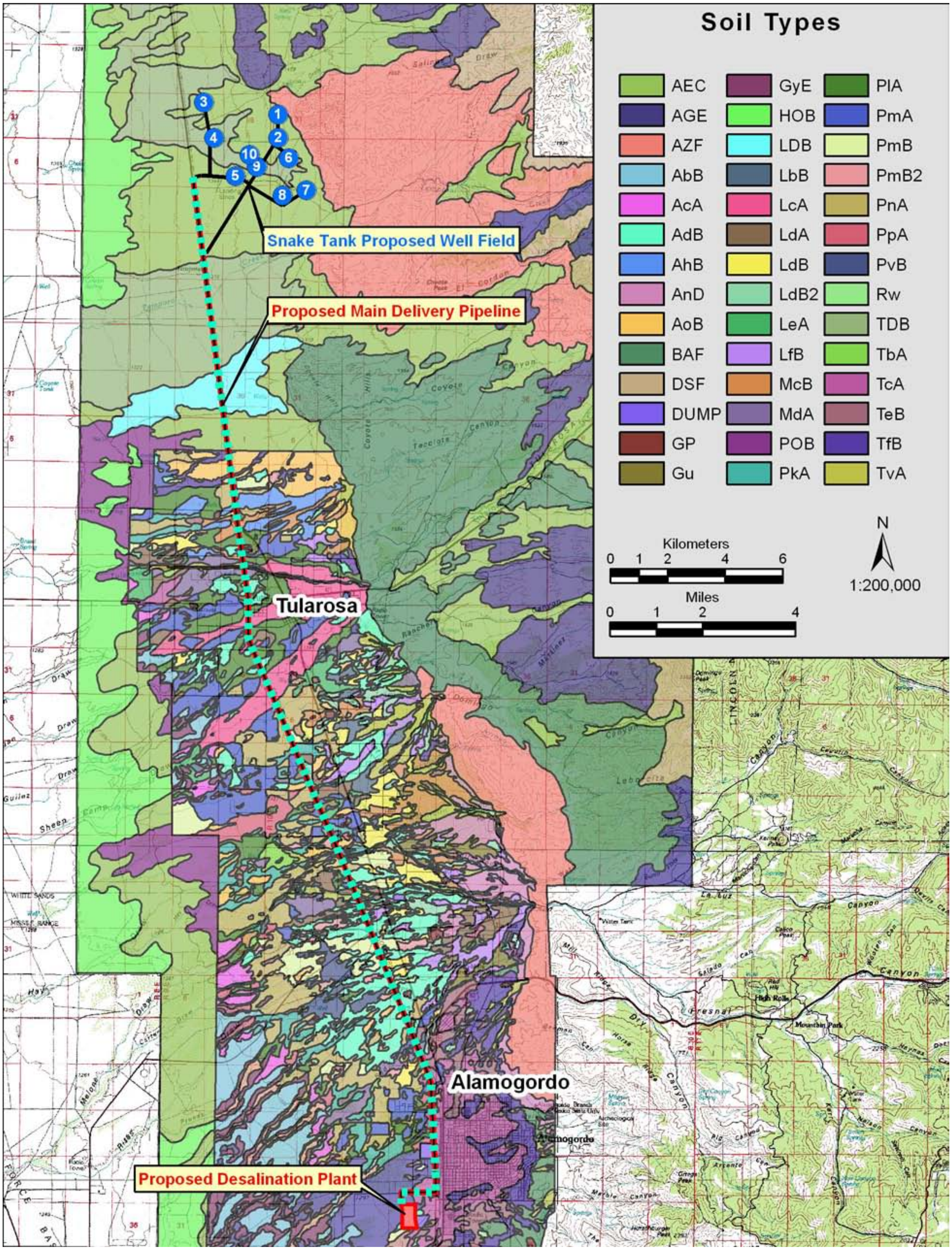


Figure 3-7. Soil types in study area.

TABLE 3-5. LAND COVER TYPES FOUND IN THE STUDY AREA

SOUTHWEST REGIONAL GAP ANALYSIS PROJECT LAND COVER TYPE	ACRES	PERCENT
Well Field and Pipelines		
Apacherian-Chihuahuan Semi-Desert Grassland and Steppe	12.1	19.0
Chihuahuan Mixed Desert and Thorn Scrub	30.6	48.2
Chihuahuan Gypsophilous Grassland and Steppe	1.7	2.8
Chihuahuan Sandy Plains Semi-Desert Grassland	3.0	4.7
North American Warm Desert Playa	16.1	25.3
Main Pipeline		
Agriculture	2.1	4.6
Apacherian-Chihuahuan Mesquite Upland Scrub	0.9	1.6
Apacherian-Chihuahuan Semi-Desert Grassland and Steppe	2.1	3.2
Chihuahuan Mixed Desert and Thorn Scrub	41.2	79.0
Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub	0.6	1.4
Developed, Medium-High Intensity	4.1	3.4
Developed, Open Space–Low Intensity	4.4	2.4
North American Warm Desert Playa	1.2	1.9
North American Warm Desert Riparian Woodland and Shrubland	0.9	2.4
North American Warm Desert Wash	0.06	0.1
Desalination Facility Site		
Developed, Medium-High Intensity	40	40.4
Developed, Open Space-Low Intensity	55	55.5
Chihuahuan Mixed Desert and Thorn Scrub	4	4.0
DATA SOURCE: SWReGAP 2005.		

Vegetation is a general term sometimes used interchangeably with the term “habitat,” which is defined as the combination of different plant communities found at any given location. Most of the project area would have been characterized historically as desert grassland dominated by black grama (*Bouteloua eriopoda*). Although remnants of this habitat exist, the influence of livestock, alteration of fire regimes, and road and utility development has eliminated the pure black grama component (Dick-Peddie 1993) and encouraged the encroachment of shrubs such as fourwing saltbush (*Atriplex canescens*), creosotebush, and honey mesquite (*Prosopis glandulosa*), as well as forbs including tansy mustard (*Descurania* sp.) and Russian thistle (*Salsola kali*).

Surface springs and seeps in the study area contain marsh vegetation and are part of a salt marsh ecosystem known scientifically as North American Warm Desert Cienegas (see spring locations on Figure 3-3**)**. A “cienega” is a freshwater-spring-fed wetland. Evaporation in these areas often creates saline conditions, especially on the margins, as evidenced by the presence of salt-tolerant species such as salt grass (*Distichlis spicata*) and alkali sacaton (*Sporobolus airoides*). The type of vegetation depends on the depth of the water. In the shallow margins, emergent plants typical of riparian vegetation are present, including species of sedge (*Carex*), rush (*Juncus*), and bulrush (*Schoenoplectus*). Emergent marsh is characteristic of the adjacent deeper water (NatureServe 2004).

Dominant plant species include salt grass, iodine bush (*Allenrolfia occidentalis*), and spike rush (*Eleocharis palustris*) (Myers and Naus 2004). These plants occur within a few meters of the edge of spring-fed surface features. They also experience changes from year-to-year depending on the edge of the water body; if a drought occurs and the water recedes, plant species dependent on these marsh ecosystems will also recede.

THREATENED AND ENDANGERED PLANT SPECIES

SWCA Environmental Consultants (SWCA) biologists conducted on-site field surveys and documented 116 different plant taxa, including 24 woody species (trees and shrubs), 21 grasses, and 71 forbs. Plant species observed in the field were compared to the lists of threatened and endangered species, candidate species, sensitive species, species of concern, rare species, and noxious weeds known to occur in Otero County. These lists include the regulatory status of each species as recorded by the U.S. Fish and Wildlife Service (USFWS) and the New Mexico Rare Plant Technical Council (NMRPTC), in cooperation with the New Mexico Department of Agriculture (NMDA). Lists of threatened and endangered species and other special status species for plants obtained from these agencies are provided in Appendix J3.

Table 3-6 summarizes data on four riparian plant species that are listed by Federal and/or state agencies and are known to occur in Otero County. Wright's marsh thistle (*Cirsium wrightii*) and Chapline's columbine (*Aquilegia chrysantha* var. *chaplinei*) have the potential to occur in the study area in suitable marsh habitat.

TABLE 3-6. LISTED RIPARIAN PLANT SPECIES NEAR OR WITHIN THE STUDY AREA

COMMON NAME *(SCIENTIFIC NAME)*	STATUS	KNOWN DISTRIBUTION AND HABITAT NEEDS	LIKELIHOOD OF OCCURRENCE IN AFFECTED STUDY AREA
Sacramento Mountains thistle *(Cirsium vinaceum)*	NMRPTCR USFWST NME BLMS	Wet soils at springs, seeps, and along streams in meadows or forest margins at 7,545–9,500 feet. Water is high in calcium carbonate that precipitates out to form large travertine mounds at some springs. *Cirsium vinaceum* may grow in almost pure stands on some of these mounds	Unlikely
Wright's marsh thistle (*Cirsium wrightii*)	NMRPTCR USFWSS NME	Wet, alkaline soils in spring seeps and marshy edges of streams and ponds at 3,450–8,500 feet	Possible
Chapline's columbine (*Aquilegia chrysantha* var. *chaplinei*)	NMRPTCR USFWSS NMS	Limestone seeps and springs in the montane scrub or riparian canyon bottoms at 4,700–5,500 feet	Possible
Goodding's onion (*Allium gooddingii*)	USFWSS NME	Typically in mature forests, along north-trending drainage bottoms associated with perennial, intermittent, and ephemeral stream courses in mixed-conifer and spruce-fir zones at 7,000–9,400 feet	Unlikely

NOTES: BLMS = Bureau of Land Management Sensitive; NME = New Mexico Endangered; NMS = New Mexico Species of Concern; NMRPTCR = New Mexico Rare Plant Technical Council Rare; USFWSS = U.S. Fish and Wildlife Service Species of Concern; USFWST = U.S. Fish &Wildlife Service Threatened

The USFWS lists four plant species as threatened or endangered in Otero County: Kuenzler hedgehog cactus (*Echinocereus fendleri* var. *kuenzleri*), Sacramento prickly poppy (*Argemone pleiacantha pinnatisecta*), Todsen's pennyroyal (*Hedeoma todsenii*), and Sacramento Mountains thistle (*Cirsium vinaceum*). Of these, only one, the Sacramento prickly poppy, was identified as possibly occurring at the study area (Table 3-7). A detailed description of this species is included below.

TABLE 3-7. FEDERALLY LISTED PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE STUDY AREA

COMMON NAME ***(SCIENTIFIC NAME)***	**FEDERAL STATUS**	**KNOWN DISTRIBUTION AND HABITAT NEEDS**	**LIKELIHOOD OF OCCURRENCE IN STUDY AREA**
Sacramento prickly poppy *(Argemone pleiacantha pinnatisecta)*	Endangered	Loose, gravelly soils on open, disturbed sites, canyon bottoms and slopes, and sometimes along roadsides, at 4,300–7,100 feet.	Possible

Sacramento Prickly Poppy. Based on known distribution, habitat needs, and field surveys, the Sacramento prickly poppy is the sole Federally-listed plant species with the potential to occur in the study area. The USFWS listed the Sacramento prickly poppy as endangered with no designated critical habitat in 1989 (USFWS 1989). This species occupies canyon habitats ranging from 4,300 to 7,100 feet in elevation in Chihuahuan Desert, piñon-juniper woodland, and the lower edge of ponderosa pine communities. Occupied canyons have largely intermittent flows after storm events or have springs that flow for a limited distance. Plants grow directly in the rocks and gravel of streambeds; on vegetated bars of silt, gravel, and rock; on cut slopes; and occasionally on banks. The study area includes a relatively small amount of marginally potential Sacramento prickly poppy habitat in the northeastern section of the well field site (shown on the map in Appendix J; however, no Sacramento prickly poppies have been documented in this area.

The USFWS and NMRPTC also list 41 plants in Otero County as species of concern or rare, respectively. Three of these species were identified as possibly occurring at the study area: desert night-blooming cereus (*Cereus greggii* var. *greggii*), Villard pincushion cactus (*Escobaria villardii*), and hairy muhly (*Muhlenbergia villiflora* var. *villosa*). Table 3-8 lists the status, known distribution, and habitat needs of these species. Narrative descriptions of each species are provided below.

Desert Night-blooming Cereus. Based on known distribution, habitat needs, and field surveys, the desert night-blooming cereus has the potential to occur in the study area. This species primarily occupies desertscrub or desert grasslands in areas where creosotebush is found in sandy or gravelly loams, along washes, or on creosotebush flats or gentle slopes at elevations from 3,937 to 4,921 feet. Typically, these plants are found growing up through and supported by shrubs, especially creosotebush and mesquite. The desert night-blooming cereus is listed by the USFWS as a species of concern and by the NMRPTC as a rare plant species.

Villard Pincushion Cactus. This species occurs in loamy soils of desert grasslands with Chihuahuan desertscrub on broad limestone benches in mountainous terrain at elevations from 4,500 to 6,500 feet. The species is common within its area of distribution, and there are no known threats to populations at this time. The Villard pincushion cactus is listed by the USFWS as a species of concern and by the NMRPTC as a rare plant species.

Hairy Muhly. This species occurs in open desert grasslands and desert savannas in alkaline to calcareous soil, at elevations from 4,800 to 5,200 feet. It is known from only three collections in New Mexico, but is more frequent eastward in Texas. Livestock grazing of the desert grasslands is the primary threat to this taxon. Hairy muhly is listed by the USFWS as a species of concern and by the NMRPTC as a rare plant species.

TABLE 3-8. OTHER SPECIAL STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

COMMON NAME *(SCIENTIFIC NAME)*	STATUS	KNOWN DISTRIBUTION AND HABITAT NEEDS	LIKELIHOOD OF OCCURRENCE IN STUDY AREA
Desert night-blooming cereus *(Cereus greggii* var. *greggii)*	USFWSS	Found primarily in desertscrub, in areas where creosotebush is found in sandy or gravelly loams, along washes, on creosotebush flats or gentle slopes; 3,937–4,921 feet	Possible
Villard pincushion cactus *(Escobaria villardii)*	USFWSSNN ME BLMS	Loamy soils of desert grassland with Chihuahuan Desert Scrub on broad limestone benches in mountainous terrain; 4,500–6,500 feet	Possible
Hairy muhly *(Muhlenbergia villiflora* var. *villosa)*	NMRPTCR	Open desert grassland and desert savanna, alkaline to calcareous soil; 4,800–5,200 feet	Possible

NOTES: BLMS = Bureau of Land Management Sensitive; NME = New Mexico Endangered; NMRPTCR = New Mexico Rare Plant Technical Council Rare; USFWSS = U.S. Fish and Wildlife Service Species of Concern

NOXIOUS WEEDS

Within the study area, SWCA biologists documented 10 plant species classified by the New Mexico Department of Agriculture (NMDA) as noxious (non-native) weeds. The State of New Mexico assigns weeds to one of three classes:

- Class A Weeds are species that currently are not present in New Mexico or have limited distribution. Preventing new infestations of these species and eradicating existing infestations is the highest priority.
- Class B Weed species are limited to certain portions of the State. In areas that are not infested, these species should be treated as Class A Weeds. In areas with severe infestations, management plans should be designed to contain the infestation and stop further spread.
- Class C Weeds are species that are widespread in the State. Management decisions for these species should be determined at the local level based on feasibility of control and level of infestation (NMDA 1999).

The noxious weed species found within the study area, their classifications, and location within the study area are listed in Table 3-9.

TABLE 3-9. NOXIOUS WEEDS OBSERVED IN THE STUDY AREA		
COMMON NAME (*SCIENTIFIC NAME*)	**CLASS***	**STUDY AREA LOCATION**
African rue (*Peganum harmala*)	B	Well field, main pipeline
Camelthorn (*Alhagi maurorum*)	A	Main pipeline
Field bindweed (*Convolvulus arvensis*)	C	Main pipeline
Malta starthistle (*Centaurea melitensis*)	B	Main pipeline
Perennial pepperweed (*Lepidium latifolium*)	A	Main pipeline
Russian knapweed (*Acroptilon repens*)	B	Main pipeline, desalination facility site
Saltcedar (*Tamarix ramosissima*)	C	Main pipeline, desalination facility site
Siberian elm (*Ulmus pumila*)	C	Main pipeline
NOTE: *Class A = weeds not native to an ecosystem with a limited distribution; Class B = weeds not native to an ecosystem and presently limited to a particular area; Class C = weeds not native to the ecosystem and widespread (Lee 1999).		

Within the Snake Tank well field site, African rue, a Class B weed, was the sole noxious weed species observed by SWCA biologists. This drought-tolerant species is found primarily in the southern New Mexico counties and spreads by seed, roots, or root fragments (Lee 1999).

Within the pipeline alignment, SWCA biologists documented eight noxious weeds: camelthorn (*Alhagi maurorum*), African rue, field bindweed (*Convolvulus arvensis*), Malta starthistle (*Centaurea melitensis*), perennial pepperweed (*Lepidium latifolium*), Russian knapweed (*Acroptilon repens*), salt cedar, and Siberian elm (*Ulmus pumila*). Of these, camelthorn and perennial pepperweed are classified as Class A weeds; Malta starthistle and Russian knapweed are classified as Class B weeds; and salt cedar, Siberian elm, and field bindweed are classified as Class C weeds.

Class A Weeds. Camelthorn is a deep-rooted, perennial shrub that reproduces primarily by vegetative clones produced from rhizomes (California Department of Food and Agriculture 2005). This species is identified by its slender spines, alternate wedge-shaped leaves, and pea-like pinkish-purple to maroon flowers. Hand removal is effective if the majority of root system can be extracted, and herbicides can also be used for control of this species (Renz and Sholedice 2006). Perennial pepperweed is a highly competitive species identified by its height (up to 6 feet), non-clasping leaves, and small, densely clustered, white-petaled flowers (Lee 1999). This species spreads from creeping roots, root fragments, and seeds. To manage these Class A noxious weeds, the State of New Mexico aims to prevent new infestations and eliminate existing ones. Control consists of hand pulling individual plants and the application of herbicides.

Class B Weeds. Malta starthistle is an annual found commonly only in the southern counties of New Mexico. This species is identified by its winged stem, yellow flowers, and spinal bracts with purple- to brown-tipped spines. Propagation occurs by seed; however, spot eradication of plants can effectively control the spread of this species. Mowing or burning prior to seed production and application of herbicides are effective treatments (Renz and Sholedice 2006). Russian knapweed is a perennial forming dense colonies by adventitious shoots, and once established, this species is difficult to eradicate (Whitson 2000), but herbicides appear to be effective (Renz and Sholedice 2006). Russian knapweed is identified by its black roots, purple flowers, and smooth, papery floral bracts. To manage these Class B noxious weeds, the State of New Mexico prioritizes preventing new infestations.

Class C Weeds. Saltcedar, Siberian elm, and field bindweed are widespread throughout New Mexico. Saltcedar forms dense monocultures, which severely limit biodiversity. This species grows into a shrub or tree and can be either deciduous or evergreen. Key identifying characteristics include five-petaled pink to white flowers; small, scale-like leaves; and reddish brown bark. Siberian elms are fast-growing trees that spread rapidly by seed germination. This species is identified by its small, toothed leaves and rough brown to gray bark. Field bindweed is a creeping perennial that forms dense mats and produces white, trumpet-shaped flowers. The seeds can remain viable for up to 50 years, making control of this species difficult. To control the spread of Class C noxious weeds, the State of New Mexico encourages long-term management and suppression.

GRAZING

Portions of the study area (Snake Tank well field) are within the Black Ledge Allotment No. 07050. The allotment is permitted for 361 cattle and 3 horses. The allotment contains 40,887 acres of land with 16,002 acres of BLM-managed, 19,265 acres of State trust land, and 5,620 acres of private land. Range improvement projects in this area include windmills, water delivery systems (pipelines, storage tanks, and water troughs), earthen reservoirs, and fences. In general, the carrying capacity for the area is approximately five cattle per section.

WILDLIFE

The term "wildlife" refers to living organisms that are not in any way altered or domesticated and that exist in natural habitats. Wildlife is a very general term for life in various ecosystems but most commonly refers to fauna (animals) such as mammals, birds, reptiles, amphibians, fish, and insects.

Each species of wildlife has specific habitat requirements and desert grassland provides a valuable biotic community in the Southwest. Most semi-desert grasslands of the northern Chihuahuan Desert have been subjected to long-term impacts by livestock. This continuous grazing has led to alteration of the grasslands and, in some cases, a transformation of the landscape from desert grasslands to desert shrublands. Wildlife population density and species variability has shifted in response to this landscape change. Some grassland has persisted, although not necessarily with the pre-grazing composition and condition, and wildlife species dependent on this particular ecosystem have had a gradual decline in available habitat.

Common wildlife taxa that occur in this region of the Chihuahuan Desert and that may use desert grasslands and desert shrublands include but are not limited to blacktail jackrabbit (*Lepus* *californicus*), cottontail rabbits (*Sylvilagus* sp.), banner-tailed kangaroo rat (*Dipodomys spectabilis*), white-throated woodrat (*Neotoma albigula*), mule deer (*Odocoileus hemionus*), javelina (*Pecari tajacu*), scaled quail (*Callipepla gambelii*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), pronghorn (*Antilocapra americana*), red-tailed hawk (*Buteo jamaicensis*), ferruginous hawk (*B.regalis*), golden eagle (*Aquila chrysaetos*), great horned owl (*Bubo virginianus*), bullsnake (*Pituophis melanoleucus*), and western rattlesnake (*Crotalus viridis*) (Bailey 1980).

THREATENED AND ENDANGERED WILDLIFE SPECIES

Biologists from SWCA conducted on-site field surveys and documented species of wildlife. Species observed in the field were compared to the lists of threatened and endangered species, candidate species, sensitive species, and species of concern known to occur in Otero County (Appendix J). These lists include the regulatory status of each species as recorded by the USFWS and the New Mexico Department of Game and Fish (NMDGF). A map of special status species occurrences is found in Appendix J.

The USFWS lists five threatened or endangered wildlife species, one mammal and four birds that could occur in Otero County. Following field surveys, SWCA biologists determined that the study area does not provide potential suitable habitat for the northern aplomado falcon (*Falco femoralis septentrionalis*) or the southwestern willow flycatcher (*Empidonax trailii extimus*). Table 3-10 provides the status, known distribution, and habitat needs of these birds. Detailed descriptions of these species are included below.

TABLE 3-10. FEDERALLY LISTED WILDLIFE WITH POTENTIAL TO OCCUR IN STUDY AREA

COMMON NAME ***(SCIENTIFIC NAME)***	**STATUS**	**KNOWN DISTRIBUTION AND HABITAT NEEDS**	**LIKELIHOOD OF OCCURRENCE IN STUDY AREA**
Birds			
Northern aplomado falcon *Falco femoralis septentrionalis*	Endangered	Prefers grassy plains interspersed with mesquite, cactus, and yucca; territories in desert grassland/savanna	Occurrence not likely
Southwestern willow flycatcher (*Empidonax trailii extimus*)*	Endangered	Found in close association with dense groves of willows, arrow weed, buttonbush, salt cedar, Russian olive, and some other riparian vegetation, often with a scattered overstory of cottonwood. Breeds in riparian habitats along rivers and streams and in other wetlands	Occurrence not likely
NOTE: * Species is listed in the New Mexico Comprehensive Wildlife Conservation Strategy			

Northern Aplomado Falcon. The study area does not provide potential suitable habitat for the northern aplomado falcon. In New Mexico, the NMDGF reports that the historic range of northern aplomado falcons included the southern tier of counties from Hidalgo and Grant eastward through Luna, Doña Ana, Otero, Eddy, and Lea and northward in the Rio Grande Basin through Sierra and Socorro counties (Meyer and Williams 2005). The USFWS has released an experimental population and has reclassified the aplomado falcon under the 10(j) rule of the Endangered Species Act (ESA). The aplomado falcon is now designated a non-essential experimental population as of July 26, 2006. Species with this designation are considered a "proposed" species for purposes of compliance with Section 7 of the ESA (Federal Register [FR] 2005). The release sites are in areas within or in proximity to potential suitable habitat with available prey, minimal natural and human-made hazards, access to logistical support, and a willing landowner or land manager (USFWS 2005a) (Appendix K).

Between 1952 and 1995, the NMDGF confirmed northern aplomado falcon sightings in Otero and Socorro Counties (Biota Information System of New Mexico [BISON-M] 2004). The Otero County sightings were a single subadult in June 1991 near Tularosa, a first-year female in September 1999 that was originally banded in Chihuahua, Mexico, and a pair of birds observed during the 2000 to 2004 surveys conducted by Meyer and Williams (2005). In 2002, the only successful nesting attempt to be documented in New Mexico since 1952 occurred in Luna County, in southwestern New Mexico (USFWS 2005b).

Southwestern Willow Flycatcher. The NMDGF has published a Comprehensive Wildlife Conservation Strategy (CWCS) for New Mexico (CWCS 2006) that includes a section devoted to wildlife species of greatest conservation need that occur in or use perennial marsh/cienega/spring/seep ecosystems in the Tularosa Watershed in New Mexico. The southwestern willow flycatcher is listed by the USFWS as an endangered species that could occur in Otero County and is included in the comprehensive strategy as occurring at the springs in the study area. In October 2004, the USFWS proposed a new designation of critical habitat for the southwestern willow flycatcher (FR 2004), which was finalized in 2005. No suitable or critical habitat is present in the project area. Table 3-10 provides the status, known distribution, and habitat needs of the species.

OTHER SPECIAL STATUS WILDLIFE SPECIES

Other special status species include species of concern listed by the USFWS; threatened, endangered, and sensitive species listed by the NMDGF; and sensitive species listed by the BLM. The BLM lists contain a total of 60 special status species that could occur in Otero County: 24 mammals, 22 birds, 6 reptiles or amphibians, 3 fish, 2 mollusks, and 3 insects. During surveys, SWCA biologists determined that the study area provides potential suitable habitat for 19 of these species (Table 3-11).

TABLE 3-11. SPECIAL STATUS WILDLIFE SPECIES WITH THE POTENTIAL TO OCCUR IN THE STUDY AREA

COMMON NAME (*SCIENTIFIC NAME*)	STATUS	KNOWN DISTRIBUTION AND HABITAT NEEDS	LIKELIHOOD OF OCCURRENCE IN STUDY AREA
Mammals			
Botta's pocket gopher (*Thomomys bottae tularosae*)	NMS	Endemic to a small portion of south-central New Mexico in the vicinity of the Tularosa Basin	Occurrence possible
Cave myotis bat (*Myotis velifer*)	BLMS NMS	Shortgrass plains, sacaton grasslands, sycamore, cotton-wood, rabbitbrush, oak savanna; never more than a few miles from water	Occurrence possible
Common hog-nosed skunk (*Conepatus mesoleucus*)	NMS	Inhabits 7 ecozones in Chihuahuan Desert Scrub habitat in New Mexico; preferred habitat has rocky areas that are used for denning	Occurrence possible
Desert pocket gopher (*Geomys arenarius arenarius*)	BLMS	Typical of Plains-Mesa Grasslands and Sand Scrub habitat in New Mexico; habitat includes borrow pits, roadside edges, agri-systems, lands with plant communities influenced by drought conditions	Occurrence possible
Desert pocket gopher (*G. bursarius arenarius*)	NMS USFWSS	Barren land indicative of sand dunes, sandy or loamy soils of the White Sands area	Occurrence possible
Fringed myotis bat (*Myotis thysanodes thysanodes*)	BLMS NMS	Desertscrub, oak-woodland, oak-juniper, piñon-juniper, ponderosa pine, spruce-fir, deciduous and coniferous riparian	Occurrence possible
Plains pocket mouse (*Perognathus flavescens qypsi*)	NMS	Has been found to inhabit Plains-Mesa Sand Scrub habitat in New Mexico; white or pale plains pocket mice have a particular association with the gypsum sands of the White Sands area	Occurrence possible
Townsend's big-eared bat (*Corynorhinus townsendii*)	BLMS NMS USFWSS	Xeric to mesic habitats, including desertscrub, sagebrush, chaparral, deciduous and coniferous forests	Occurrence possible
White Sands woodrat* (*Neotoma micropus leucophaea*) *This subspecies is now considered to be the southern plains woodrat (*Neotoma micropus canescens*)	USFWSS	Typical of Plains-Mesa Grasslands in New Mexico; white or pale southern plains woodrats have a particular association with the gypsum sands of the White Sands area	Occurrence possible
Birds			
Baird's sparrow (*Ammodramus bairdii*)	NMT BLMS USFWSS	Shortgrass prairie, desert grassland	Occurrence possible
Common ground dove (*Columbina passerina pallescens*)	NME	Agricultural and undeveloped areas at elevations below 5,400 feet; open stands of creosotebush and large succulents	Occurrence Possible
Ferruginous hawk	BLMS	Grassland, semi-desert grass-shrub,	Occurrence Possible

TABLE 3-11. SPECIAL STATUS WILDLIFE SPECIES WITH THE POTENTIAL TO OCCUR IN THE STUDY AREA

COMMON NAME (*SCIENTIFIC NAME*)	STATUS	KNOWN DISTRIBUTION AND HABITAT NEEDS	LIKELIHOOD OF OCCURRENCE IN STUDY AREA
(*Buteo regalis*)		sagebrush-grass, piñon-juniper, open country, prairies, plains, badlands	
Loggerhead shrike (*Lanius ludovicianus*)	BLMS	Agricultural land, prairies, montane meadows, sagebrush, desertscrub, piñon-juniper woodlands, and woodland edge; open stands of creosotebush and large succulents	Observed
Mountain plover (*Charadrius montanus*)	NMS USFWSS	Shortgrass prairies and dry playas dominated by blue grama and buffalo grass and scattered taller vegetation during the breeding season; appears to require some degree of bare ground, which may be provided by livestock grazing, prairie dog towns, disturbed areas around windmills and water tanks, and barren playas	Occurrence possible
Western burrowing owl (*Athene cunicularia hypugaea*)	BLMS	Grasslands, prairies, or open areas near human habitation, especially golf courses and airports, open stands of creosotebush and large succulents	Observed
Yellow-billed cuckoo (*Coccyzus americanus*)	USFWSS	Western race associated with lowland deciduous woodlands, willow and alder thickets, second-growth woods, deserted farmlands, and orchards; Chihuahuan Desert Scrub, open stands of creosotebush and large succulents in southern New Mexico and southwest Texas	Occurrence possible
Reptiles and Amphibians			
Mottled rock rattlesnake (*Crotalus lepidus lepidus*)	NMT	Rocky canyons or hillsides in pine-oak forests, mesquite-grasslands, and desert; talus slopes	Occurrence possible
Texas horned lizard (*Phrynosoma cornutum*)	BLMS	Arid and semiarid open country with loose soil supporting bunchgrass, cactus, juniper, mesquite, or acacia	Observed
Insects			
Sacramento Mountains blue butterfly (*Icaricia icarioides*)	USFWSS	Known to occur in Otero County; distribution and habitat needs not completely known; high likelihood of occurrence restricted to the geographic limits of the Sacramento Mountains (outside of the study area)	Occurrence possible

NOTE: BLMS = Bureau of Land Management Sensitive; NME = New Mexico Endangered; NMS, New Mexico Species of Concern; NMT = New Mexico Threatened; USFWSS = U.S. Fish and Wildlife Service Species of Concern

SPECIAL STATUS RIPARIAN WILDLIFE

The CWCS (2006) (described above) includes two bird and three mammal riparian species that could occur at the springs near Snake Tank well field and are also listed by resource agencies as sensitive species and/or species of concern that could occur in Otero County. These species are the peregrine falcon (*Falco peregrinus*), white-faced ibis (*Plegadis chihi*), New Mexico meadow jumping mouse (*Zapus hudsonius luteus*), spotted bat (*Euderma maculatum*), and desert bighorn sheep (*Ovis canadensis mexicana*). Table 3-12 summarizes the status, known distribution, and habitat needs of these species. Detailed descriptions are provided in Appendix J.

One additional species of concern listed for Otero County, the White Sands pupfish (*Cyprinodon tularosa*), was also listed in the CWCS as occurring in the Tularosa Watershed. However, this fish does not occur in any of the five affected springs near the Snake Tank well field. However, because this species is restricted to surface water features in the study area and is limited in population and location to the Tularosa Basin, it is included in Table 3-12 and is described in greater detail below.

TABLE 3-12. FEDERAL- AND STATE-LISTED WILDLIFE SPECIES THAT COULD OCCUR IN OTERO COUNTY AND ARE IDENTIFIED IN THE NEW MEXICO CWCS AS OCCURRING IN CIENEGA/SPRING ECOSYSTEMS

COMMON NAME ***(SCIENTIFIC NAME)***	**STATUS**	**KNOWN DISTRIBUTION AND HABITAT NEEDS**	**LIKELIHOOD OF OCCURRENCE IN STUDY AREA**
Birds			
Peregrine falcon (*Falco peregrinus*)	USFWSS	Centers on cliffs in wooded/forested habitats for nesting, with large "gulfs" of air nearby in which these predators can forage. Preferred hunting (foraging) habitats include croplands, meadows, river bottoms, marshes, and lakes	Occurrence possible; suitable foraging habitat within the project's region of influence
White-faced ibis (*Plegadis chihi*)	BLMS	Shoreline marsh habitats bordered by open water, desert streams with a narrow band of trees and shrubs along the margins, reservoir habitats	Occurrence possible; suitable habitat within the project's region of influence
Mammals			
New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)	USFWSS	Riparian and wetland habitats characterized by spikerush, sedges, and rushes; close to permanent water	Occurrence possible; suitable habitat within the project's region of influence
Spotted bat (*Euderma maculatum*)	NMT BLMS	Riparian communities, piñon-juniper woodlands, and ponderosa pine and spruce-fir forests	Occurrence possible; suitable habitat within the project's region of influence
Desert bighorn sheep (*Ovis canadensis mexicana*)	NME	Tends to occur within 1 mile of a water source; prefers grass/desert shrub and live oak communities, avoid grassland and piñon-juniper communities	No longer occurs in Otero County
Fishes			
White Sands pupfish (*Cyprinodon tularosa*)	NMT	Fine mud-silt and sand-gravel bottoms of clear, shallow, strongly alkaline pools and streams with saltgrass and salt cedar along the border; endemic to the Tularosa Basin	Unlikely to occur; known populations are outside of project's region of influence
NOTE: BLMS = Bureau of Land Management Sensitive; NME = New Mexico Endangered; NMT = New Mexico Threatened; USFWSS = U.S. Fish and Wildlife Service Species of Concern			

White Sands Pupfish

The White Sands pupfish is endemic to the Tularosa Basin. Only four populations exist, and the species is currently classified as threatened by the State of New Mexico (19 NMAC 33.1). In 1991, the White Sands pupfish was listed in the Federal Register as a Category 2 species for consideration to be listed as a threatened or endangered species (FR 1991) but was dropped from consideration in 1996 when the USFWS classification scheme was changed and Category 2 and 3 species were no longer considered Federal candidate species (FR 1996). An initial conservation agreement was created in 1994 (Pittenger and Propst 1994), and in 2006 a cooperative agreement was signed by representatives of the WSMR, Holloman AFB, White Sands National Monument, the USFWS, and the NMDGF. Signatories agree to protect, manage, and enhance habitats; restrict non-emergency activities including vehicular traffic in essential habitat; prevent the introduction of non-native aquatic fauna; and monitor and remove specifically identified populations of non-native fauna (NMDGF 2006a).

The White Sands pupfish is the only species of fish endemic to the Tularosa Basin. The four locations where it is found are Malpais Spring, Salt Creek, Mound Spring, and Lost River. The Malpais Spring and Salt Creek populations are considered native; the White Sands pupfish was probably introduced to the latter two sites in the late 1960s or early 1970s (Pittenger and Springer 1999). The populations in Malpais Spring, Salt Creek, and Mound Spring are all located on WSMR, and the population in Lost Creek is on Holloman AFB.

These four habitats are on the western edge of the Tularosa Basin near the San Andres Mountains and are fed by perennial springs, but water discharge fluctuates greatly). Currently, these springs have only native aquatic animal species, but invasive crayfish (*Procambarus clarkii*) and western mosquitofish (*Gambusia affinis*) inhabit waters nearby and may pose a future problem. Another potential threat is the salt cedar that occurs around many of the springs. The especially long taproot of this exotic plant allows it to intercept deep water tables and interfere with natural aquatic systems (NMDGF 2006b).

The greatest threats faced by the White Sands pupfish include the introduction of non-native species, dewatering, chemical contamination of habitat, and habitat degradation (Pittenger and Propst 1994; Pittenger and Springer 1999). Currently, the White Sands pupfish is the only fish present in its habitat. However, western mosquitofish and largemouth bass (*Micropterus salmoides*) occur in ponds on WSMR and Holloman AFB; if either of these species is introduced to habitats supporting White Sands pupfish, it is likely the latter would be eliminated (Pittenger and Propst 1994). On the other hand, the reduction in the feral horse population occupying White Sands pupfish habitat from 1,800 to less than 200 has greatly improved habitat quality (Stephanie Carman, NMDGF, personal communication February 2007). Monitoring data from 1995 to the present indicate that the White Sands pupfish populations fluctuate with available wetted habitat and have been stable under conditions over the past 12 years (S. Carman, NMDGF, personal communication February 2007).

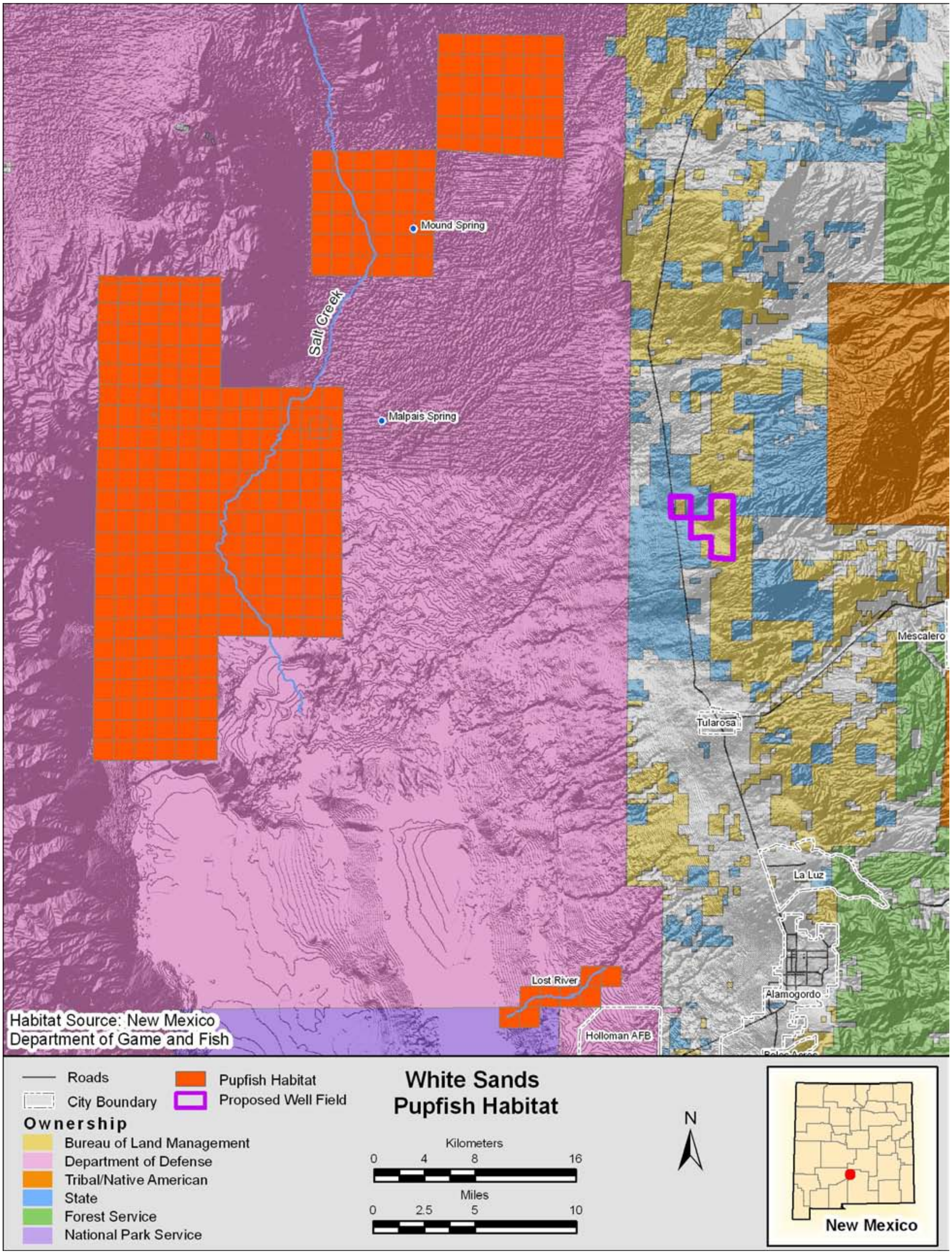


Figure 3-8 Habitat for White Sands pupfish.

3.3.5 CULTURAL RESOURCES

Cultural resources can be components of the environment that are the result of human activity on the landscape or natural resources of special concern to one or more groups of people for cultural reasons. Constituting an interface between the human realm and the physical environment, cultural resources play a role in linking modern-day individuals, societies, and communities to their own past and cultural values. The scientific or historical study of cultural resources may also contribute to a general intellectual sense or understanding of humanity's collective history and condition, and this may be an important value to people who otherwise have no personal historical links to a particular area. Resources that are the result of human activity include a variety of "historic properties" (which include prehistoric archaeological sites), structures, and artifacts. Natural resources of cultural significance can include natural features of the landscape and areas where ceremonies are conducted or native plants are gathered. Any of these resource types that are important to one or more groups of people may be considered traditional cultural properties (TCPs). Indian Trust Assets (ITAs) such as mineral rights also fall under the category of natural resources. Individuals or interested parties are welcome to comment on the proposed project.

CULTURAL RESOURCES LAW

To safeguard the cultural and intellectual values relating to cultural resources, as well as legal rights involving ITAs, the U.S. and State of New Mexico governments have formulated a series of regulations and policies. These efforts date back to the Antiquities Act of 1906, but they gathered steam with the passage of the National Historic Preservation Act (NHPA) in 1966. The most significant laws include the NHPA, the American Indian Religious Freedom Act (AIRFA), and the Native American Graves Protection and Repatriation Act (NAGPRA).

With respect to the management of historic properties under Section 106 of the NHPA, an important threshold is National Register of Historic Places (NRHP) eligibility status. The identification of historic properties also involves an evaluation process. Sites or other properties are evaluated as "eligible," "not eligible" or "not sure" (or "eligibility status unknown"). Eligibility status depends upon significance (or lack of significance) of the resource according to one or more of the following criteria:

A. Association with events that have made a significant contribution to the broad patterns of our history.

B. Association with the lives of significant persons in the past.

C. Resources (typically buildings or structures) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

D. Resources (usually archaeological sites) that have yielded, or may be likely to yield, information important in history or prehistory.

For archaeological sites, significance status is usually determined (or at least recommended) based on the presence or absence of intact subsurface archaeological remains. Within a study area or area of potential effect (APE), any identified resource determined or considered to be eligible to the NRHP (or for which eligibility status is unknown) requires further management before construction can begin. Resources deemed not eligible to the NRHP require no further treatment.

CULTURAL-HISTORICAL SETTING

The Tularosa Valley has been inhabited for at least 12,000 years, and prehistoric archaeological remains here are included within the Jornada Mogollon cultural region (U.S. Army 2000). This immense span of prehistory is subdivided into three traditions: Paleoindian (ca. 10,000-6000 B.C.), Archaic (ca. 6000 B.C.-A.D. 250) and Formative (ca. A.D. 250-1475). This sequence marks the local development of human societies from highly mobile, hunting-and-gathering peoples who lived in small-scale, informal societies, to farmers who constructed adobe pueblos, maintained more complex societies, and participated in long-distance exchange networks. Following the abandonment of the Tularosa Valley by Formative tradition peoples, nomadic groups re-occupied the area, most significantly the Mescalero Apache, who were present in the area by the seventeenth century, and horse-mounted Comanche, who ranged throughout the area from the 1700s until the mid nineteenth century (Railey and Holmes 2002:17–67).

The Euro-American history of the region began with the arrival of Spanish explorers in the sixteenth century, although the earliest explorers tended to bypass the Tularosa Valley, traveling along the Rio Grande to the west and the Pecos River to the east. The Spanish began exploiting the natural salt resources in the Tularosa Valley in the 1600s, but the area north of El Paso remained unsettled by Euro-Americans until the late nineteenth century, in part because of threats from the Mescalero Apache and Comanche. Once the threat of raiding had subsided, ranching quickly expanded into the Tularosa Valley, and the 1880s saw a cattle boom there. Mining activity also began to flourish in the area in the late nineteenth century, and irrigation-based farms sprang up along the eastern margin of the valley. With the construction of the El Paso and Northeastern Railroad in 1897-1898, economic development and population growth increased rapidly, and the City of Alamogordo was founded. In the twentieth century, ranching activities diminished as the environment was degraded by over-grazing, and mining activities dissipated as mineral resources played out or failed to deliver on initial production promises and hopes. During this same century, however, the expansion of the Fort Bliss Military Reservation and establishment of the WSMR refocused much of Alamogordo’s economy on military-related activities and support services, and these remain important sources of livelihood in the area (Railey and Holmes 2002:67-78).

EXISTING CONDITIONS

In 2004, 2005, and 2009, SWCA conducted Class III cultural resources surveys of the study area. The survey included proposed locations of the well field and associated pipelines, the project main-delivery pipeline, and the proposed desalination facility that is within the City corporate boundary. Survey of these areas identified 11 archaeological sites within the study area, designated by Laboratory of Anthropology (LA) numbers and detailed in Table 3-13. Of these sites within the proposed project APE, two sites—LA 86735 and LA 150031—are recommended and have been determined eligible for listing on the NRHP under Criterion D. Where avoidance is not possible, impacts to the two sites would be mitigated. Mitigation may include having an archaeologist present to monitor construction activities, testing the sites to determine the need for further investigation through data recovery, and/or performing subsequent archaeological data recovery (excavation) within entire sites or in potentially affected portions of the sites. All or portions of a site may be destroyed as a result of archaeological excavations, but the site would still retain its eligibility to the NRHP under Criterion D for information potential in the form of recovered scientific data. As part of mitigation, there will be a public presentation in the form of a brochure, presentation meetings, or public report detailing the results of these archaeological excavations. The remaining nine sites were either destroyed by previous construction activities or were fully documented for their information potential and are recommended as not eligible to the NRHP; no further management of these sites is recommended.

No standing buildings or structures are present within the surveyed APE, and no TCPs have been identified within the action area.

The Three Rivers Petroglyph and Pueblo Site, listed (No. 52) on the State Register of Cultural Properties (SRCP), is located approximately 7 miles north of the study area, outside the project APE. Additionally, the Tularosa Original Townsite National Historic District is listed on both the NRHP (No. 79001545) and the SRCP (No. 703). None of the historic resources that are part of this district are located within the project APE.

3.3.6 INDIAN TRUST ASSETS

ITAs are defined as the presence or potential for Indian real property, physical assets, and/or intangible property rights that could be affected by one or more of the alternatives.

REGULATORY BACKGROUND

The Indian trust responsibility is a legal duty on the part of the United States to protect and maintain rights reserved by, or granted to, Indian tribes or individuals. Trust relationships are established through a Congressional Act or Executive Order and through provisions identified in historical treaties. The courts have further interpreted these rights through decisions and regulations.

The Department of the Interior publication, *Departmental Manual Part 303: Indian Trust Assets*, defines general policy and principles for managing ITAs. Agencies are required to protect and preserve ITAs to ensure that their use promotes the interests of the beneficial owner, enforce leases, promote tribal control, manage and distribute income, maintain good records, and protect treaty-based fishing, hunting, gathering, and similar rights of access and resource use on traditional tribal land. Both BLM and Reclamation policy requires explicit evaluation in NEPA analyses of potential effects of proposed project on ITAs (Reclamation 1993). The Government-To-Government Consultation Plan for this EIS was prepared in November 2004. Government-To-Government consultation letters (Appendix L) and Military consultation letters (Appendix M) were prepared.

TABLE 3-13. CULTURAL RESOURCES (ARCHAEOLOGICAL SITES) WITHIN THE STUDY AREA		
SITE NO.	**SITE SUMMARY**	**NRHP RECOMMENDATION**
LA 66917	Remnants of one or more historic secondary refuse dumps of restaurant and domestic trash from the first half of the 20th century, largely destroyed by road construction and disturbed from plowing	Not Eligible
LA 66918	Historic secondary dump from the late 19th/early 20th century, largely destroyed and/or buried by plowing, blading, and road construction activities	Not Eligible
LA 66920	Historic dump, destroyed by road construction	Not Eligible
LA 66921	Prehistoric artifact scatter, destroyed by road construction	Not Eligible
LA 66922	Homestead/farming site from the early 20th century, destroyed by road construction and plowing	Not Eligible
LA 66923	Railroad-related stock pens and associated structures from the late 19th/early 20th century, largely destroyed by road construction	Not Eligible
LA 86735	Remnants of historic railroad station from the late 19th/early 20th century	Eligible
LA 127399	Remnants of historic railroad station from the late 19th/early 20th century, largely disturbed by road construction and plowing	Not Eligible
LA 150031	Single charcoal-stained area, cultural affiliation and date unknown	Eligible
LA 152308	Single-episode, railroad-related dump from the turn of the 20th century	Not Eligible
LA 162625	Single-episode, railroad-related dump from the turn of the 20th century	Not Eligible

EXISTING CONDITIONS

No ITAs have been identified within the study area, although the Mescalero Apache Tribe has unresolved groundwater and surface water issues. The BLM will continue to consult with the Mescalero Apache during the NEPA process.

3.3.7 SOCIOECONOMIC RESOURCES

Socioeconomic resources in the study area include the social and economic environment of Otero County as defined by the characteristics of the human population in the region. These characteristics include growth rate, labor force, employment, income, and other economic indicators. Local taxes and water rates are also considered.

POPULATION AND ECONOMIC INDICATORS

Otero County is one of 33 counties in New Mexico, and its total population in 2000 was 62,298. The communities of Tularosa and Alamogordo (and La Luz) lie entirely within Otero County. In 2000, Otero County had a per-capita income of $14,345, lower than the Statewide average of $17,261. The estimated median family income for the entire county in 2000 was $34,781, also lower than the state average of $39,425. In addition, 19.3 percent of the county population was below the poverty threshold (U.S. Census Bureau 2000). Table 3-14 and Table 3-15 provide data on population groups and economic status at the state, county, and city levels from the 2000 Census for the study area.

Population is a determining factor in the demand for water. Table 3-16 shows actual population and growth rates from 1970 to 2000 and projected population and growth rates from 2010 to 2030 for Otero County. The population in the study area increased between 1970 and 2000 from 41,095 persons to 62,298 persons and is projected to increase to 73,348 persons by 2030.

The rate of population growth in Otero County experienced a steady increase between 1970 and 2000. The population increase in the county was 7 percent more from 1980 to 1990, and 4 percent more from 1990 to 2000. In spite of these increases, future projections seem to indicate a decline in percent growth, with 12 percent less from 2000 to 2010, 3 percent less from 2010 to 2020, and 1 percent less from 2020 to 2030.

Additional population data obtained in 2007 from the U.S. Census Bureau, Population Division, indicates an even smaller rate of population growth, estimated from 2000 to 2006 at 0.7 percent growth from 62,298 to 62,744.

TABLE 3-14. COMPARISON OF ETHNIC AND RACIAL POPULATIONS

UNIT	TOTAL POPULATION	POPULATION GROUPS BY PERCENTAGE OF TOTAL POPULATION					
		WHITE	AFRICAN-AMERICAN	AMERICAN INDIAN	ASIAN	OTHER	HISPANIC*
New Mexico	1,819,046	66.8	1.9	9.5	1.1	17.0	42.1
Otero County	62,298	73.7	3.9	5.8	1.2	11.7	32.2
Alamogordo	35,582	75.4	5.6	1.1	1.5	12.1	32.0
Tularosa	2,864	68.6	0.9	4.3	0.7	21.5	56.1

DATA SOURCE: U.S. Census Bureau 2000.
NOTE: *Includes some individuals counted under other ethnic/racial categories.

TABLE 3-15. ECONOMIC COMPARISON DATA

UNIT	MEDIAN HOUSEHOLD INCOME	MEDIAN FAMILY INCOME	PER CAPITA INCOME	PERCENT INDIVIDUALS BELOW POVERTY LEVEL	PERCENT FAMILIES BELOW POVERTY LEVEL
New Mexico	$34,133	$39,425	$17,261	18.4	14.5
Otero County	$30,861	$34,781	$14,345	19.3	26.8
Alamogordo	$30,928	$35,673	$14,662	16.5	13.2
Tularosa	$27,522	$30,313	$12,507	21.4	19.5

DATA SOURCE: U.S. Census Bureau 2000.

TABLE 3-16. POPULATION AND GROWTH RATE, OTERO COUNTY

POPULATION GROWTH	YEAR						
	1970	1980	1990	2000	2010*	2020*	2030*
Population	41,095	44,665	51,928	62,298	67,018	70,508	73,348
Population Increase	–	3,570	7,263	10,370	4,720	3,490	2,840
Percent Growth	–	9	16	20	8	5	4

DATA SOURCE: U.S. Census Bureau 2000; BBER 2004.
NOTE: *Population values are based on BBER revised population projections for New Mexico state and counties.

Total full- and part-time employment in Otero County increased from 19,222 jobs in 1970 to 27,278 jobs in 2000 (Table 3-17). Employment increased by 19.5 percent in the 1970s, 10.2 percent in the 1980s, and 7.7 percent in the 1990s. County growth rates for transportation and public utilities, wholesale trade, retail trade, and services employment all experienced a decline in the 1990s, with farm employment and government and government enterprises actually losing jobs in the same time period. In 2000, government and government enterprises jobs contributed the most to total employment in Otero County, followed by services, retail trade, and finance, insurance, and real estate.

As of March 2006, the unemployment rate for Otero County was 3.9 percent. In the 1990s, Otero County's unemployment rate was equal to or greater than 4.3 percent and went as high as 10.3 percent in 1992 (Economagic 2006).

TABLE 3-17. FULL- AND PART-TIME EMPLOYMENT BY SECTOR IN OTERO COUNTY

	YEAR				PERCENTAGE CHANGE		
EMPLOYMENT SECTOR	1970	1980	1990	2000	1970–1980	1980–1990	1990–2000
Farm employment	385	512	561	555	32.9	9.5	-1.1
Agricultural services, forestry, fishing and other	34	96	162	(D)	182.3	68.7	N/A
Mining	51	17	42	(D)	-66.6	147.0	N/A
Construction	421	774	870	1,514	83.8	12.4	74.0
Manufacturing	1,166	1,029	825	872	-11.7	-19.8	5.7
Transportation and public utilities	470	674	1,163	1,166	43.4	72.5	0.3
Wholesale trade	125	180	307	332	44.0	70.5	8.1
Retail trade	1,993	3,191	3,816	4,286	60.1	19.6	12.3
Finance, insurance, and real estate	512	1,017	932	1,553	98.6	-8.3	66.6
Services	3,444	3,565	5,290	6,223	3.5	48.4	17.6
Government and government enterprises	10,621	11,922	11,354	10,402	12.2	-4.7	-8.4
Employment (Number of Jobs)	**19,222**	**22,977**	**25,322**	**27,278**	**19.5**	**10.2**	**7.7**

DATA SOURCE: U.S. Department of Commerce 2006.
NOTE: (D) = not shown to avoid disclosure of confidential information, but estimates for this item are included in the totals; N/A, not able to determine number.

Total earnings paid to workers in Otero County have increased from $146,281,000 in 1970 to $344,362,000 in 1980, $591,387,000 in 1990, and $763,930,000 in 2000 (Table 3-18). The greatest increases in earnings between 1990 and 2000 came from the following industrial sectors: construction (169 percent); finance, insurance, and real estate (150 percent); retail trade (49 percent); and manufacturing (46 percent). Farm employment was the only sector to experience a reduction in earnings from 1990 to 2000 (-33 percent). Overall, earnings increased by 29 percent in the 1990s.

TABLE 3-18. OTERO COUNTY EARNINGS					
	EARNINGS ($1,000)				**PERCENT CHANGE**
SECTOR	**1970**	**1980**	**1990**	**2000**	**1990–2000**
Farm employment	1,568	816	3,282	2,183	-33
Agricultural services, forestry, fishing, other	168	675	2,100	(D)	N/A
Mining	170	525	1,225	(D)	N/A
Construction	3,650	12,370	15,885	42,728	169
Manufacturing	11,895	15,696	14,305	20,857	46
Transportation and public utilities	3,204	12,284	30,537	38,767	27
Wholesale trade	1,399	2,254	5,674	6,015	6
Retail trade	9,775	28,417	41,790	62,413	49
Finance, insurance, and real estate	2,282	6,266	9,406	23,515	150
Services	22,517	43,585	100,216	117,852	17
Government and government enterprises	89,653	221,474	366,967	445,299	21
Total Earnings (Thousands of Dollars)	**146,281**	**344,362**	**591,387**	**763,930**	**29**

DATA SOURCE: U.S. Dept. of Commerce 2006.
NOTE: (D) = not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals; N/A = not able to determine number.

Table 3-19 shows residential water and sewer rates in Alamogordo and Tularosa (the communities closest to the study area) compared to rates in eight other Southwest cities. Among these communities, Alamogordo has the lowest combined rate for these services, and Tularosa has the second lowest. Water rates for study area residential customers are on the lower end of the range.

TABLE 3-19. COMPARISON OF RESIDENTIAL WATER AND SEWER RATES FOR 10 SOUTHWEST CITIES			
CITY	**DOLLARS PER MONTH, 2004**		
	WATER	**SEWER**	**TOTAL**
Alamogordo*	17.81	10.84	28.65
Tularosa*	23.73	9.42	33.15
Phoenix	20.71	15.97	36.68
Tucson	25.04	12.52	37.56
Las Vegas	22.99	15.64	38.63
El Paso	26.13	14.79	40.92
Albuquerque	29.29	15.34	44.63
San Antonio	30.75	15.76	46.51
Dallas	24.01	23.24	47.25
Austin	30.34	31.23	61.57

DATA SOURCE: El Paso Water Utilities Public Service Board 2004; NMED 2005a.
NOTE: *Numbers for Alamogordo and Tularosa were obtained from NMED (2005a). Values are provided for residential average water use of 6,000 gallons per month and residential average sewer rate per month.

3.3.8 ENVIRONMENTAL JUSTICE

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (U.S. Environmental Protection Agency [EPA] 2005a, 2005b). This resource topic refers specifically to the demographic and economic characteristics of the human population that could experience adverse effects from implementation of the proposed project which includes the residents of Tularosa, Alamogordo, and surrounding areas of Otero County.

Three environmental justice parameters were represented on EPA maps for the 1990 and 2000 U.S. Censuses in Otero County:

- Economic Status – Degree of Vulnerability (DVECO)
- Minority Status – Degree of Vulnerability (DVMAV)
- Potential Environmental Justice Index (EJ Index) – derived from a formula that multiplies the DVECO, the DVMAV, and the total population ranking (PF) in the survey area.

The EJ Index value is used as a demographic correlation variable to measure sociological equity for project permitting. The information given in the EPA environmental justice report does not represent the final analysis of a site with regard to environmental justice. Rather, the indices and raw data reported are indicators of vulnerability for subgroups of people to other stressors (EPA 2005b). Table 3-20 shows the EPA EJ Index ranking for the study area.

TABLE 3-20. ENVIRONMENTAL JUSTICE VALUE AND POPULATION VULNERABILITY

SURVEY SITE	EJ INDEX VALUE BY U.S. CENSUS YEAR		POPULATION VULNERABILITY, 2000 CENSUS	COMMENTS
	1990	2000		
Site 1 Alamogordo	1	2	Low	Includes the northwest side of the City of Alamogordo
Site 2 Alamogordo	3	2	Low	Includes the Village of Tularosa
Site 3 Alamogordo	6	2	Low	Includes the Village of Tularosa; significant decrease in percentage of economically stressed individuals between census years contributed to drop in EJ Index value
Site 4 Alamogordo	1	1	Low	Significant drop in total population in this survey area, from 55 in 1990 down to 10 in 2000
Site 5 Alamogordo	1	4	Low	Total population in the survey area is extremely low (12 in 1990, down to 5 in 2000); 50 percent were economically stressed in 2000, which contributed to the higher EJ Index value; also, project features in this survey grid are completely within federal and state land ownership, with no private residents in the immediate vicinity

NOTE: Based on a 50-square-mile survey area.

3.3.9 LAND USE

Land use designations in the study area include 1) shrub and brush rangeland, 2) mixed rangeland, and 3) cropland and pasture (Anderson et al. 1976; USGS 1990) (Figure 3-9).

On-site field visits were conducted to verify land use designation and geographic information. NRCS classifications were used to determine the presence of lands classified as important or prime farmlands, rangelands, or forest land. Prime farmland is defined as land suitable for the production of any food, feed, fiber, forage, and/or oilseed crops, and is designated by soil type (NRCS 2005).

The south end of the study area is near the northern boundary of Alamogordo. Except for portions of the main pipeline route near Tularosa with some residential development, most of the land use in the study area falls into one of the following categories: open space with native habitat typically present in the Chihuahuan Desert, rangeland for livestock grazing, agricultural production, transportation rights-of-way, and utility corridors.

Otero County contains a total of 1,207,598 acres of farmlands, and neighboring Lincoln County contains a total of 1,605,566 acres of farmlands. While the total farmland acreage within the Tularosa Basin in Otero and Lincoln counties is not quantified, the number of irrigated agricultural acres is summarized in Table 3-21.

Ownership and/or administration of the study area fall into one of the following categories (Anderson et al. 1976; USGS 1990) (see Figure 3-9):

- Federal – BLM
- State – State Lands; New Mexico Department of Transportation (NMDOT)
- Private – Individual or group of individuals; private company or business
- Utility – Utilities with rights-of-way transferred via lease or easement from an original owner to a publicly-owned company; also, utilities with an agreement to use an existing right-of-way that stays under the ownership of the original entity. This land ownership type may fall under the Federal, state, or private designation, depending on location.

TABLE 3-21. GROUNDWATER DEPLETIONS FROM IRRIGATED AGRICULTURE IN THE TULAROSA BASIN

TYPE OF IRRIGATION	COUNTY	IRRIGATED ACREAGE	SURFACE WATER (AFY)	GROUND WATER (AFY)	TOTAL DIVERSION (AFY)
Flood	Lincoln	475	0	2,265	2,265
	Otero	985	5,693	915	6,608
Subtotal		***1,460***	***5,693***	***3,180***	***8,873***
Drip	Lincoln	75	0	170	170
	Otero	1,895	0	6,303	6,303
Subtotal		***1,970***	***0***	***6,473***	***6,473***
Sprinkler	Lincoln	65	0	107	107
	Otero	2,850	0	11,830	11,830
Subtotal		***2,915***	***0***	***11,937***	***11,937***
Lincoln County Total		**615**	**0**	**2,542**	**2,542**
Otero County Total		**5,730**	**5,693**	**19,048**	**24,741**
Lincoln County Percent		10	–	–	–
Otero County Percent		90	–	–	–
Tularosa Basin Total		**6,345**	**5,693**	**21,590**	**27,283**
SOURCE: Livingston and Shomaker 2002a, 2002b.					

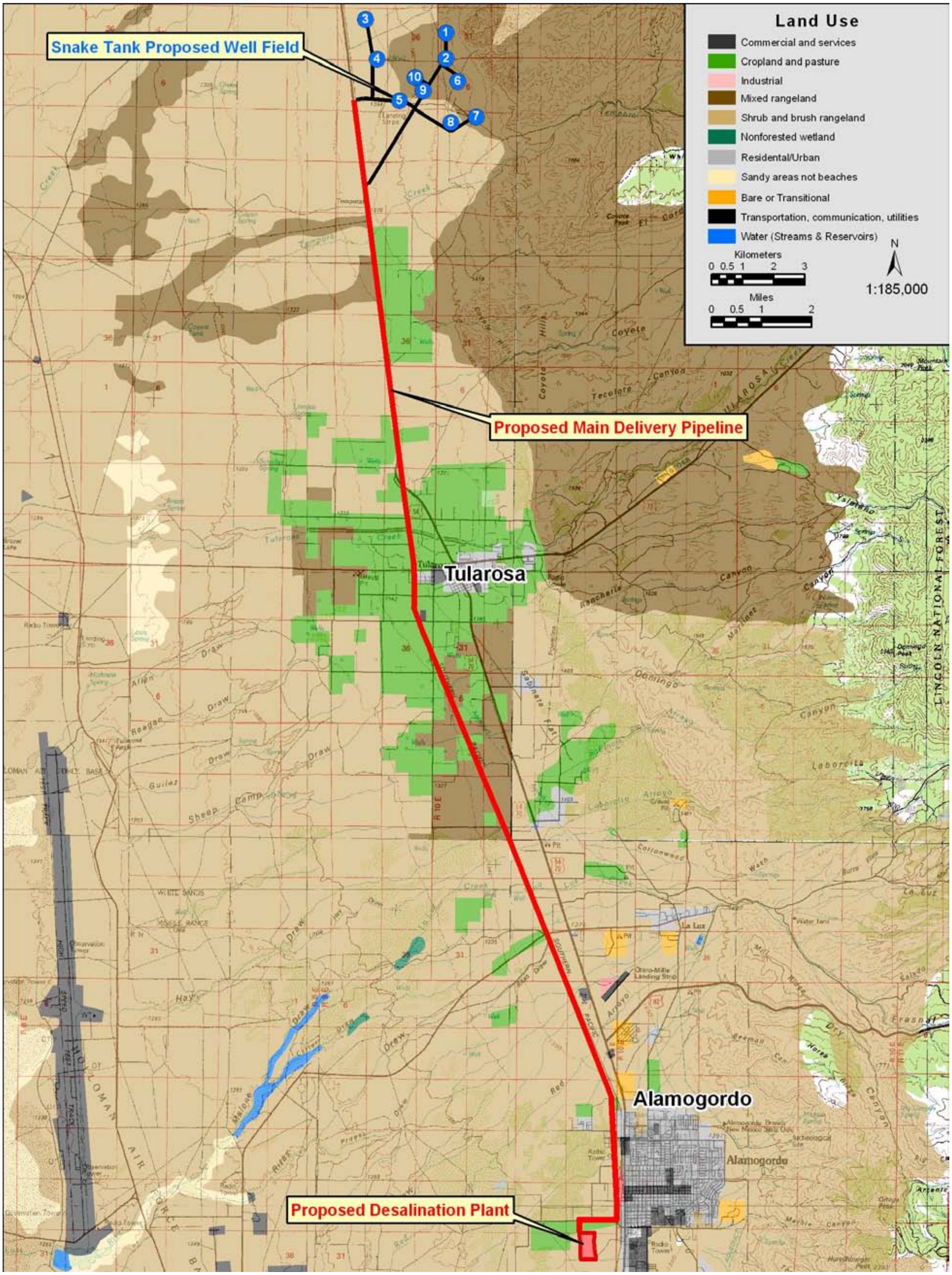


Figure 3-9. Study area land uses.

3.3.10 ENERGY REQUIREMENTS

Resources discussed in this section include electricity and natural gas. PNM, based in Albuquerque, New Mexico, and its subsidiary company, Texas-New Mexico Power Company (TNMP), provide these services to the study area.

PNM is currently assessing the electric power needs and delivery systems that need to remain in place to continue to provide service to the study area. The Amrad Distribution Station provides electricity to Alamogordo and the surrounding area. The electric transmission and generation requirements for this area are now designated by PNM as Eastern New Mexico, with a projected 2007 peak load of 85 megawatts (MW) (Figure 3-10). PNM/TNMP plans to temporarily transmit power from the El Paso Electric Company (EPE) and redirect additional power from the Las Cruces area to maintain adequate MW in the study area to meet projected loads (PNM 2006).

Transmission line capacities in the area, including lines to the Amrad station, were assessed in a feasibility study in 2003 by EPE when a new High Voltage Converter Station (HVCS) was proposed at a terminal near Artesia, New Mexico. This study recommended that the Amrad station upgrade its transmission lines to handle the additional loads associated with the installation of the HVCS. Results of the study concluded that electric transmission systems in the southern portions of New Mexico would require modifications or upgrades to continue to operate reliably and meet expected loads following installation of the HVCS (EPE 2002).

An extensive network of electric transmission and distribution power lines exists throughout the study area. This network includes the U.S. 54/U.S. 70 corridor and most of the areas near Alamogordo. New Mexico Gas Company also provides natural gas service to the study area. Gas lines currently exist along U.S. 54/U.S. 70.

3.3.11 TRANSPORTATION

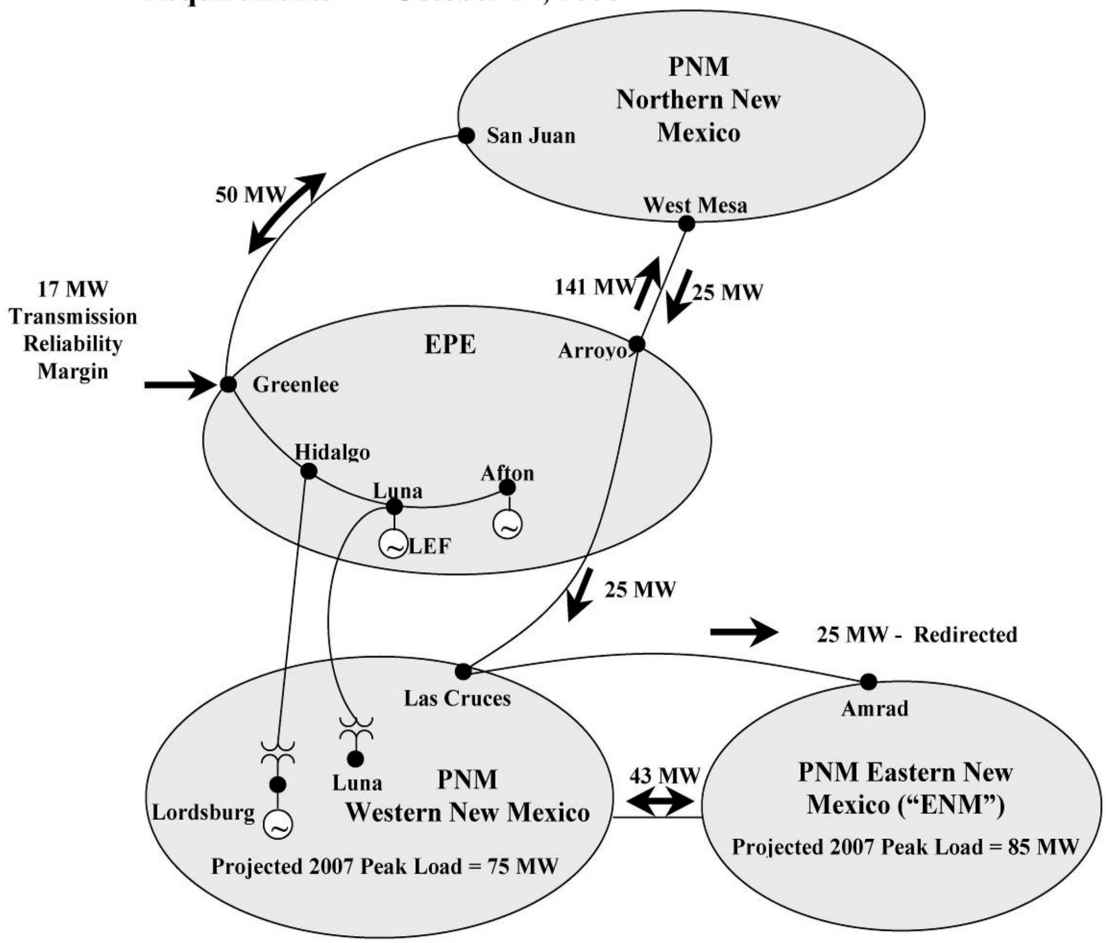
Transportation and circulation systems include roadways, railroads, and airports. There are no airports in the study area that would be affected by the proposed action, thus airports are not discussed in the section.

ROADWAYS

The major road that provides access to the study area is U.S. 54, a major north-south, non-interstate freeway that runs through both Tularosa and Alamogordo. There is one major intersection in Tularosa, where U.S. 70 joins U.S. 54 from the east; from that point, U.S. 54 and U.S. 70 share the same transportation corridor south to Alamogordo.

Traffic volume is typically reported as Annual Average Daily Traffic (AADT), the total number of vehicles per day averaged over an entire year. The AADT can be measured directly with continuous count equipment or indirectly by taking short traffic counts for a few days and adjusting the counts with factors from the AADTs to account for daily and seasonal variations.

Southern New Mexico ("SNM") Transmission and Generation Requirements -- October 24, 2006



<u>SNM Summary*</u>

	2005	Est. 2007
ENM Load > 68 MW	173 Hours	403 Hours
ENM Load > 43 MW	3,299 Hours	4,719 Hours
Total Load >75 MW	6,002 Hours	6,696 Hours

Projected 2007 Peak Load = 160 MW
Transmission Rights = 75 MW
Load Side Resource Requirements = 85 MW

*These are nominal figures, and should be revised as to reflect changes in peak load and load profile

Notes:

- Need to acquire transmission from EPE on an hourly, daily, weekly or monthly time frame from May thru August to serve Eastern New Mexico load.
- The existing 25 MW from West Mesa to Las Cruces has been redirected from West Mesa to Amrad to serve Eastern New Mexico load. Schedules under this agreement should be maintained at 25MW unless the Eastern New Mexico load is less than 68 MW.
- Assumes no Eddy County Network Resource.

Figure 3-10. **PNM resources electrical transmission network.**

A comparison of a road's AADT to its capacity is known as its Level of Service (LOS). The LOS scale runs from A through F, with A the best and F the worst. Traffic volume (AADT-to-capacity) ratios as they relate to LOS values are shown in Table 3-22.

TABLE 3-22. ROADWAY LEVELS OF SERVICE

LOS	DESCRIPTION	CRITERIA (VOLUME/CAPACITY) FOR TWO-LANE HIGHWAYS
A	Free flow with users unaffected by presence of other users of roadway	0.15
B	Stable flow, but presence of the users in the traffic stream becomes noticeable	0.27
C	Stable flow, but operation of single users becomes affected by interactions with others in traffic stream	0.43
D	High density but stable flow; speed and freedom of movement severely restricted; poor level of comfort and convenience	0.64
E	Unstable flow; operating conditions at capacity, with reduced speeds, maneuvering difficulty, and extremely poor levels of comfort and convenience	1.00
F	Forced breakdown of flow, with traffic demand exceeding capacity; unstable stop-and-go traffic	Greater than 1.00
DATA SOURCE: Transportation Research Board 1994; U.S. Army Corps of Engineers 2004.		

U.S. 54 in the northern portion of the study area has an AADT of 2,287, which is within the lowest AADT category for the state (0.00–7,984.00) and just 1.3 percent of the highest AADT (168,636) (NMDOT 2004). This segment has a LOS of A (Table 3-23). The segment of U.S. 54 in the southern portion of the study area has an AADT of 13,875, the third highest in Otero County and within the second lowest AADT category for the state, at 8.2 percent of the highest AADT (NMDOT 2004). This segment of U.S. 54 has a LOS of C.

TABLE 3-23. TRAFFIC CAPACITY OF ROADWAYS IN STUDY AREA

ROADWAY	CAPACITY (VEHICLES PER HOUR)	TRAFFIC IN 2004* (VEHICLES PER DAY)	VOLUME** (VEHICLES PER HOUR)	VOLUME-TO-CAPACITY RATIO	LOS
U.S. 54	95.3	2,287	1504.5	0.06	A
U.S. 54/U.S. 70 corridor	578.0	13,875	1504.5	0.38	C
SOURCE: *NMDOT 2004; **Global Security 2005.					

RAILWAYS

One commercial freight carrier, the UPRR, provides rail service to Tularosa, Alamogordo, and the study area. The UPRR line runs parallel to U.S. 54 north of Tularosa, but splits west from the roadway as it nears the village.

3.3.12 AIR QUALITY

Air quality refers to the composition of air with respect to quantities of pollutants and is routinely compared with "standards" of maximum acceptable pollutant concentrations. Air quality in a given location can be described by the concentration of individual pollutants in the atmosphere and is generally expressed in units of ppm or micrograms per cubic meter ($\mu g/m^3$).

Under the authority of the Clean Air Act (CAA), the EPA has established nationwide air quality standards to protect public health and welfare, with an adequate margin of safety. These Federal standards, the National Ambient Air Quality Standards (NAAQS), were developed for one or more of seven criteria pollutants, including lead (Pb), nitrogen oxide (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter 10 microns or less in size (PM_{10}), particulate matter 2.5 microns or less in size ($PM_{2.5}$), and ozone (O_3).

The EPA has classified all areas of the U.S. as either meeting (in attainment) or not meeting (in nonattainment) the NAAQS for each individual criteria pollutant. Under the CAA, state and local agencies may establish air quality standards and regulations of their own, provided they are at least as stringent as the Federal requirements. The CAA amendments of 1990 established a framework for achieving attainment and maintenance of the health-protective NAAQS.

Individual states are required to establish a State Implementation Plan (SIP), which must be approved by the EPA. A SIP is a document designed to provide a plan for maintaining existing air quality in attainment areas and programmatically eliminating or reducing the severity and number of NAAQS violations in nonattainment areas. The underlying goal of a SIP is to bring state air quality conditions into and/or maintain compliance with the NAAQS.

The principal method of maintaining or improving ambient air quality is by controlling emissions from sources. The SIP will usually establish regulations to control stationary emission sources; the EPA establishes regulations to control mobile sources, which are installed by vehicle manufacturers. In attainment areas, Prevention of Significant Deterioration (PSD) regulations apply; in nonattainment areas, New Source Review regulations apply.

The PSD regulations provide special protection from air quality impacts for certain areas, primarily National parks and wilderness areas, designated as Class I areas. Mandatory PSD Class I areas established under the CAA Amendment of 1977 for New Mexico are listed under 40 CFR 81.421. These are areas where visibility has been determined to be an important issue by the EPA Administrator in consultation with the Secretary (U.S. Army Corps of Engineers [USACE] 2004b).

Four potential PSD Class I areas occur in general proximity to the study area:

- San Andres National Wildlife Refuge – administered by the USFWS, approximately 32 miles southwest of the study area.
- White Sands National Monument – administered by the National Park Service, approximately 12 miles southwest of the study area.
- White Mountain Wilderness Area – administered by the Lincoln National Forest, approximately 16 miles northeast of the study area.
- Capitan Mountain Wilderness Area – administered by the Lincoln National Forest, approximately 42 miles northeast of the study area.

Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. Meteorological conditions have a significant impact on the pollutant concentrations because they control the dispersion or mixing of pollutants in the atmosphere through the influences of wind speed, wind direction, atmospheric stability, and other meteorological variables. For example, summer thunderstorms can produce dust storms that carry large quantities of particulate matter high into the atmosphere.

The affected environment for inert pollutants (all pollutants other than ozone and its precursors) is generally limited to a few miles downwind of a source. For PM_{10} emissions from construction and operational activities, the affected environment is limited to the area immediately surrounding the construction sites. For large sources of ozone precursors, the affected environment for ozone can extend much farther downwind than for inert pollutants. In the presence of solar radiation, the maximum effect of volatile organic compounds (VOCs) and NO_x emissions on ozone levels usually occurs several hours after these pollutants are emitted and many miles from the source. For the study area, the affected environment for air quality includes Tularosa, Alamogordo, and the immediately surrounding areas on the west side of the Sacramento Mountains and the east side of the Tularosa Basin in Otero County.

The NMED Air Quality Bureau classifies the air quality in the affected region for this project as in attainment under the CAA for all pollutants. This means that the air quality in the study area does not exceed acceptable levels of the NAAQS criteria pollutants per EPA standards.

3.3.13 CLIMATE CHANGE

Ongoing scientific research has identified the potential impacts of climate changing pollutants on global climate. These pollutants are commonly called “greenhouse gases” (GHGs) and include carbon dioxide (CO_2), methane, nitrous oxide, water vapor, and several trace gas emissions. Through complex interactions on a regional and global scale, these emissions cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although climate changing pollutant levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO_2 concentrations to increase dramatically and are likely to contribute to overall climatic changes, typically referred to as global warming.

The EPA has not promulgated rules to regulate GHGs; however, climate has the potential to influence renewable and non-renewable resource management. The EPA’s Inventory of U.S. Greenhouse Gas Emissions and Sinks found that in 2006, total U.S. GHG emissions were over 6 billion metric tons and that total U.S. GHG emissions have increased by 14.1 percent from 1990 to 2006. The report also noted that GHG emissions fell by 1.5 percent from 2005 to 2006. This decrease was, in part, attributed to the increased use of natural gas and other alternatives to burning coal in electric power generation.

New information about GHGs and their effects on national and global climate conditions are constantly emerging. The specific impacts include changes in annual and seasonal temperatures, and changes in precipitation quantities and patterns. However, the specific changes at any given location cannot be definitively concluded to be resultant of climate change induced by increased GHG emissions.

Global mean surface temperatures have increased nearly 1.0 degrees Celsius (°C) or 1.8 degrees Fahrenheit (°F) from 1890 to 2006 (Hansen et al. 2007). However, observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Figure 3-8 demonstrates that northern latitudes (above 24° North) have exhibited temperature increases of nearly 1.2°C (2.1°F) since 1900, with nearly a 1.0°C (1.8°F) increase since 1970. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

The Intergovernmental Panel on Climate Change (IPCC) has recently completed a comprehensive report assessing the current state of knowledge on climate change, its potential impacts, and options for adaptation and mitigation. At printing of this EIS, this assessment is available on the IPCC website at http://www.ipcc.ch/**.** According to this report, global climate change may ultimately contribute to a rise in sea level, destruction of estuaries and coastal wetlands, and changes in regional temperature and rainfall patterns, with major implications to agricultural and coastal communities. The IPCC has suggested that the average global surface temperature could rise 1°F to 4.5°F in the next 50 years, with significant regional variation. The National Academy of Sciences (2006) confirmed these findings, but also indicated that there are uncertainties regarding how climate change may affect different regions. Computer models indicate that such increases in temperature will not be equally distributed globally, but are likely to be accentuated at higher latitudes, such as in the Arctic, where the temperature increase may be more than double the global average (BLM 2007). Also, warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures. Vulnerabilities to climate change depend considerably on specific geographic and social contexts.

The BLM recognizes the importance of climate change and the potential effects it may have on the natural environment. Several activities occur within the planning area that may generate emissions of climate changing pollutants. For example, oil and gas development, large fires, and recreation using combustion engines, can potentially generate CO_2 and methane. Wind erosion from disturbed areas and fugitive dust from roads along with entrained atmospheric dust has the potential to darken glacial surfaces and snow packs resulting in faster snowmelt. Other activities may help sequester carbon, such as managing vegetation to favor perennial grasses and increase vegetative cover, which may help build organic carbon in soils and function as "carbon sinks."

3.3.14 VISUAL RESOURCES

Visual resources are based on an assessment and classification of visual landscapes or scenic viewscapes for their scenic attractiveness and ability to provide recreational opportunities. The definition of this resource category includes what viewers like and dislike about visual resources that compose a particular scene. Different viewers may evaluate visual resources differently; neighbors and travelers may, in particular, have different opinions on what they like and dislike about a scene. Viewers define visual quality in terms of natural harmony, cultural order, and project coherence (Minnesota Department of Transportation 2005). The criterion used to determine the level of significance of impacts to this resource category is visual quality, usually assessed through some type of visual resource management (VRM) system.

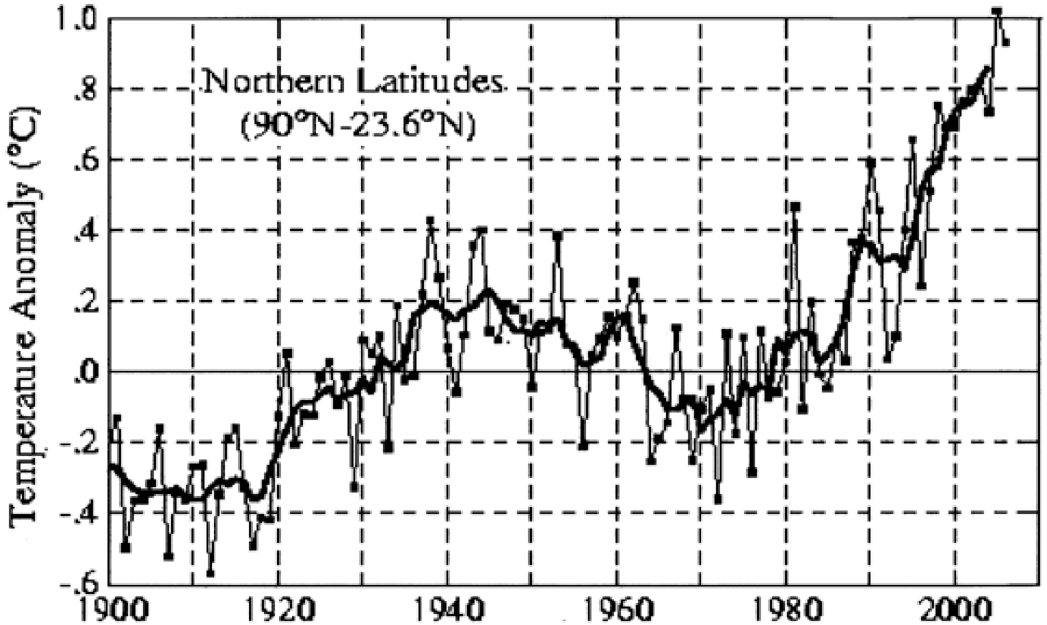


Figure 3-8. Annual Mean Temperature Change for Northern Latitudes (24 - 90° N) (Source: Hansen et al. 2007).

Visual resources include natural and human-made physical features that give a particular landscape its character and value. Features contributing to visual perception include landforms, vegetation, size, water, color, texture, adjacent or bounding scenery, and cultural modifications. Modifications in a landscape that repeat the landscape's basic elements are said to be in harmony with their surroundings. Typically, these visual perception features are used to evaluate landscapes on public and private lands.

The degree to which a management activity affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape (BLM 2004a). The affected visual resource environment encompasses approximately 2 miles around both the desalination facility and the Snake Tank well field. Portions of these sites occur on State Lands or lands administered by the BLM.

The Snake Tank well field currently has VRM Class III and IV designations from the BLM. VRM designations apply only to BLM surface features. Objectives for management of these classes can be found in the BLM H-8410-1 visual resource inventory. The management objectives for Classes III and IV are presented here for convenience (BLM 2004b):

- Class III Objective: To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- Class IV Objective: To provide for management activities which require major modifications of the existing character of the landscape. The level of change to the

characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

Visual sensitivity of the existing landscape is dependent on its visual character, the amount of public use of the area, public visibility, the presence or absence of adjacent developments, and the ability of the setting to absorb the structure(s). Absorption refers to how well the facility would fit within the existing setting. Visual sensitivity ratings are in three levels:

- High Visual Sensitivity: Areas with unique or valued visual attributes, minimal landscape disturbance, high visibility, and high public activity, because they have a limited ability to absorb changes that are not visible.
- Moderate Visual Sensitivity: Areas with typical visual attributes, surrounding development, lower visibility, limited public visibility, and disturbed landscape, because they have some ability to absorb changes without appearing to have changed.
- Low Visual Sensitivity: Areas with pervasive or degraded visual attributes, limited public use and viewing, or areas with development similar in characteristics to the facilities, because they can absorb changes without appearing noticeably different.

The Snake Tank well field is considered an area of moderate visual sensitivity. The vegetation in the well field has been greatly altered by the application of herbicides in recent years to promote grazing opportunities for livestock; reduction of shrubs in this environment allows grassland species to increase in density. Most of the area supports creosotebush in various stages of viability and is not considered distinctive vegetative habitat, exhibiting an overall high level of disturbance as a result of the herbicide application. One non-native invasive plant, African rue, was observed at this location. Built structures in and around the well field area include U.S. 54; the UPRR; barbed-wire fences; a ranch with several buildings and a bermed retention pond (Stover Ranch); another retention pond with an associated well (Lower Snake Tank); and a network of dirt access roads for the ranch, well, and ponds; and aboveground utility power lines.

4.0 ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter describes and analyzes the reasonably foreseeable impacts of the No Action and Proposed Action on the resources described in Chapter 3. The alternatives considered in detail, as described in Chapter 2, are:

- Alternative A (No Action Alternative) – Continued use of the City's existing surface and groundwater rights.

- Alternative B (Proposed Action) – Use of Snake Tank well field with desalination facility with the purchase and lease of water rights.

The impacts of the alternatives are described for the 10 resource categories presented in Chapter 3: water resources, geology, biological resources, cultural resources, Indian Trust Assets (ITAs), socioeconomics, land use, transportation, air quality, and visual resources. Existing environmental conditions serve as a baseline for the analyses, and thresholds have been established for each resource to determine the degree of individual effects.

The types of impacts analyzed in this section include:

- Direct impacts (long- and short-term)—spatially and temporally immediate.
- Indirect impacts (long- and short-term)—removed in space and/or time.
- Cumulative impacts—impacts of the alternative when considered together with non-related past, present, or reasonably foreseeable future actions.

Short-term impacts are impacts that occur during construction and last no more than 5 years following the completion of construction activities. *Long-term* impacts are impacts that occur during construction and last more than 5 years following the completion of construction activities.

4.2 ENVIRONMENTAL CONSEQUENCES OF EACH ALTERNATIVE

4.2.1 WATER RESOURCES

This section describes the anticipated environmental consequences on surface water quality and quantity and groundwater quality and quantity. The analysis is based on the surface water and groundwater resources described in Section 3.3.1 and Appendix H.

ANALYSIS METHODS

The analysis of groundwater impacts was based on groundwater models developed and used by the NMOSE, the City, and the USGS specifically for the Tularosa Basin. These models can be used to make predictions of how water levels, flow rates and directions, or water quality might change in the future. While groundwater models can only approximate the behavior and responses of an aquifer, they provide useful tools for the evaluation and comparison of water resource development projects. The three models used for the groundwater analysis are the NMOSE Model (a.k.a., the Morrison Model; Morrison 1989), the JSAI Model developed for the City (JSAI 2003), and the USGS Model (Huff 2005). Details on all three models and results are provided in Appendix H. JSAI (2009) completed a hydrogeologic assessment of proposed injection wells for the Project that was used in analyzes impacts of the Project (Appendix I).

ALTERNATIVE A – NO ACTION

SURFACE WATER

Under the No Action Alternative, the City would continue to divert surface water from the City's existing points of diversion, especially in periods of drought. These surface water diversions could adversely affect downstream water users and would reduce the quantity of surface water in the rivers and springs. From 1967 through 2001, the City's surface water diversions from the La Luz–Fresnal flume, Alamo Canyon, and Bonito Lake (City's share) averaged 3,614 afy, 1,372 afy, and 700 afy, respectively. This analysis assumes that, on average, the City would continue to divert a combined total of 5,686 afy from the existing resources until the year 2040. No additional points of surface water diversion are assumed.

Under the No Action Alternative, the City's diversion of surface water would reduce the amount of surface water available below the City's diversion points in both La Luz Creek and Alamo Canyon because the City would need to maximize diversions and use its existing water rights to meet the demand. Users with junior water rights, such as agricultural users, could experience a decrease in available water for their uses. In addition, the Tularosa Creek, the primary source of drinking water for the Village of Tularosa, would be similarly affected by an increase in diversions by the City.

The relationship between springs and groundwater levels in the Tularosa Basin is not well documented or understood. Springs are fed by groundwater sources, and springs located in proximity to the City's groundwater wells may be experiencing declines due to the groundwater pumping. Declines in groundwater levels caused by increased demands to pump water from existing wells could have an indirect, long-term adverse impact on surface water resources at springs and in groundwater-fed streams. Based on the USGS Model described in Huff (2005), the greatest effects on surface water are expected to occur in the agricultural area near Tularosa.

Under the No Action Alternative, the City and the Village of Tularosa would continue to maximize their surface water diversions and could cause declines in the available surface water resources in the agricultural area near Tularosa. As a result, the No Action Alternative would have a long-term, adverse impact on surface water resources.

GROUNDWATER

Under the No Action Alternative, the City would continue to pump groundwater from existing wells and well fields to meet the increasing water demands of its service area. Although increased pumping may be difficult due to current groundwater conditions, the City has unused water rights at the La Luz and Prather well fields and would be allowed to pump more groundwater using these existing rights. This pumping could have a direct, long-term, adverse impact on existing groundwater resources, particularly the groundwater resources of the Alamogordo Tularosa Administrative Area.

Based on the current pumping patterns and rates throughout the Tularosa Basin, numerous wells are projected to go dry by 2045 due to a decline in the water table (Figure 4-1) (Blandford 2006). The proposed project is expected to increase groundwater drawdown potentially resulting in more wells going dry. Given the anticipated water table decline, water rights holders should expect that wells that do not fully penetrate the aquifer may require deepening at some point in the future (Blandford 2006).

Significant groundwater drawdown near existing well fields could influence the migration of saline groundwater into fresh groundwater. Predominant water flow along the eastern margin of the Tularosa Basin is westward, away from the mountain-front recharge areas and toward the center of the basin (Huff 2005). If drawdown is sufficient to reverse this gradient, groundwater with greater salinity may be drawn toward municipal well fields and private wells in the affected area. Some localized groundwater flow changes are anticipated under the No Action Alternative (Huff 2005); however, the gradient changes are not of sufficient magnitude to affect water quality within the 40-year planning period.

ALTERNATIVE B – PROPOSED ACTION

SURFACE WATER

Overall, streams in the Tularosa Basin are not expected to be adversely affected by increased groundwater pumping at Snake Tank well field under Alternative B. The potential impacts of groundwater pumping at Snake Tank well field on springs near the well field are not well understood. Because the groundwater wells would tap into the basin fill aquifer, pumping is not expected to influence the flow of Maxwell Spring and other nearby springs (Shomaker 2006). The source of these springs originates in the same geologic formation as the well field aquifer, and the spring source is likely separated by a subsurface barrier between the bedrock and the basin fill from which water would be pumped. However, if these and other springs are hydraulically linked to the basin-fill aquifer, pumping of up to 20,000 acre-feet of a 5-year period under this alternative could have a direct, long-term, adverse effect on these surface water resources. However, hydrologic models suggest ongoing diversion of up to 10,000 afy from the well field would have no identifiable effect on the springs on the nearby High Nogal Ranch based on the NMOSE's analysis (NMOSE 2005a).

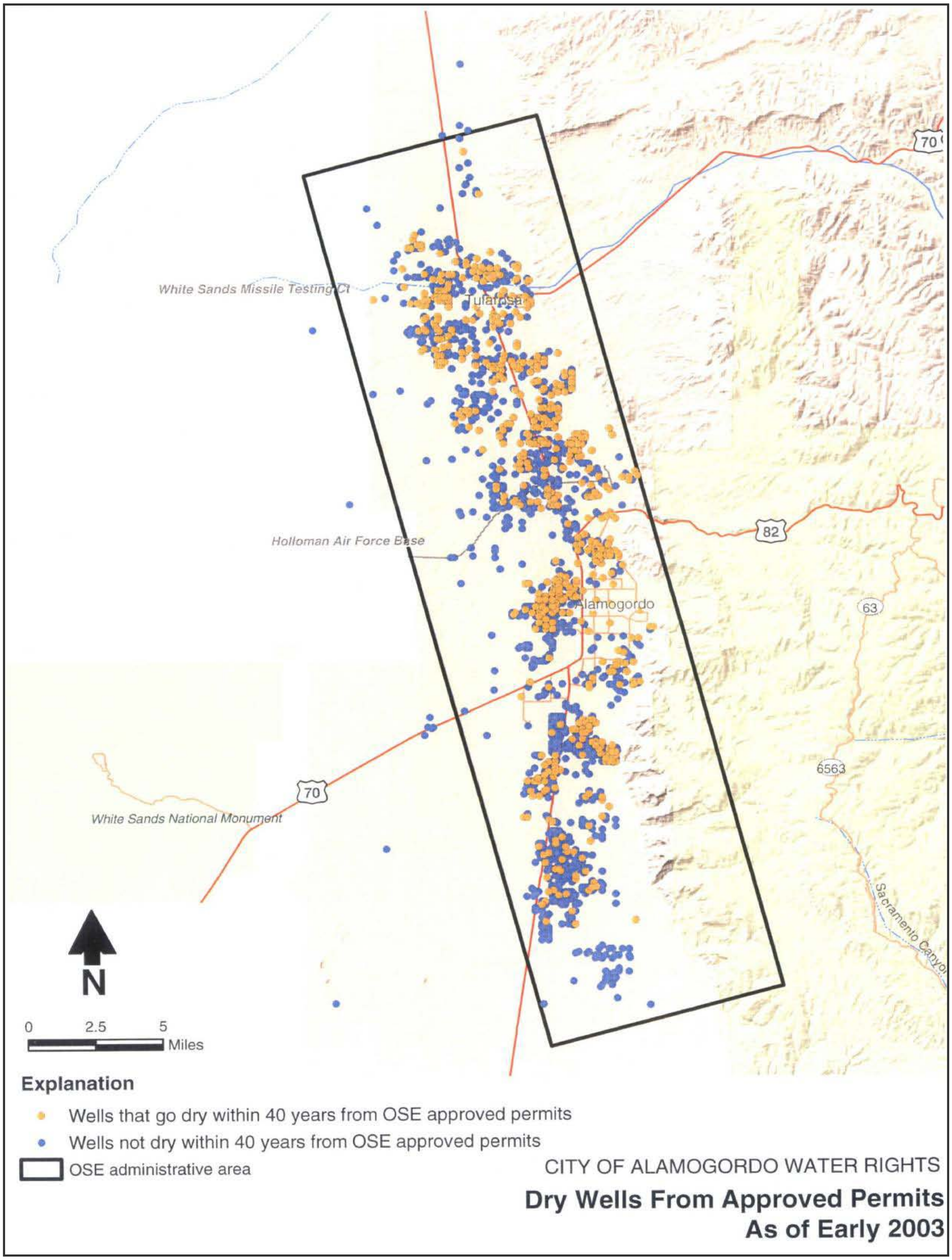


Figure 4-1. Predicted dry wells in the Tularosa Basin by 2045 (Huff 2005).

A change in groundwater flow direction in the area near Tularosa from pumping at Snake Tank well field could adversely affect near-surface groundwater discharge into Tularosa Creek (Havenor 2006). If the creek and groundwater table are hydrologically connected, the pumping of groundwater could result in a base flow reduction (NMOSE 2005a). However, this reduction may overestimate the impacts, and the groundwater table does not appear to be hydrologically connected to the creek (NMOSE 2005a). Minimal adverse impacts are anticipated on surface water flows in Tularosa Creek.

GROUNDWATER

Increased pumping at Snake Tank well field under Alternative B would have a direct, long-term, adverse impact on groundwater resources in the area due to substantial drawdown of the water table. Assuming a diversion of up to 4,000 afy by the year 2045, the water table is predicted to drawdown by a few feet to more than 119 feet near the well field (NMOSE 2009) (Figure 4-2, Figure 4-3, and Figure 4-4).

Incremental drawdown at Snake Tank well field would cause some wells in the immediate vicinity to go dry unless they could be extended deeper into the aquifer to account for the change in the water table levels. The aquifer is expected to be thick enough to allow water-right holders to deepen wells and continue pumping water, with minimal impacts from the Snake Tank well field pumping (Blandford 2006).

Pumping of groundwater from Snake Tank well field is not expected to adversely affect groundwater quality. Saline groundwater is not expected to migrate into freshwater groundwater sources based on the extent of drawdown predicted over the next 40 years (JSAI 2006). The extent of drawdown is not large enough to reverse the hydraulic gradient and alter groundwater flows from the areas of higher salinity along the boundary of White Sands Missile Range to the west (see Figure 4-2).

The deep well injection of concentrate will be within a suitable target geologic formation. Suitability depends on four factors: 1) water quality (TDS > 10,000 mg/L); 2) favorable transmissivity and storage capacity; 3) confining layer above the target formation; and 4) reasonable depth to target formation (JSAI 2009). It is anticipated that NM Environment Department would classify the proposed wells as Class I non-hazardous waste injection wells. The Environment Department may allow injection into a zone containing TDS concentrate between 5,000 and 10,000 mg/L, provided that it is not currently being used as a domestic of agricultural water supply, and there is no reasonable relationship between economic and social costs of failure to designate it use as agricultural or domestic water supply (JSAI 2009). TDS concentrations in the target injection zone must be elevated so injected brine does not degrade the existing groundwater resources. Confining layers such as shale that separate the target injection zone from shallow aquifers also serve to protect semi-fresh groundwater resources. Existing data support the possibility of achieving compliance at the proposed desalination site on La Velle Road (Appendix I).

As confirmed by existing data and drilling in the region, suitable bedrock confining units and injection zones are found at depth at the proposed desalination site (JSAI 2009).

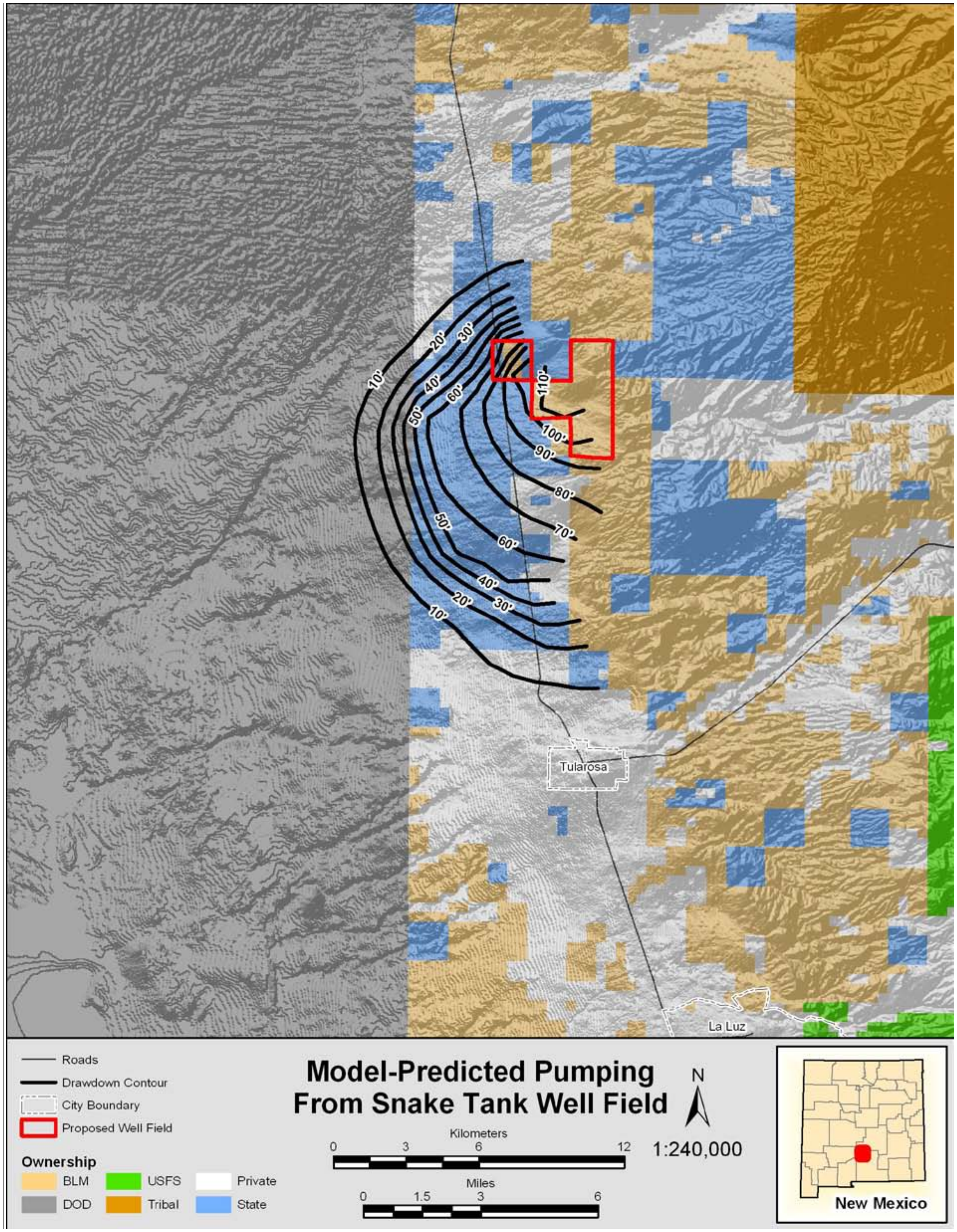


Figure 4-2. **JSAI model drawdown predictions.**

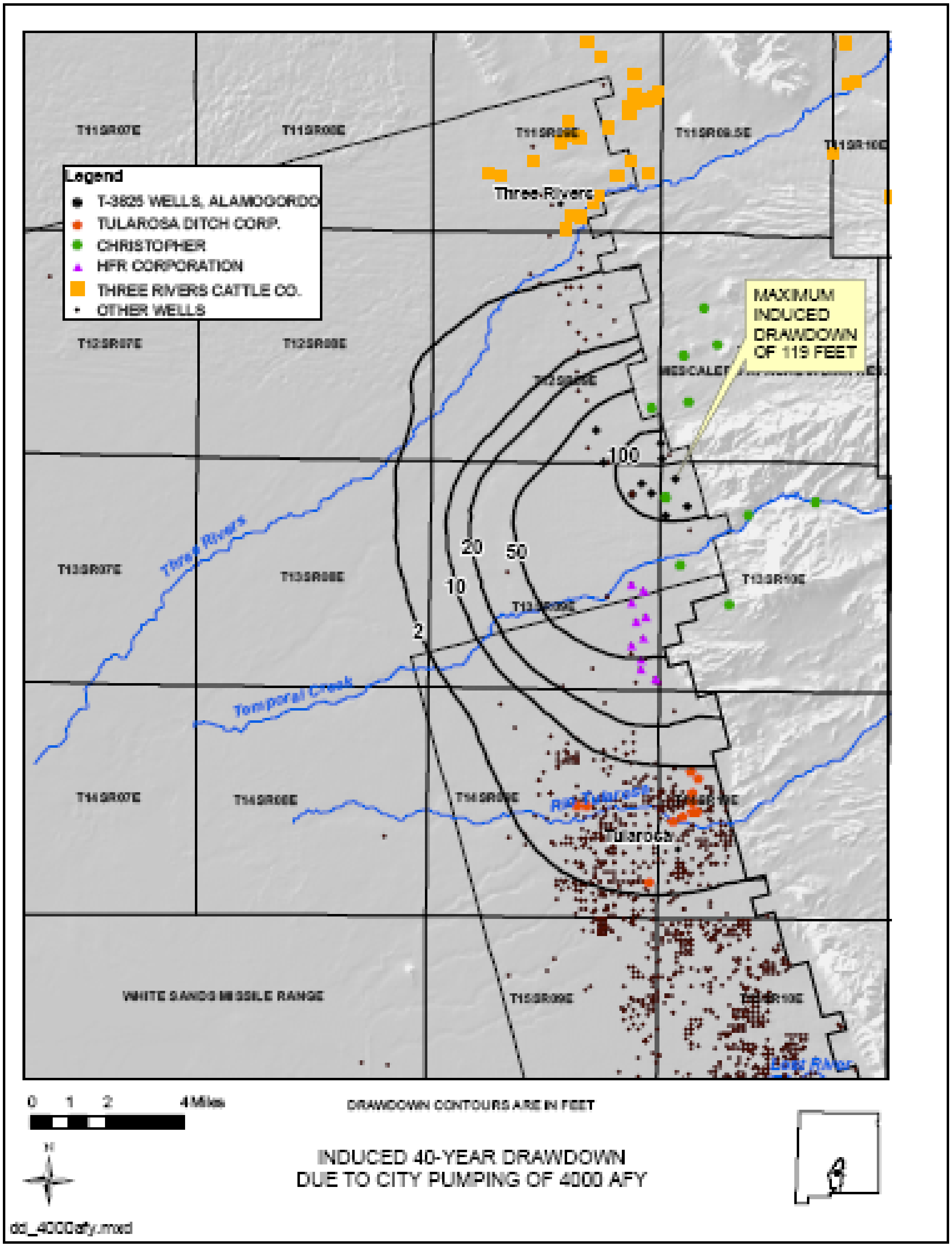


Figure 4-3. NMOSE model drawdown predictions (NMOSE 2009).

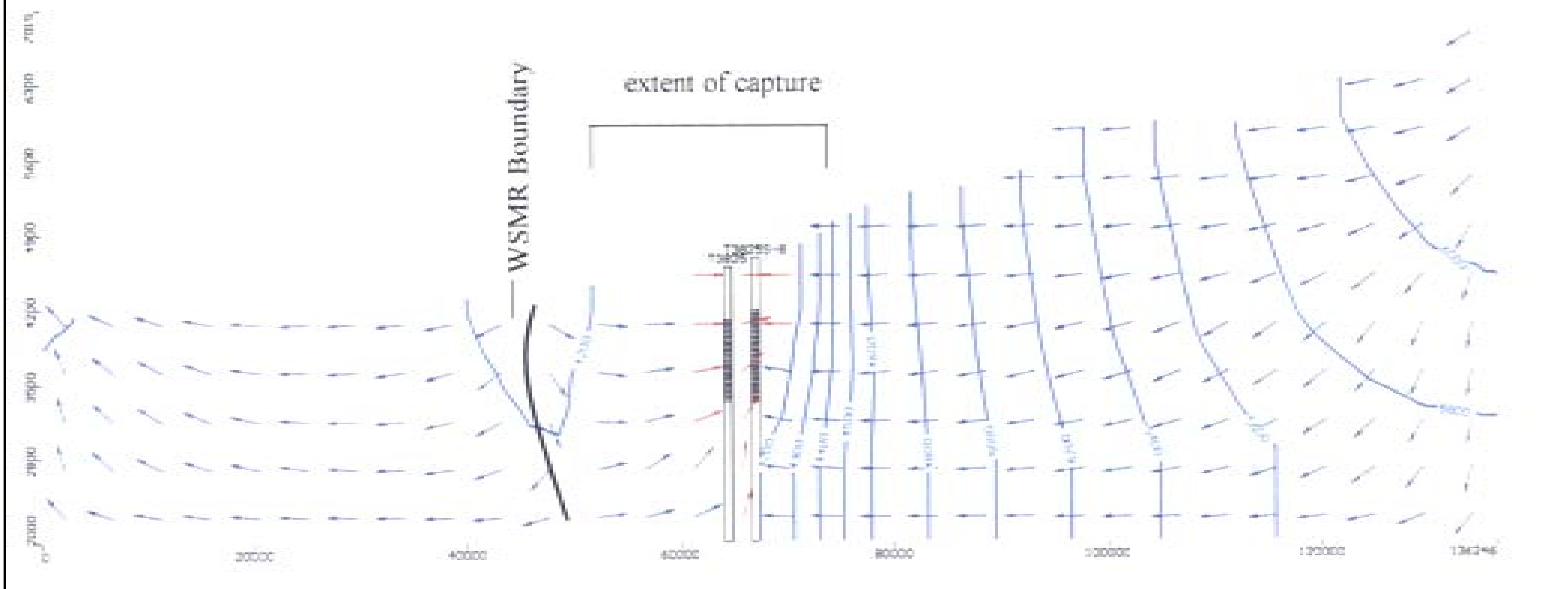


Figure 4-4. Groundwater flow direction with Snake Tank well field pumping (Huff 2005).

4.2.2 GEOLOGY

This section describes the anticipated environmental consequences on geology. The analysis is based on the geologic resources described in Section 3.3.2.

ANALYSIS METHOD

Impacts to unique geologic resources were analyzed to determine whether groundwater pumping under each alternative would affect the geologic stability of the Tularosa Basin or geologic resources within White Sands National Monument. Ground-disturbing activities during construction are not expected to affect the geologic stability of the basin, and no ground would be disturbed within the boundaries of White Sands National Monument. These issues are not further discussed.

Impacts to the geologic stability of the Tularosa Basin were examined by determining the potential for land-surface subsidence associated with groundwater pumping. Impacts to White Sands National Monument were evaluated by assessing the proximity of groundwater drawdown and changes in groundwater flow direction.

ALTERNATIVE A – NO ACTION

GEOLOGIC STABILITY

Because this alternative would require continued reliance on groundwater to meet current and future water demands, the potential for land-surface subsidence due to groundwater drawdown would likely increase in some areas. Current groundwater pumping patterns throughout the Tularosa Basin would continue to extract water from the basin-fill aquifer. Subsidence, which is the lowering of the land-surface elevation from changes that take place underground, can be associated with pumping groundwater. Based on the drawdown patterns through 2040 predicted by the USGS Model (Huff 2005), the greatest drop in groundwater elevation would occur near the agricultural area around Tularosa (see Figure 4-4). Although to date no other studies have documented subsidence in this area, continued groundwater pumping under this alternative would be expected to increase the likelihood of groundwater drawdown in that agricultural area. As a result, the No Action Alternative could have a direct, long-term, adverse effect on geologic stability. This impact would create construction and safety hazards in subsidence zones because of potential structural damage.

WHITE SANDS NATIONAL MONUMENT

Under the No Action Alternative, adverse impacts to geological resources within White Sands National Monument would be negligible. Minimal localized groundwater flow changes are anticipated under the No Action Alternative (Huff 2005), and pumping is not expected to cause groundwater flow to be diverted from Lake Lucero, the source for the gypsum sand that makes up the dunes.

Projected groundwater drawdown under this alternative would also have a negligible impact to groundwater discharge into Lake Lucero. Groundwater drawdown from existing users between 2005 and 2045 would be along the eastern margin of the Tularosa Basin (see Figure 4-4), which would not likely affect groundwater discharge into Lake Lucero. Therefore, negligible impacts to dune formation at White Sands National Monument are anticipated under the No Action Alternative.

ALTERNATIVE B – PROPOSED ACTION

GEOLOGIC STABILITY

Compared with Alternative A, the additional groundwater pumping under this alternative would increase the potential for direct, adverse impacts to geologic stability over the long term. The additional development of up to 4,000 afy would increase the potential for land-surface subsidence because more water would be extracted from the area near the Snake Tank well field. The additional drawdown through 2045 near the well field, as predicted in the JSAI Model (see Figure 4-2), would in turn increase the likelihood for land-surface subsidence.

WHITE SANDS NATIONAL MONUMENT

Groundwater drawdown under this alternative would not affect Lake Lucero or the White Sands National Monument. Groundwater drawdown under this alternative would occur along the eastern margin of the Tularosa Basin (see Figure 4-2, Figure 4-3, and Figure 4-4). No groundwater drawdown is predicted to occur near White Sands National Monument. Therefore, it is unlikely that the amount or flow direction of groundwater discharge into Lake Lucero would be affected by groundwater pumping under this alternative.

4.2.3 SOILS

This section describes the anticipated environmental consequences on soils. The analysis is based on the soils described in Section 3.3.3 and Appendix J.

ANALYSIS METHOD

New and existing data were used to assess existing soil resources in the study area. Maps were generated showing soil units, using digital data downloaded from the Natural Resource Conservation Service website (NRCS 2005). Soil descriptions were included with the map information and are provided in Appendix J1. The Soil Survey of Otero Area, New Mexico (NRCS 1975) was the original source for the data on the NRCS website and was consulted directly as well. The maps and data provide a baseline for soils in the region against which the level of effect on these resources following implementation of a project alternative could be measured.

Impacts on soils would be considered significant if they result in a change to soil types exceeding 10 percent of the current conditions. The impact concern for soils is contamination.

ALTERNATIVE A – NO ACTION

No ground-disturbing activities would occur under the No Action Alternative; therefore, soil conditions would remain similar to current conditions.

ALTERNATIVE B – PROPOSED ACTION

Potential impacts to soils would be associated with construction activities. Adverse impacts to soils would occur at the Snake Tank well field during construction of groundwater wells and pipelines, at the desalination facility site during facility construction, and along the pipeline alignments during pipeline construction. These impacts would be localized and limited to the immediate area of impact. Potential effects on soils include increased susceptibility to wind and water erosion and loss of topsoil. Soil sterilization would not occur because the soils within the study area are naturally high in salt.

Under Alternative B, facility construction would cause short-term soil disturbance and displacement associated with the pipelines and long-term soil displacement associated with the desalination facility and groundwater wells. Approximately 20 acres of soil would be affected by facility construction; much of these lands were previously disturbed, as the area was a former refuse facility (Table 4-1).

TABLE 4-1. SOIL DISTURBANCE UNDER ALTERNATIVE B BY PROJECT FEATURE

PROJECT FEATURE	AFFECTED ACRES BY SOIL TYPE	
Long-Term Effects		
Desalination Facility	AdB	31.7
	AKA	41.0
	DUMP	23.9
	PmB	4.6
Well Field and Associated Infrastructure	AEC	58.36
	TDB	14.3
Short-Term Effects		
Main Delivery Pipeline	AEC	16
	TDB	14.66
	PnA	13.87
	AdB	10.18
	PlA	9.03
	LcA	5.75
	PkA	5.63
	LDB	5.57
	AoB	5.39
	PmB	6.42
	LdA	4.66
	McB	3.81
	PmA	3.75
	TvA	1.57
	MdA	1.45
	LdB	1.15
	TfB	0.96
	AhB	0.66
	Gu	0.54
	Rw	0.36
Total Affected Acreage		**285.27**
NOTE: All soils except "Gu" are classified as highly erodible.		

4.2.4 BIOLOGICAL RESOURCES

This section describes the anticipated environmental consequences on biological resources, including vegetation, wildlife, and special status species. The analysis is based on the biological resources described in Section 3.3.4 and Appendix J.

VEGETATION

ANALYSIS METHOD

Field surveys were conducted in 2004, 2005, and 2009 to document habitat types and individual plant species. Agency lists and available literature were obtained and reviewed to establish types of habitat and sensitive species that could occur in the area. Data obtained from SWReGAP (USGS 2005) provided a baseline of available habitat in the region from which to measure the level of effects on vegetation following implementation of each alternative.

Indicators used to measure the level of effect include the area in acres of vegetative community according to SWReGAP, the area in acres of suitable habitat available to special status plant species, and the existing area or potential area for the spread of noxious weeds. In addition, effects on availability of grazing land for livestock were addressed as indirect effects.

ALTERNATIVE A – NO ACTION

The No Action Alternative would not affect vegetation because no new facilities would be constructed and no new water resources would be developed. There would be no loss or modification of vegetative communities or special status plant species, no additional spread of noxious weeds, and no impacts on grazing. There would be no direct or indirect impacts in the short- or long-term within the study area.

ALTERNATIVE B – PROPOSED ACTION

Construction of new facilities and pipelines would result in the temporary and permanent removal of native vegetation and the permanent removal of previously altered native desert habitat. The desalination facility would be located across from the Research Facility on previously disturbed land owned by the City. The construction would result in the permanent removal of approximately 10 acres, and the temporary disturbance of 25 acres of poor quality desert habitat. Water extraction wells in the well field would permanently disturb 20 acres, with an additional 57 acres of temporary disturbance, while the main delivery pipeline to the facility in Alamogordo would temporarily disturb an area of approximately 29 acres. Short-term loss of potential wildlife habitat would result from the direct impacts of installing the main delivery pipeline. Although recovery in the semiarid landscape is slow, these narrow, linear areas of disturbance would eventually be re-colonized by local plant species. New roads in the well field and along the pipeline would permanently affect another 39.5 acres. Thus, the total area of vegetation affected by construction of these facilities would be approximately 111 acres. Of the total acreage affected by the project, approximately 69.5 acres would experience long-term, direct impacts from facilities, well pads occupying new ground, and new roads.

The study area contains a variety of habitats, ranging from native, relatively undisturbed shrub and grassland communities typically found in the Chihuahuan Desert to heavily disturbed, non-native environments such as agricultural fields and human development found near Tularosa.

SWReGAP lists 31 habitat types that could be affected by construction activities under this alternative. However, just three of the habitat types constitute most of the potentially affected vegetative communities within a 5-mile radius of project facilities in the study area:

- Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub – approximately 95,634 acres, or 47 percent of the total habitat in the study area.
- Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe – approximately 62,065 acres, or 31 percent of the total habitat in the study area.
- North American Warm Desert Playa – approximately 3,646 acres, or 2 percent of the total habitat in the study area.

Altered habitats within or adjacent to the study area for Alternative B include rangeland for livestock grazing, a limited amount of residential and commercial landscaping and development near Tularosa, transportation rights-of-way, agricultural fields, and utilities. Potential effects on vegetation under this alternative are discussed below by facility.

Snake Tank Well Field

Construction of 10 well pads would result in a long-term disturbance of approximately 2 acres of habitat for each pad. There would be approximately 8.68 miles of water pipelines throughout the well field, terminating at the main delivery pipeline at U.S. 54. The total area of effect from the pipeline in the well field would be approximately 53 acres. Access roads have an estimated width of 10 feet and would have an area of potential effect in the well field of approximately 10.5 acres.

African rue (a Class B Weed) was the only noxious weed species observed within the well field site during surveys. The BLM has documented the presence of this plant within the study area and identified severe infestations near U.S. 54 and Snake Tank Road. Ground-disturbing activities related to installation of facilities in the well field for Alternative B would result in the increase of bare soil that would promote the spread of existing populations. Heavy equipment used during the construction activity may trample existing plants and transport seeds that can germinate in previously unaffected areas.

One plant species with the potential to occur in the well field, the Sacramento prickly poppy, is Federally-listed by the US Fish and Wildlife Service (USFWS) as endangered. This species was not observed in the well field during surveys at the site. Marginal potential habitat for this species was identified in the northeast section of the well field. Well pads 1 and 2 and associated access roads would permanently remove 5.9 acres of suitable prickly poppy habitat, with associated pipelines temporarily disturbing 10.8 acres.

Desalination Facilities

Vegetation in the area where the desalination facilities would be located is typical of the Chihuahuan desert scrub/grassland classification in New Mexico (Dick-Peddie 1993; Brown 1994) with some species more representative of disturbed desert habitat. Native plants observed during the field visit included alkali sacaton, silverleaf nightshade (*Solanum elaeagnifolium*), Fendler's globemallow (*Sphaeralcea fendleri*), green prairie coneflower (*Ratibida tagetes*), Chinese thorn-apple (*Datura ferox*), feather fingergrass (*Chloris virgata*), carelessweed (*Amaranthus palmeri*), James' holdback (*Pomaria jamesii*), lyreleaf greeneyes (*Berlandiera lyrata*), fourwing saltbush, honey mesquite, broom snakeweed (*Gutierrezia sarothrae*), plains pricklypear (*Opuntia polyacantha*), tree cholla (*Cylindropuntia imbricata*), and winterfat (*Krascheninnikovia lanata*). Non-native plants seen during the survey were Russian thistle, Russian knapweed, salt cedar, common sheep sorrel (*Rumex acetosella*), and jimsonweed (*Datura stramonium*). These latter species and carelessweed can be weedy or invasive and are usually found in recently disturbed areas (NRCS 2009).

Main Delivery Pipeline

The total distance of the main delivery pipeline is 23.8 miles from the Snake Tank well field to the desalination facility site. With a disturbance right-of-way width of 10 feet for the pipeline and an additional 10 feet for the access road, the total area disturbed by this pipeline would be approximately 58 acres. For the pipeline and access road on the main delivery pipeline the percentages of projected area of disturbance per habitat type are: 0.0004 percent short-term and 0.0004 percent long-term, Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub; 0.0003 percent short-term and 0.0003 percent long-term, Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe; and 0.0003 percent short-term and 0.0003 percent long-term, North American Warm Desert Playa.

Acreages of other habitat types that comprised a minimum of 1 acre and will be disturbed by the main delivery pipeline are listed below:

- Agriculture – 1.1 acres short-term for the pipeline, 1.1 acres long-term for the access roads.
- Developed, Medium–High Intensity – 2.1 acres short-term for the pipeline, 2.1 acres long-term for the access roads.
- Developed, Open Space–Low Intensity – 2.4 acres short-term for the pipeline, 2.4 acres long-term for the access roads.

The majority of the disturbance associated with the route planned for the main delivery pipeline for Alternative B occurs within the previously disturbed right-of-way for U.S. 54. However, a conservative approach was taken, and the total number of acres of pre-disturbance habitat was used for the entire corridor.

Effects on vegetation from Alternative B include the reduction in grazing land and the control and spread of noxious weeds. Within the main delivery pipeline right-of-way, eight noxious weed species were observed during surveys:

- African rue (a Class B Weed)
- Camelthorn (a Class A Weed)
- Field bindweed (a Class C Weed)
- Malta starthistle (a Class B Weed)
- Perennial pepperweed (a Class A Weed)
- Russian knapweed (a Class B Weed)
- Saltcedar (a Class C Weed)
- Siberian elm (a Class C Weed)

It is likely that previous disturbance to this corridor from installation of U.S. 54 and the Union Pacific Railroad have contributed to an increase in the number of noxious weed species in this area. Further disturbance related to installation of the main delivery pipeline under Alternative B may encourage the spread of noxious weeds due to the increased exposed soil combined with the possible transport of seed by heavy machinery traveling along the pipeline route.

Riparian Vegetation

Riparian vegetation associated with spring ecosystems are highly sensitive to change or disturbance, but their distribution is very limited in the Tularosa Basin. In addition, these systems have a unique assemblage of plant species that do not occur elsewhere in the Chihuahuan Desert.

Two listed plant species have the potential to occur in local spring riparian habitat:

- Wright's marsh thistle – New Mexico endangered, USFWS species of concern. Occurs in Otero County in wet, alkaline soils in spring seeps and on marshy edges of streams and ponds at elevations of 3,450-8,500 feet.

- Chapline's columbine – New Mexico sensitive, USFWS species of concern. Occurs in Otero County in limestone seeps and springs in montane scrub or riparian canyon bottoms at elevations of 4,700-5,500 feet.

Changes in water flow could potentially have short- and long-term impacts to riparian vegetation associated with springs. Pumping groundwater from basin-fill at the Snake Tank well field would not have direct or indirect effects on the flow of springs since they originate as groundwater discharge from topographic breaks in the geologic formations that make up the Sacramento Mountains, such as the San Andres Formation and the underlying Yeso Formation. Shomaker (2006) suggests that the location of springs is primarily governed by the presence of impermeable beds within the Yeso Formation. Pumping from the Snake Tank well field would not influence the flow of water at these springs because of the subsurface barrier that exists between the low-permeability geologic units and the basin fill (Shomaker 2006). Consequently, Alternative B would not affect spring flows, and therefore would have no indirect, direct, or cumulative impacts on riparian vegetation.

LIVESTOCK GRAZING

ALTERNATIVE A – NO ACTION

Under this alternative, no new facilities would be constructed and no modifications to water sources would be necessary. Therefore, no livestock foraging habitat would be removed and there would be no changes to existing livestock leases.

ALTERNATIVE B – PROPOSED ACTION

The construction of the well field, pipelines, and associated roads would result in the loss of approximately 120 acres of available livestock forage area, which represents 2.9 percent of the total allotment. This assumes that revegetation of those areas not in continual use will be slow in the semiarid climate. In the semi-desert grassland, an average of 128 acres of forage are needed to support one cow, therefore Alternative B would have a very minimal impact on the grazing allotment and would not require an adjustment to the grazing permit.

Installation of the main delivery pipeline with associated clearing of access roads will affect approximately 246 acres, representing a 6 percent loss in livestock foraging habitat. However, less than 1 mile (0.98 percent) of the land that occurs along the projected right-of-way is owned by the BLM, and most of this land has been previously disturbed and may contain little forage value.

Grazing allotments have the potential to be affected by water extraction in the well field under this alternative. Stocking rates for allotments are tied to base waters, which are defined as water that is suitable for consumption by livestock and is available and accessible to the authorized livestock when the public land is used for grazing. Potential drawdown of the water table from the extraction wells in the Snake Tank well field could reduce water availability for base waters. If base waters become unusable by livestock, the permittee would be given the opportunity to provide and apply for an alternative base water source.

WILDLIFE

ANALYSIS METHOD

Field surveys were conducted in 2004, 2005, and 2009 to document wildlife species and potential habitat. Agency lists and available literature were obtained and reviewed to establish which sensitive wildlife species were likely to occur in the area. Data obtained from the USFWS and the NM Department of Game and Fish (NMDGF) provided information on the habitat requirements for these species to create a baseline against which to measure the level of effect from each alternative.

Indicators used to measure the level of effect include the area in acres of suitable habitat available to wildlife species, the numbers of individual wildlife species present or with the potential to occur in the study area, and the presence of special status wildlife species. The presence of a wildlife species is directly influenced by the size and quality of available habitat. This relationship is the primary focus for identifying issues under each alternative that have the potential to affect wildlife. Because of the transient habit of some wildlife, particularly migratory birds and larger mammals, potential impacts to local populations would vary considerably depending on the timing and degree of preferred habitat disturbance.

ALTERNATIVE A – NO ACTION

The No Action Alternative would not affect special status wildlife species or wildlife habitat because no new facilities would be constructed and no new water resources would be developed. There would be no disturbance of or change to special status wildlife species and no loss or modification of wildlife habitat. No short- or long-term direct or indirect impacts would occur within the study area.

ALTERNATIVE B – PROPOSED ACTION

Approximately 69.5 acres of mixed habitat would be permanently lost by construction of aboveground facilities, roads, and well pads under Alternative B. Approximately 111 additional acres of habitat would be temporarily unavailable for use by wildlife during pipeline installation.

Well Field

Under this alternative, wildlife habitat loss due to construction of the wells and the interconnecting pipelines would occur in the Chihuahuan Creosotebush, Semi-Desert Grassland, and Desert Playa habitats that exist in the study area. There is the potential for sensitive wildlife to occur in these habitat types within the well field. In particular, the mottled rock rattlesnake (*Crotalus lepidus lepidus*) could occur in the eastern half near wells 1, 2, 6, 7, and 8, and a loggerhead shrike (*Lanius ludovicianus*) was observed near one of the project well field pipelines during field surveys. Also, the mountain plover (*Charadrius montanus*) typically uses Desert Playa habitat.

Constructing well pads would directly impact 20 acres of mixed habitat in the long-term, with pipeline rights-of-way having short-term direct impacts on approximately 57 acres. Permanent access roads within the right-of-way would have long-term impacts, affecting 10.5 acres of mixed habitat. Direct and indirect long-term effects on suitable wildlife habitat in the well field for Alternative B would be approximately 30 acres, which equates to removing 0.02 percent of the total available habitat within a 5-mile radius of the well field. Watering systems such as pipelines that are tied to wells are required by the BLM to be available for wildlife year-round. Drawdown could cause water to become unavailable causing displacement of wildlife or mortality in the case of less mobile local species.

Groundwater pumping at the Snake Tank well field would not impact springs inhabited by the White Sands pupfish or streams that supply inhabited springs. Models used to predict direction of groundwater flow and groundwater salinity after 40 years of pumping show no reversal of the groundwater gradient, or salinity migration in the area along the WSMR boundary, west of the well field. Model results show that groundwater pumping would have to be much greater to change the groundwater or salinity gradient. The absence of any change in groundwater flow patterns west of the WSMR boundary suggests that pumping at the Snake Tank well field would not produce any short- or long-term impacts on springs or streams to the west that contain or support to White Sands pupfish habitat (Figure 4-5).

Indirect and long-term impacts may occur to other springs within the Tularosa Basin not designated as habitat for the White Sands pupfish. Approximately nine surface springs occur in the study area for the Snake Tank well field drawdown area. Shomaker (2006) has predicted that spring flows would not be affected by the groundwater pumping, suggesting that there would be no direct, indirect, or cumulative impacts in the short- or long-term to riparian habitat available to wildlife at these springs. However, spring ecosystems are highly sensitive to change or disturbance; therefore, the effects of this alternative on wildlife would be difficult to quantify until operation of the well field is initiated.

Pipeline

Construction of the main delivery pipeline for Alternative B would impact minimal Chihuahuan Creosotebush, Semi-Desert Grassland, and Desert Playa habitats. Wildlife associated with these habitat types have the potential to occur along the pipeline, but most of the route would be located in previously disturbed transportation corridor rights-of-way for U.S. 54 and the UPRR, and very little of the original native habitat remains.

The right-of-way for the main delivery pipeline would temporarily disturb approximately 29 acres of potential wildlife habitat. Additional access roads within the right-of-way would permanently remove 29 acres of mixed habitat within a previously disturbed area. Long-term effects to wildlife along the main delivery pipeline for Alternative B would result in removing approximately 0.002 percent of the total available habitat within a 5-mile radius of the main delivery pipeline. Some direct mortality of less mobile wildlife species could occur during the excavation and construction phases of the project. Most wildlife species will disburse from the area during the disturbance associated with the project activities, and minimal mortality can be expected.

The northern aplomado falcon, a Federally-listed endangered species, and the ferruginous hawk, a BLM sensitive species have the potential to occur along the right-of-way for the main pipeline. Temporary displacement of these species may occur during the construction of the pipeline, but no direct or indirect short- or long-term impacts to either species are expected. Potential impacts to these species from the main delivery pipeline are the same as for the well field as described above. Neither species was observed during the field survey.

4.2.5 CULTURAL RESOURCES

This section describes the anticipated environmental consequences on cultural resources, including historic and prehistoric properties and archaeological sites. The analysis is based on the cultural resources described in Section 3.3.5.

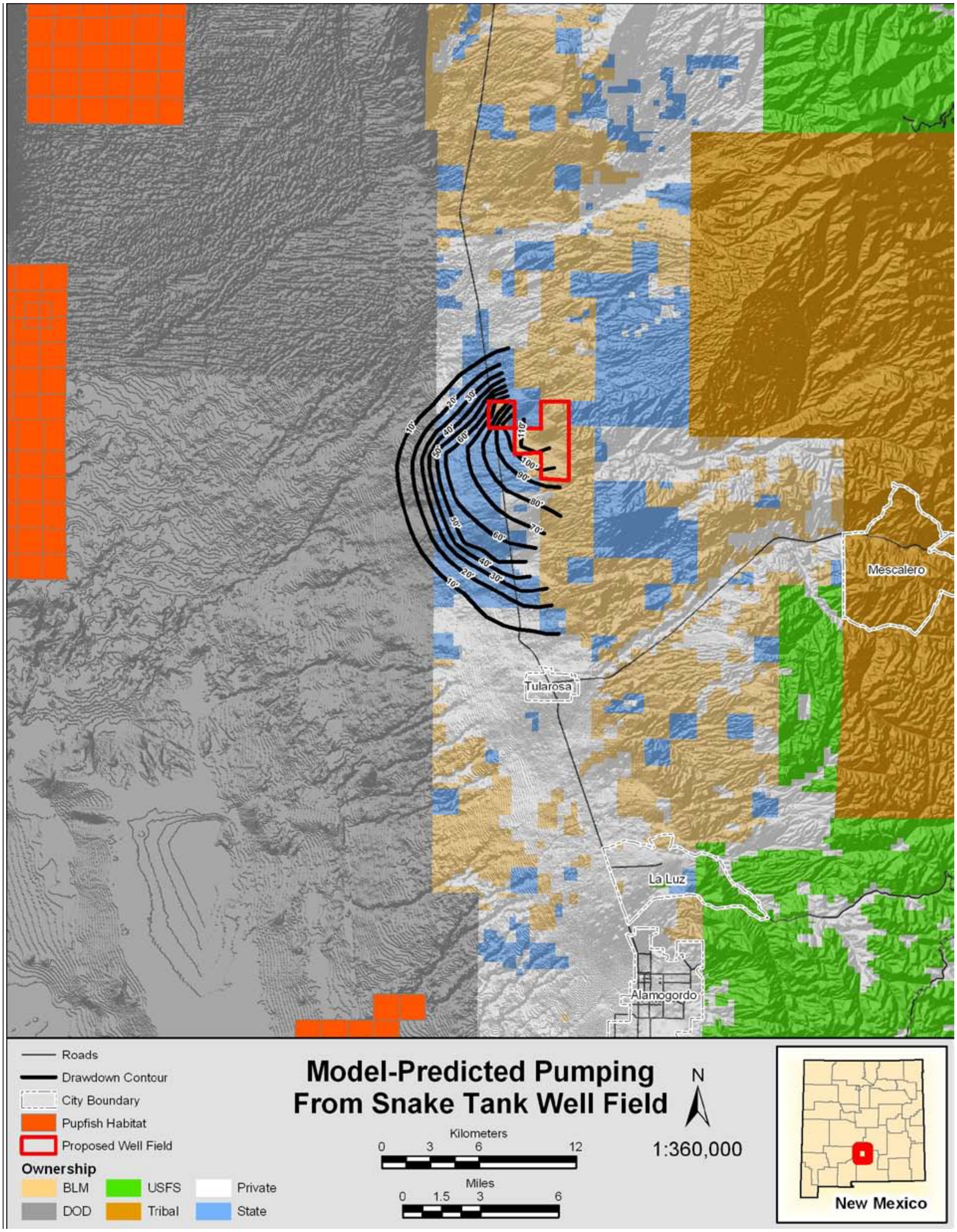


Figure 4-5. Predicted drawdown from JSAI model and habitat for White Sands pupfish.

ANALYSIS METHOD

Impacts to cultural resources were evaluated based on the extent of known historic properties and archeological sites in the area of potential effect. Resources eligible for listing on the National Register of Historic Places (NRHP) were given higher priority during the analysis because of their importance for providing information about the history and prehistory of the Alamogordo-Tularosa region. Substantial, long-term adverse effects would occur if any property eligible for listing on the NRHP is adversely affected. The potential for buried, unknown cultural resources was also considered during the analysis.

ALTERNATIVE A – NO ACTION

Under the No Action Alternative, there would be no construction or operation of new water extraction wells or a pipeline distribution system. This alternative would not involve ground-disturbing activities, thus adverse impacts to cultural resources would not occur.

ALTERNATIVE B – PROPOSED ACTION

Under this alternative, two known historical properties—LA 86735 and LA 150031—both recommended and now determined eligible for listing on the NRHP may be adversely affected by ground disturbance from project construction activities. One site would be affected by construction of an access road in the Snake Tank well field and the other would be affected by construction of the main pipeline between the desalination plant and Alamogordo. Adverse impacts to either of these sites would be substantial and long term.

4.2.6 INDIAN TRUST ASSETS (ITAs)

ITAs are defined as Indian real estate property, physical assets, and/or intangible property rights. There are no known ITAs within the study area and therefore, there would be no impacts to ITAs by either of the alternatives.

4.2.7 SOCIOECONOMIC RESOURCES

This section describes the anticipated environmental consequences on socioeconomic resources, including population, economics, and agricultural productivity. The analysis is based on the socioeconomic resources described in Section 3.3.7.

ANALYSIS METHOD

The analysis of impacts on socioeconomic resources was focused on the loss of farmland due to a change in water rights allocation and potential growth-inducing effects. Direct, long-term adverse effects were also evaluated in terms of the direct conversion of farmland to non-agricultural uses due to construction activities associated with groundwater wells, pipelines, and treatment facilities. Impacts are reported in 2005 dollars, unless otherwise noted.

Alternative A – No Action

Under the No Action Alternative, the City would not construct or operate a new well field, desalination facility, or pipelines, nor would it or purchase or lease water rights.

Crop Production

Agricultural fields using water rights for irrigation would remain in production, and no land would be fallowed. Therefore, crop production would not be affected by this alternative. In addition, this alternative does not include facilities or new construction, and the City would not incur costs for construction of these facilities.

Regional Economic Impacts

Based on projected population growth through the year 2045, the demand for municipal water would increase while the City's ability to supply water to users would remain fixed. The expected demand for the City by the year 2045 is 10,842 afy (see Chapter 1 for details). An increase in demand without change in supply would likely cause a rise in the rate charged to water users per unit of water. Rate increases for water would likely have an indirect, long-term, adverse impact on the composition of goods and services purchased by households and businesses throughout the area. Increased water rates could reduce future commercial and industrial activity in the region, reducing commercial and industrial business and causing an indirect, long-term, adverse impact to the region's economy.

Alternative B – Proposed Action

The amount of water rights purchased or leased under this alternative would be 198 afy.

Crop Production

The purchase and lease of up to 198 afy of water rights under Alternative B could fallow up to approximately 733 acres of agricultural land, based on the consumptive irrigation requirement of 2.5 afy/ac. Therefore, of the 6,345 acres of irrigated agricultural land in the Tularosa Basin, about 11.5 percent would be fallowed by implementation of this alternative.

Regional Economic Impacts

Farm employment in 2004 in Otero County accounted for 0.4 percent of total earnings in Otero County and about 1 percent of total earnings in Lincoln County (BBER 2005b). Therefore, assuming that earnings in both counties were generated only within the Tularosa Basin, fallowing 10 percent of lands used for irrigated agriculture would affect 0.04 percent of total earnings in Otero County and 0.01 percent of total earnings in Lincoln County.

In 2005, water was valued at $1,300 per acre-foot for purchasing the water right in perpetuity and $160 per acre-foot for a one-year lease. These values are based on purchase prices paid by Reclamation in 2005 for other water projects.

To identify potential impacts, three scenarios are considered: 1) all rights are purchased; 2) an equal number of rights are purchased and leased; and 3) all rights are leased.

If water rights to divert up to 198 afy are purchased, the regional economy would benefit from $257,400 in City spending. If equal numbers of water rights are purchased and leased to reach the goal of up to 198 afy, the regional economy would benefit from $144,550 in City spending. In contrast, the regional economy would benefit $31,680 annually in City spending if all 198 afy are leased under this alternative (Table 4-2).

TABLE 4-2. RANGE OF COSTS FOR WATER RIGHTS ACQUISITION UNDER ALTERNATIVE B

ACQUISITION TYPE	AMOUNT (AFY)	SCENARIO 1 (PURCHASE ALL)	SCENARIO 2 (PURCHASE/LEASE)	SCENARIO 3 (LEASE ALL)
Purchase	198	$257,400	–	–
Purchase	99	–	$,128,700	–
Lease (annually)	99	–	$15,840	–
Lease (annually)	198	–	–	$31,680
Total Expenditure		**$257,400**	**$144,540**	**$31,680**

4.2.8 ENVIRONMENTAL JUSTICE

This section describes the anticipated environmental consequences on environmental justice. The analysis is based on the environmental justice conditions described in Section 3.3.8.

ANALYSIS METHOD

Environmental justice indices and maps for EPA Region 6 were obtained as a basis for determining potential effects on minority and low-income populations. Five plots were derived to cover the entire study area within a radius of 5 miles of facilities, and numbers were provided for these plots for both 1990 and 2000 U.S. Census figures.

All of the numbers provided for the 2000 U.S. Census are in the lower categories for each item, due in part to a relatively low population overall in the study area. Both the Minority Ranking and the Economic Ranking are based on a number scale between 1 and 5, with 1 the lowest (less than or equal to the New Mexico state percentage for minorities) and 5 the highest (greater than or equal to two times the state percentage). The EJ Index is a value based on a formula that takes into account both population and the minority and economic rankings. The lowest range of values for the index is between 1 and 12 (Low Vulnerability).

The EPA typically produces environmental justice maps that project the data for minorities and income for a 50-square-mile area (5-mile-radius circle) centered on a given map coordinate or point. Linear projects require a different approach, with the number of map coordinates for the centers of the survey circles dependent on the length of the alignment. For this EIS, five map coordinates were plotted for each center point to cover all of the facilities in the study area and accurately portray the environmental justice parameters. EJ Indices were represented on the EPA maps for the 1990 and 2000 U.S. Censuses in Otero County.

The environmental justice value is used as a demographic correlation variable to measure sociological equity for permitting. The information given in the EPA environmental justice report does not represent the final analysis of a site in regard to environmental justice. Rather, the indices and raw data reported are indicators of vulnerability to other stressors for subgroups of people. Construction sites and operation impacts for each alternative were then compared to the presence of minority and low-income populations in the study area.

ALTERNATIVE A – NO ACTION

Under the No Action Alternative, water availability may be severely limited. This could potentially lead to an increase in housing costs, both purchase and rental, as the construction of new homes declines but demand stays the same or increases slightly. The majority of workers in the service industry are in lower income brackets, and many could be faced with the scenario of not being able to afford housing in the region. Low-income residents in general might leave the area to find affordable housing. In addition, construction and service industry jobs may be lost because of the lack of development and decrease in tourism.

ALTERNATIVE B – PROPOSED ACTION

Implementation of Alternative B is not expected to incur disproportionate impacts to minorities in the study area. Minority vulnerability was in the lowest category (1, less than or equal to the state percentage) for all five EPA survey points in the 2000 U.S. Census year. This implies that the study area has a low minority ranking and that impacts to persons would be the same for all regardless of race.

Alternative B is not expected to incur disproportionate impacts to low-income groups in the study area. Low-income vulnerability was slightly higher than the lowest category, at level 2 (less than or equal to 1.33 times the state percentage), the average value across all five EPA survey points in the 2000 U.S. Census year. Site 5 has an extremely low population within a 5-mile radius, with 5 persons living close to the well field in 2000. A low population with 50 percent considered low income contributes to an abnormally high economic vulnerability (4, between 1.66 and 1.99 times the state percentage) for this particular site. Impacts from this alternative in the entire study area should be the same for all persons regardless of economic status.

The EJ Index provides a numerical basis from which to measure and analyze potential impacts to the local minority and low income populations in the study area under Alternative B. As shown in Table 4-3, EJ Index values from the 2000 U.S. Census for all five survey points in the study area were in the lowest bracket. The numbers for the index range from 0 to 100, with the lowest bracket of values between 1 and 12 (Low Vulnerability). The highest EJ Index recorded for this alternative was a value of 4 in the year 2000.

TABLE 4-3. ENVIRONMENTAL JUSTICE INDEX VALUES FOR THE STUDY AREA							
EPA SURVEY POINT	**MINORITY RANKING BY U.S. CENSUS YEAR**		**ECONOMIC RANKING BY U.S. CENSUS YEAR**		**POTENTIAL EJ INDEX BY U.S. CENSUS YEAR**		**POPULATION VULNERABILITY, 2000 CENSUS**
	1990	**2000**	**1990**	**2000**	**1990**	**2000**	
Site 1	1	1	1	2	1	2	Low Vulnerability
Site 2	1	1	3	2	3	2	Low Vulnerability
Site 3	2	1	3	2	6	2	Low Vulnerability
Site 4	1	1	1	1	1	1	Low Vulnerability
Site 5	1	1	1	4	1	4	Low Vulnerability

These findings indicate that Alternative B would have no potential for disproportionately high and adverse human health or environmental effects to minority and low-income populations in the study area.

In compliance with Executive Order 12898, Alternative B would avoid disproportionate high and adverse impacts on minority and low-income population groups. Construction and operation activities for this alternative are not expected to disproportionately impact minorities or other special population groups, and no residences or businesses would be relocated. Alternative B would not result in displacement of people and is consistent with the EPA's environmental justice policy. In addition, a notice was posted in appropriate media outlets in the study area announcing a public scoping meeting to give local populations an opportunity to provide comments on and become involved in the NEPA process.

The purchase or lease of water rights under Alternative B would have no effect on environmental justice. Sellers or lessors of water rights would act voluntarily to sell or lease their holdings, regardless of minority or low-income status. The City would not selectively choose rights that could disproportionately affect these groups.

4.2.9 LAND USE

This section describes the anticipated environmental consequences on land use and ownership. The analysis is based on the land uses described in Section 3.3.9.

ANALYSIS METHOD

Field surveys were conducted to establish current land use conditions. Land Ownership/Use maps were generated using digital land ownership data downloaded from the BLM New Mexico website (BLM 2004c) and local land use information from Anderson et al. (1976), USGS (1990), and NRCS (2005). The maps and data provided a regional baseline land characterization from which to measure the level of effect following implementation of the alternatives. These effects were addressed by determining the potential for a reduction or a decrease in quality of an existing use or a change in or lack of compatibility with local land management objectives.

ALTERNATIVE A – NO ACTION

The No Action Alternative would not affect land use or ownership in the study area. The pipeline corridors would continue to be used for the existing infrastructure, utilities, and transportation rights-of-way. Current land uses under the management of the BLM, State trust land, the NM Department of Transportation, Otero County, the Village of Tularosa, and private parties would not be affected.

ALTERNATIVE B – PROPOSED ACTION

Construction and operation of the facilities proposed under Alternative B are not expected to incur significant changes in current land use activities in the study area. The groundwater wells would be located on pasture currently used for grazing and shrubland/rangeland, and the desalination facility will be built adjacent to the Research Facility in an area that has already been partially disturbed. The main delivery pipeline would be located in previously disturbed transportation rights-of-way, with no change in land use.

Construction of the groundwater production facilities would result in a minor impact to or change in land use activities in the study area and would be compatible with land management objectives of Federal and state agencies. Approximately 10 acres would be permanently altered to improve infrastructure consisting of the desalination plant (Table 4-4). The small area impacted permanently by this alternative would not cause a substantial shift in the regional land use.

During construction, impacts on sensitive land uses could result from fugitive dust from ground-disturbing activities. The nearest receptors would be in or north of Tularosa. Fugitive dust from construction of the main distribution pipeline would not interfere with any land use, assuming dust generation would be limited by dust suppression measures during construction.

The purchase or lease of water rights would have no effect on land use under Alternative B. Sellers or lessors of water rights would act voluntarily to sell or lease their holdings, and these actions would be independent of land use, ownership, and zoning. Use of lands owned by those property owners that participate in the purchase or lease of water rights might shift from agriculture to less water dependent uses.

TABLE 4-4. LAND USES AFFECTED BY FACILITY CONSTRUCTION				
PROJECT SEGMENT	**LAND USE TYPE**	**ACRES IN STUDY AREA**	**ACRES DISTURBED (TEMPORARY)***	**ACRES DISTURBED (PERMANENT)****
Desalination Site Facility	Disturbed shrub and brush rangeland	99.0	25.0	10.0
Extraction Well Field Pads	Mixed rangeland	34.31 (based on ~5.5-acre buffers)	34.31	12.0 (based on ~2.0-acre finished pad) 6.3 for access roads
	Shrub and brush rangeland	22.84 (based on ~5.5-acre buffers)	22.84	8.0 (based on ~2.0-acre finished pad) 4.2 for access roads
Extraction Well Field Pipelines	Mixed rangeland	15.5	15.5	None likely***
	Shrub and brush rangeland	37.15	37.15	None likely***
Main Pipeline (Snake Tank Road to Alamogordo)	Mixed rangeland	17.39	17.39	4.5 from new roads
	Shrub and brush rangeland	49.27	49.27	12.7 acres from new roads
	Cropland and pasture	43.51	43.51	11.8 from new roads
	Residential	1.21	1.21	None likely
TOTALS		**320.18**	**246.18**	**69.5**

NOTES: *Assumes a 50-foot right-of-way multiplied by segment length and converted to acres.
**Based on 10 foot right-of-way disturbance for pipeline and new roads
***Assumes that following pipeline placement and reclamation efforts, the surface will recover within a reasonable amount of time to pre-construction conditions and that permanent disturbance is highly unlikely. In addition, most of these pipeline segments are within previously disturbed rights-of-way that no longer exhibit characteristics of the original environment.

4.2.10 ENERGY REQUIREMENTS

This section describes the anticipated environmental consequences on energy resources, including electricity and natural gas. The analysis is based on the energy resources described in Section 3.3.10.

ANALYSIS METHOD

This analysis was based on the ability of service providers in the Alamogordo-Tularosa region to supply electricity and natural gas to the facilities.

ALTERNATIVE A – NO ACTION

ELECTRICAL SERVICES AND DISTRIBUTION

The No Action Alternative would not affect electrical services and distribution because no new facilities requiring electricity would be constructed. There would be no change to current electricity availability, and any loss or modification of electrical services and distribution. No direct, indirect, or cumulative impacts in either the short- or long-term would occur within the study area under Alternative A.

GAS SERVICES AND DISTRIBUTION

The No Action Alternative would not affect natural gas services and distribution because no new facilities requiring gas would be constructed. There would be no change to current gas availability and any loss or modification of gas services and distribution. No direct, indirect, or cumulative impacts in either the short- or long-term would occur within the study area under Alternative A.

ALTERNATIVE B – PROPOSED ACTION

ELECTRICAL SERVICES AND DISTRIBUTION

Electricity would be required for the desalination facility and groundwater wells. There would be a long-term increase in demand for electrical service in the region. Independent of whether the project facilities are built, Public Service Company of New Mexico plans to upgrade service availability in the Tularosa Basin to support a projected increase in demand.

Under Alternative B, electricity would be required for the pumps at each of the 10 well heads proposed at the Snake Tank well field. The pumps would likely have a periodic load, meaning the pumps would turn on and off in cycles depending on desalination facility capacity and storage.

Of the improvements affiliated with Alternative B, the electricity requirements would be greatest at the desalination facility. Electricity would be required to run the Reverse Osmosis filter system, lights, and other equipment in the facility buildings. Electricity would also be needed to run the pumps that transfer the treated water to a storage tank and through the main delivery pipeline, and transfer untreated concentrate to a deep-well injection site. Electric distribution lines already exist along U.S. 54, therefore only a short secondary line will need to be extended to the facility.

GAS SERVICES AND DISTRIBUTION

The buildings at the desalination facility would require gas service for space heating. It is estimated 4.6 million cubic feet of natural gas a year would be required to heat the buildings. Gas distribution lines extend the existing research facility; therefore, only a short pipeline extension would be required to reach the desalination plant. Gas requirements and impacts are discussed in more detail in section 4.2.12, Air Quality.

Impacts to gas services would be direct and long-term due to an increase in demand not expected to exceed current gas availability. There would be no direct impacts to gas distribution in the short- or long-term and no indirect or cumulative impacts in the short- or long-term within the study area for gas services and distribution under Alternative B.

4.2.11 TRANSPORTATION

This section describes the anticipated environmental consequences to transportation, including roadways and railroads. The analysis is based on the roadway, traffic, and railroad information described in Section 3.3.11.

ANALYSIS METHOD

Potential effects to transportation were addressed by determining the significance of impacts and subsequent change to the Level of Service (LOS) for any roadway in the study area. Effects to the LOS rating for roadways are reported as Annual Average Daily Traffic (AADT), or the total number of vehicles per day averaged over an entire year. An increase in AADT could have an impact on the LOS for the roadway in question.

AADT information was obtained from a traffic-flow map for Otero County available at the NMDOT website (NMDOT 2004). Roadway LOS data were obtained from the Transportation Research Board (1994) and the US Army Corps of Engineers (2004b). Volume (vehicles per hour) for a typical two-lane highway similar to U.S. 54 was provided by Global Security (2005). A decrease in the transportation LOS rating was used to identify impacts to transportation within the study area. The maps and data provided a baseline for transportation characteristics in the region from which to measure the intensity of effects on transportation following implementation of a given alternative.

The analysis used the AADT, which provided the estimated vehicles per hour, to compare the vehicles per hour to the roadway capacity and produce the volume to capacity ratios, which were then used to select the appropriate LOS.

ALTERNATIVE A – NO ACTION

Under the No Action Alternative, transportation conditions would not be changed by construction and operation of a desalination facility and associated infrastructure. There would be no difference in the LOS rating for roadways in the study area.

ALTERNATIVE B – PROPOSED ACTION

Construction and operation of facilities under Alternative B have the potential to increase vehicular traffic, primarily along U.S. 54 and U.S. 54/70, in the form of heavy equipment for construction and private passenger vehicles belonging to construction and operation workers. The majority of the traffic is assumed to consist of vehicles coming from and going to the southern, more populated areas in the study area, including Tularosa and Alamogordo.

During construction, there would be up to 12 round trips per day to the well field and main delivery pipeline by a mixture of private vehicles and contractor-owned light and heavy trucks. The well field would require more intensive installation activities than the main delivery pipeline and thus would experience a heavier volume of traffic. The main delivery pipeline would be installed in short segments, so that activities affecting transportation would be sporadic and less intense than those for the other project activities. The desalination facility is located within the City limits and would see an increase in vehicular volume during construction and operating activities.

Alternative B operation-related traffic is projected to include approximately four round trips per day by private vehicles to the desalination facility. Incidental trips would occur on an occasional basis for maintenance activities in the well field and for deliveries of chemicals used for operation of the desalination facility. Round-trip traffic for both maintenance in the well field and deliveries to the facility is expected to average about one trip a week.

Access to all of the facilities for this alternative would be off of U.S. 54, U.S. 54/70, and the Relief Route, for the most part using existing transportation corridors or access roads.

ROADWAY LEVEL OF SERVICE

Implementation of Alternative B is not expected to cause a decrease in the LOS for transportation in the region. Even with the greatest amount of traffic projected for any given time or activity under this alternative, most likely the construction of the desalination facility and the well field, it is highly unlikely that the activities would cause a decrease in the LOS for roadways in the study area. Table 4-5 summarizes the results of the LOS impact analysis.

TABLE 4-5. TRANSPORTATION EFFECTS ON LOS UNDER ALTERNATIVE B

ROADWAY	CAPACITY (VEHICLES PER HOUR)	TRAFFIC IN 2004* (VEHICLES PER DAY)	VOLUME** (VEHICLES PER HOUR)	VOLUME-TO-CAPACITY RATIO	LOS
Existing Conditions (before Alternative B)					
U.S. 54	95.3	2,287	1504.5	0.06	A
U.S. 54/U.S. 70 corridor	578.0	13,875	1504.5	0.38	C
Conditions after Alternative B* **					
U.S. 54	95.3	2,304	1504.5	0.06	A
U.S. 54/U.S. 70 corridor	578.0	13,892	1504.5	0.38	C

NOTES: *NMDOT 2004.
**Global Security 2005.
***With added traffic after Alternative B. Estimates are conservative, adding both construction and operation traffic. Approximately 17 additional vehicles per day were anticipated under Alternative B.

This construction and operation of facilities under this alternative are not expected to decrease the LOS for roadways in the study area. The volume-to-capacity ratio for traffic and the LOS would remain the same. Therefore, no effect on transportation in the study area under Alternative B is expected.

Construction plans indicate that it should be possible to maintain travel lanes on adjacent roads during pipeline installation. Although access to driveways of local businesses and residences from the travel lanes may be disturbed during construction of the main delivery pipeline, access should not be severely affected. Access points and drivers' ability to make turning movements on and off the highway should also be unaffected during construction. Traffic control measures would be implemented to help with disturbance to vehicular flow during Alternative B construction activities. Following completion, public access along the right-of-way would remain at the same level as it was prior to construction.

Some of the chemicals used in the desalination process are considered hazardous materials and would be transported to the facility site via main roads. The number of current hazardous cargo trips on this route is unknown, but given the relatively low traffic volume, truck traffic would not appreciably increase the risk of accidents along this route. If an accident occurred, existing response procedures are in place to handle any associated release of hazardous materials. Accidents involving vehicles carrying hazardous cargo typically release small (a few gallons or less) volumes of hazardous materials (U.S. Department of Transportation Summary Statistics and Data 2005), and impacts on nearby residences and commercial establishments would likely be temporarily impacted should an accident occur.

RAILWAYS

The UPRR would not be affected by this alternative. The main delivery pipeline would use part of the existing railway rights-of-way, and access roads adjacent to the railroad. Construction of the pipeline would be short-term in duration, and would not affect railway operations.

4.2.12 AIR QUALITY

This section describes the anticipated environmental consequences on air quality. The analysis is based on the air quality conditions described in Section 3.3.12.

ANALYSIS METHOD

Existing data were used to assess current trends of air quality in the study area, and National Ambient Air Quality Standards (NAAQS) and information concerning attainment status and criteria pollutants were obtained from the EPA. The Clean Air Act was also reviewed for information concerning attainment and Prevention of Significant Deterioration (PSD) Class I areas. In addition, non-attainment area information was obtained from the EPA "Green Book," (EPA 2008). The NMED Air Quality Bureau maintains attainment status for areas in the state in accordance with the Clean Air Act, and this information was reviewed as well. These data provided a baseline for air quality issues in the region from which to measure the significance of effect on air quality following implementation of the alternatives.

Indicators used to measure the level of effect on air quality within the study area were based on pollutant concentrations, usually defined as criteria pollutants, from the NAAQS. Potential impacts to air quality were assessed by comparing standards established by the EPA (NAAQS) with estimated concentrations of air pollutant emissions, called criteria pollutants that would be generated by construction and operation activities. Air quality impacts would be considered significant if they:

- Increase criteria pollutants concentrations above NAAQS;
- Contribute to an existing violation of any NAAQS;

- Delay timely attainment of NAAQS; or
- Impair visibility within any federally mandated PSD Class I area.

In non-attainment or maintenance areas, air quality impacts would be considered potentially significant (require a conformity analysis) if they exceed 100 tons per year of CO, O_3 precursors, VOCs and NO_2, or PM_{10}. According to the EPA General Conformity Rule, 40 CFR Part 51, Subpart W, any proposed federal action that has the potential to impact air quality in a non-attainment area must undergo a conformity analysis. A conformity analysis is not required for pollutants for which a region is designated as attainment. Otero County and the entire study area are in attainment, as discussed in Chapter 3.

Section 169A of the Clean Air Act established the PSD regulations to protect air quality in regions that already meet NAAQS. Certain national parks, monuments, and wilderness areas have been designated as PSD Class I areas, where appreciable deterioration in air quality is considered significant.

In attainment areas, PSD rules define a stationary source as "major" if annual emissions exceed 250 tons per year of VOCs, NO_2, CO, SO_2, or PM_{10}. The project includes mobile (non-permitted) emission sources or vehicles, which are conservatively included in the PSD rules defined for stationary sources and the non-attainment area thresholds as well. This means that vehicle emissions have been compared to the 100 tons per year and 250 tons per year minimum thresholds for criteria pollutants, even though they are not defined as stationary sources and are not located in non-attainment or maintenance areas.

ALTERNATIVE A – NO ACTION

Under the No Action Alternative, no construction emissions and no change in operational emissions would occur.

ALTERNATIVE B – PROPOSED ACTION

A number of possible sources of pollutants that could impact air quality would be associated with the installation and operation of facilities for Alternative B. Emissions from combustion engines that may impact local air quality include engine exhaust from construction equipment, from private vehicles for worker transport, from heating for the desalination facility and from maintenance and delivery and removal of concentrate from a variety of vehicles during operation of the facilities.

CONSTRUCTION EMISSIONS

Construction activities under Alternative B would produce short-term combustion and fugitive dust emissions that would cease once construction is completed. Emissions from construction activities would include exhaust emissions from heavy equipment (e.g., bulldozers, trucks) and fugitive dust emissions from excavation and grading activities.

Fugitive dust would be a concern during construction. Ground disturbance resulting from Alternative B installation activities would release fugitive dust into the air, especially when vegetation is removed and bare soil is exposed to the wind. The nearest receptors would be in or north of Tularosa. Fugitive dust from construction of the main delivery pipeline and disturbance to soils would have a direct, short-term, adverse impact on air quality, assuming implementation of dust suppression measures during construction.

For the purposes of this alternative, it is assumed that all construction activities would occur over a period of one year, although actual construction is expected to take less time. It is also assumed that the size of the desalination facility would be approximately 12,000 square feet (a little over 0.25 acre) on the site, including the Reverse Osmosis process/administration building, a delivery area, a chemical storage building, and a clear well and finished water transfer pump station. Facility infrastructure, including grading the building sites, grading and paving the parking lot at the Reverse Osmosis building would also be included.

Emissions of CO, SO_2, NO_2, PM_{10}, and VOCs from construction activities were calculated using emission factors for grading and general industrial construction from the South Coast Air Quality Management District (1993) California Environmental Quality Act Air Quality Handbook. These emissions include exhaust from on-site construction equipment as well as fugitive dust emissions from grading activities (Table 4-6).

TABLE 4-6. ESTIMATED ANNUAL CRITERIA AIR POLLUTANT EMISSIONS UNDER ALTERNATIVE B

SOURCE	EMISSIONS (TONS/YEAR) BY CRITERIA AIR POLLUTANT				
	CO	SO_2	NO_2	PM_{10}	VOCS
CONSTRUCTION					
Buildings	2.4	–	10.9	0.8	0.7
Grading for Buildings, Parking Lot	1.46	0.3	3.44	5.34	0.29
Paving Parking Lot	0.107	0.0064	0.138	0.01	0.026
Pipelines	22.47	–	103.31	7.34	7.03
Commuting, Personal Vehicles	3.217	0.001	0.26	0.012	0.44
Construction Subtotal	***29.654***	***0.3074***	***118.048***	***13.502***	***8.486***
OPERATIONS					
Heating for RO Facility	0.05	0.01	0.23	0.0003	0.007
Concentrate Removal	2.102	0.455	3.864	0.329	0.117
Commuting, Personal Vehicles	1.062	0.0003	0.086	0.004	0.145
Operations Subtotal	***3.214***	***0.4653***	***4.18***	***0.3333***	***0.269***
TOTAL EMISSIONS	**32.868**	**0.7727**	**122.228**	**13.8353**	**8.755**

It is assumed that 12 full-time employees would be working at the site during the construction of the desalination facility. The potential increase in emissions from vehicles used by construction personnel commuting to and from the site have been calculated using emission factors from Calculation Methods for Criteria Air Pollutant Emission Inventories (Jagielski and O'Brien 1994). All commuting vehicles are assumed to be light-duty, gasoline-powered vehicles with 1995 as the average vehicle model year. Annual criteria pollutant emissions from commuting vehicles of 12 full-time employees, assuming an average round-trip commuting distance of 50 miles and a carpooling ratio of 1.1, are presented in Table 4-6.

OPERATIONAL EMISSIONS

Operation of the facilities proposed for Alternative B would generate some long-term direct emissions. These emission sources would include burning of natural gas to provide heating for the Reverse Osmosis process/administration building and commuting vehicle emissions for approximately four employees. For the purposes of this alternative, it is assumed that Reverse Osmosis building heating would annually require approximately 4.5 million cubic feet of natural gas. Although this would be a stationary source, the emissions from heating the Reverse Osmosis building would be well below any threshold outlined in the PSD rules. The resulting emissions for operation of Alternative B are shown in Table 4-6.

It is estimated that approximately four employees would be required for the operations phase of the facility under Alternative B. The resulting increases in emissions from commuting traffic were calculated by assuming an average round trip distance of 50 miles and using emission factors from Jagielski and O'Brien (1994). All commuting vehicles are assumed to be light-duty, gasoline-powered vehicles with 1995 as the average vehicle model year. Annual criteria pollutant emissions associated with operational commuters for this alternative is shown in Table 4-6.

Occasional truck traffic would also travel to the Reverse Osmosis facility to deliver materials and for maintenance. Similarly, there would be occasional trips to the water extraction wells for inspection and maintenance activities. Air pollutant emissions from these trips were not modeled because they would be incidental and infrequent and would not contribute measurably to air quality impacts.

CLEAN AIR ACT COMPLIANCE

As shown in Table 4-6, construction and operation of the facilities proposed under Alternative B would generate low levels of emissions for CO, PM_{10}, and VOCs, well below the annual conformity thresholds of 100 tons per year for non-attainment areas. Emissions for NO_2, primarily due to pipeline installation, were slightly above this threshold, but since the study area is in attainment and this analysis used a conservative approach, no conformity analysis is required. Estimated emissions for CO, SO_2, NO_2, PM_{10}, and VOCs are all well below PSD thresholds of 250 tons/year for attainment areas and would be insignificant for both the stationary sources covered by the PSD rules and the mobile sources also included in this study. Therefore, the implementation of Alternative B would not trigger a conformity determination under Section 176(c) of the Clean Air Act and would not result in direct, indirect, or cumulative impacts in the long- or short-term to air quality in the study area.

There are no PSD Class I areas in the immediate vicinity of the study area. Several exist in the region, but they are distant from the study area. Therefore, given the long distances involved and the very low emission increases from Alternative B, there would be no direct or indirect cumulative impacts to PSD Class I air quality in the short- or the long-term under Alternative B.

4.2.13 CLIMATE CHANGE

This section describes the anticipated environmental consequences as a result of climate change and the anticipated impacts climate change may have on each alternative and vice versa. The analysis is based on the climate change described in Section 3.3.13.

ANALYSIS METHOD

This analysis was conducted by evaluating projects of similar size and nature, and by evaluating projected uses of electricity and fossil fuels for both the construction phase and operation of the groundwater pumps, pipeline, and desalination plant, and the re-injection of saline water to deep aquifers.

ALTERNATIVE A – NO ACTION

Under the No Action Alternative, there would be no additional impacts to greenhouse gas (GHG) levels within the project area because there would be no additional surface disturbance, travel on existing or new roads, or release of hydrocarbons from the proposed project area into the atmosphere.

The impacts of climate change are not expected to have a large impact on the purpose and need of this project. Regardless of the anticipated impacts of climate change, the water demands of Alamogordo are expected to exceed current supplies, and the need for the additional waters made available through this alternative will remain.

ALTERNATIVE B – PROPOSED ACTION

This alternative would involve two phases during which there would be an impact on climate: the construction phase and the operations phase. Consumption of oil and gas as part of the construction of the proposed desalination plant is expected to produce GHGs, NO_x, and VOCs as heavy machinery is used to erect the desalination plant, install the wells at the Snake Tank well field, and construct the requisite pipeline and the re-injection pumps. During the operational phase of the project, the project is expected to increase hydrocarbons into the atmosphere through the combustion of fuels to run the wells, the desalination plant, and the brine re-injection pumps.

Climate science is an emerging field and one that, because of the diffuse nature of air and water vapor, the vast size of the atmosphere, and the myriad feedback loops that impact climate, does not produce precise findings. As such, the impact of combusted hydrocarbons from the construction of one plant is unknown. Because of the uncertainties involved in climate science--particularly as they relate to the extrapolation of localized releases on state, national, and international climate impacts--no metric exists to determine the effects that this alternative would have on climate.

The impacts of climate change are not expected to have a large impact on the purpose and need of this project. Regardless of the anticipated impacts of climate change, the water demands of Alamogordo are expected to exceed current supplies, and the need for the additional waters made available through this alternative will remain.

4.2.14 VISUAL RESOURCES

This section describes the anticipated environmental consequences on visual resources. The analysis is based on the visual setting described in Section 3.3.14.

ANALYSIS METHOD

New and existing data were used to assess past and current trends of visual resources in the study area. Field surveys were conducted to establish current viewscape conditions. Dimensions of facilities were obtained for the various alternatives in order to compare the current landscape with the conceptual placement of these structures. The data and conceptual thought process provided a baseline for visual characteristics in the region from which to measure the level of effect on these resources following implementation of the alternatives. The indicators used to measure the level of effect on visual resources within the study area are visual quality and changes to visual sensitivity.

Determination of impacts to visual resources was based on an assessment and classification of scenic or visual landscapes for their attractiveness and ability to provide recreational opportunities. The degree to which a management activity affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape (BLM 2004a). Visual sensitivity of the existing landscape is dependent on its visual character, the amount of public use of the area, public visibility, the presence or absence of adjacent developments, and the ability of the setting to absorb any structure(s). Absorption refers to how well a facility would fit within the existing setting. Potential effects on visual resources include disruptive impacts to the existing viewshed that reduce visual sensitivity and decrease the visual landscape’s attractiveness and ability to provide recreation for casual viewers. The degree to which the alternatives would alter an existing landscape, the relative value placed on the affected landscape and accessibility of the affected area for viewers are all taken into consideration.

Three levels of visual sensitivity were used to measure potential impacts relating to the alternatives that could affect visual resources in the study area:

- High Visual Sensitivity – areas with unique or valued visual attributes, minimal landscape disturbance, high visibility, and high public activity, because they have a limited ability to absorb changes that are not visible.
- Moderate Visual Sensitivity – areas with typical visual attributes, surrounding development, lower visibility, limited public visibility, and disturbed landscape, because they have some ability to absorb changes without appearing to be altered.
- Low Visual Sensitivity – areas with pervasive or degraded visual attributes, limited public use and viewing, or with development similar in characteristics to the facilities, because they can absorb changes without appearing noticeably different.

ALTERNATIVE A – NO ACTION

There would be no effects to visual resources under the No Action Alternative. No new structures would be built, and no new visual elements would be introduced into the existing landscape.

ALTERNATIVE B – PROPOSED ACTION

WELL FIELD

Visual impacts under Alternative B would occur from the water extraction wells and associated infrastructure in the well field. This area was determined to have a moderate visual sensitivity. The vegetation in the well field area has been altered by the application of herbicides in recent years to promote grazing for livestock. Most of the area supports creosotebush in various stages of viability and disturbance and is not considered distinctive vegetative habitat. Existing structures near the well field that influence the visual landscape at this location include U.S. 54; the UPRR; barbed-wire fences; a ranch with several buildings and a bermed retention pond (Stover Ranch); another retention pond with an associated well (Lower Snake Tank); a network of dirt access roads for the ranch, wells, and ponds; and aboveground utility power lines. The well heads themselves would be relatively small and difficult to see at a distance. The access roads and interconnecting pipelines would be more visible, but they would be at or below ground level and would blend into the existing network of roads already in place at this location. Portions of the new installation would likely be visible to travelers passing by on U.S. 54. Given the degree of constructed roads and plant disturbance in the surrounding landscape, the well field location would not be considered to have high scenic value or sensitivity to modification.

DESALINATION FACILITY

Visual impacts under Alternative B would occur from the aboveground structures for the desalination facility. This area was determined to have a low to moderate level of visual sensitivity. No portions of the site are considered distinctive vegetative habitat, but some are in a relatively natural and undisturbed condition. The remainder of the site has been disturbed. This disturbance has subsequently increased the presence of non-native and/or invasive plants. Given the relatively common landscape characteristics and the degree of constructed modifications in the surrounding landscape, the desalination site location would not be considered to have high scenic value or sensitivity to modification.

MAIN DELIVERY PIPELINE

Impacts from the installation of the main delivery pipeline would likely be indirect and short-term during construction, and this area was determined to have a low level of visual sensitivity. Because the pipeline would be installed below the ground surface and the disturbed land would recover, no direct or indirect long-term impacts to visual resources are likely. In addition, the alignment would generally use existing UPRR and highway easements. Pipeline corridors introduce linear traces into the landscape, but these would be less noticeable if placed within an existing corridor where they would not introduce a new linear feature. The route follows the UPRR for most of its length, with degraded visual attributes from previous disturbance, almost no public viewing because of the raised railroad bed and limited access, and pipeline features that would be almost the same as the existing landscape.

4.2.15 CUMULATIVE IMPACTS

Regulations prepared by CEQ for implementing NEPA require Federal agencies to disclose and analyze effects that could result from the incremental effects of an action, “when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person under takes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time” (40 CFR 1508.7). This section analyzes the impacts of the No Action Alternative and Proposed Action (Alternative B), when considered together with non-related past, present, or reasonably foreseeable future actions.

Of the many activities that may affect development within the study area, Table 4-7 lists the projects that could have a cumulative effect when combined with the Proposed Action. The first part of this section describes these projects and their time period. The second part of the section analyzes the cumulative impacts of each project for the resource categories described in previous chapters. The geographic area used for this analysis is the Tularosa Basin. The identified future actions considered in assessing cumulative effects would be implemented within the next 5 years. To assess the effects of these actions once implemented, a 40-year period was assumed.

TABLE 4-7. RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS CONSIDERED FOR CUMULATIVE IMPACTS ANALYSIS

PROJECT NAME	PROJECT DESCRIPTION	TIME PERIOD
Tularosa Basin National Desalination Research Facility	Sandia National Laboratories and Reclamation partnered to construct a new test and evaluation facility for desalination technologies. Construction on the Research Facility began in 2003. Approximately 500 afy of brackish water would be pumped from the basin-fill aquifer and used for research purposes. The 13,000-square-foot facility would house office space for researchers and staff, a control room, a water laboratory, and a resource area and learning center for visitors. Concentrate from the desalination process would be injected into the ground.	The NEPA process was completed in 2003 and operations and began in 2007. The Research Facility would operate indefinitely.
El Paso–Fort Bliss Desalination Facility	The El Paso–Fort Bliss Desalination Facility would treat brackish water pumped from the Hueco Bolson Aquifer to provide drinking water to the City of El Paso and Fort Bliss. The Hueco Bolson Aquifer extends into the southern portion of the Tularosa Basin and contains both potable and brackish water. The aquifer is recharged by inter-basin groundwater flow from the Tularosa Basin to the Hueco Bolson. Potable water is currently pumped from the Hueco Bolson Aquifer by Fort Bliss, the City of El Paso, small communities in Texas and New Mexico, and Ciudad Juárez, Mexico. The desalination facility would draw approximately 30.5 mgd of brackish water from the Hueco Bolson Aquifer and provide 27.5 mgd of potable water. This project would extend the useful life of the aquifer and intercept the flow of brackish water to wells that are operated by Fort Bliss.	The NEPA process was completed in 2005 and operations and began in 2008. The desalination facility would operate indefinitely.
Alamogordo Flood Control Project	This project is being completed by the USACE. The purpose of the project is to intercept storm water flow from channels (arroyos) that drain runoff from the Sacramento Mountains on the east side of the City. By constructing flood control structures, portions of the City would be protected from 100-year flood events and property would be protected from potential flood damage. The project includes lining channels with concrete, constructing sediment basins, and joining existing channels to control flooding.	The USACE began construction in January 2005.
Transformation of the 49th Fighter Wing at Holloman Air Force Base	The U.S. Air Force proposes to transform the combat capability of the 49th Fighter Wing and maximize the use of available infrastructure at Holloman AFB by replacing the retiring F-117A aircraft and T-38A aircraft supporting the F-117A mission with two F-22A squadrons. The Air Force has identified Holloman AFB as the preferred location for the third operational wing of the Air Force's F-22A Raptor, which would enhance the low observable, precision weapons system capability of the 49th Fighter Wing. According to the Air Force, this transition would result in a net loss of more than 300 personnel, or a 5 percent reduction in assigned personnel at Holloman AFB.	A Final EA for the Transformation of the 49th Fighter Wing at Holloman AFB was published in August 2006.
Land Use Changes at Fort Bliss Military Reservation, McGregor Range	Land use changes and designations, increased troop levels, and training and rangeland utilization, as well as other operational and support activities, are proposed in the Tularosa Basin portion of the McGregor Range. Approximately 20,000 to 30,300 more military personnel would be assigned to Fort Bliss. The reasonably foreseeable land use development that would potentially affect resources within the study area for this EIS includes an increase of off-road vehicle maneuvering within the Tularosa Basin portion of the Range by 20–50 percent.	Fort Bliss Mission and Master Plan Final Programmatic Environmental Impact Statement (PEIS) was completed in 2001. A Draft Supplemental Programmatic Environmental Impact Statement (SEIS) was completed in 2006 to supplement the Master Plan PEIS. The planning period extends to 2030.

TABLE 4-7. RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS CONSIDERED FOR CUMULATIVE IMPACTS ANALYSIS		
PROJECT NAME	**PROJECT DESCRIPTION**	**TIME PERIOD**
Tularosa Creek Water System Storage Study	This study would evaluate the feasibility of constructing a reservoir on Tularosa Creek and a pipeline to deliver stored water to the TCDC.	The study began in 2006.
City of Alamogordo Water Resources Conservation Program	This program includes water reclamation, water conservation and rationing, a tier rate structure, education and outreach, and ongoing repair and replacement of existing water infrastructure. As a result of this program, the City has averaged 226.03 gpcpd in the 1990s and 149.69 gpcpd in the first 4 years of this decade.	The Water-Rationing Ordinance, No. 1008, was adopted by the City of Alamogordo in 1997.
Holloman Land Exchange	Federal legislation was passed on January 3, 2006 to enact the "Holloman Air Force Base Land Exchange Act." The Act provides that a land exchange involving private land and BLM land in the vicinity of Holloman AFB for the purpose of removing private land from the required safety zone surrounding munitions storage bunkers at Holloman AFB. Approximately 241 acres of private land owned by Mesa Verde LLC would be transferred to BLM, and in return BLM would withdraw the 320 acres to Holloman AFB. Approximately 320 acres of federal land managed by the BLM would be transferred to Mesa Verde LLC. The federal land is located south of the City of Alamogordo and the private land borders Holloman AFB to the east of the base.	The land exchange began in 2006.
PNM Transmission Line Expansion	PNM is proposing to construct a new transmission line from the existing switching station to Holloman AFB to provide additional capacity.	The expansion began in 2008.

No Action Alternative

The No Action Alternative would result in continual use of existing water resources including additional drawdown of groundwater supplies as water demand in the City of Alamogordo increases. Under this alternative, only 7,444 acre-feet/year would be available to the City of Alamogordo. This would not meet water demands of the City by 2010. The No Action Alternative would have both short-term and long-term impacts on individual resources.

The No Action Alternative combined with cumulative impacts of other projects would not impact the following resources: biological resources, including vegetation along the pipeline and at the well field; livestock grazing; wildlife; cultural resources; ITAs; environmental justice; land use; energy requirements; transportation; air quality; climate change; and visual resources. These resources have not been evaluated based on the past and present actions and reasonable foreseeable actions in the section below. Water resources, surface and groundwater, geology, soil resources, and socioeconomic resources have been evaluated below.

Water Resources

Past and Present Actions: Under the No Action Alternative, the City would continue to divert surface water from the City's existing points of diversion, especially in periods of drought. These surface water diversions combined with other current surface water diversions could adversely affect downstream water users and would reduce the quantity of surface water in the rivers and springs. Under the No Action Alternative, the City's diversion of surface water would reduce the amount of surface water available below the City's diversion points in both La Luz Creek and Alamo Canyon because the City would need to maximize diversions and use its existing water rights to meet the demand. Users with junior water rights, such as agricultural users, could experience a decrease in available water for their uses. Under the No Action Alternative, the City and the Village of Tularosa would continue to maximize their surface water diversions and could cause declines when combined with other surface water diversion projects in the agricultural area near Tularosa.

Based on the current pumping patterns and rates throughout the Tularosa basin, numerous wells are projected to go dry by 2045 due to a decline in the water table (see 1) (Blandford 2006). The proposed project is expected to increase groundwater drawdown resulting in more wells going dry. Existing models vary between drawdown projects, with some projecting a few feet and others over 100 feet. Given the anticipated water table decline, water rights holders should expect that wells that do not fully penetrate the aquifer may require deepening at some point in the future (Blandford 2006). Other water withdrawal or diversion projects listed in Table 4-8 could contribute to groundwater drawdown.

Currently the Tularosa Basin National Desalination Research Facility utilizes 500 afy of the basin-fill in the Tularosa Basin. The El Paso/Fort Bliss Desalination Facility uses groundwater resources from the Hueco Basin. Currently, the Hueco Basin receives 5,900 afy of inter-basin groundwater from the Tularosa Basin. This may cause groundwater in the Tularosa Basin to move south and west. No cumulative effects to the basin-fill aquifer in the Tularosa Basin are anticipated because of the El Paso/Fort Bliss Desalination Facility (see Table 4-8). Drawdown for projects within the Tularosa Basin would primarily be associated with City of Alamogordo activities. Other present and reasonable foreseeable actions would have a minimal impact on recharge or drawdown of Tularosa Basin water resources.

Reasonable Foreseeable Actions: Cumulative water resource-related impacts would be evaluated as other management decisions combine to impair or deplete existing resources over time. In most cases, documentation, including NEPA, would identify future cumulative impacts from individual project activities.

GEOLOGY

Past and Present Actions: Because the No Action Alternative would require continued reliance on groundwater to meet current and future water demands, the potential for land-surface subsidence due to groundwater drawdown, in addition to other groundwater withdrawal projects, would likely increase in some areas. Subsidence, which is the lowering of the land-surface elevation from changes that take place underground, can be associated with pumping groundwater from these projects.

Reasonable and Foreseeable Actions: Cumulative geologic resource-related impacts would be evaluated as other management decisions combine to impair or deplete existing resources over time. In most cases, documentation, including NEPA, would identify future cumulative impacts from individual project activities.

SOILS

Past and Present Actions: No ground-disturbing activities would occur under the No Action Alternative; although, soil conditions would be impacted when combined with other projects. Subsidence from pumping of groundwater would likely affect local soil conditions around groundwater wells.

Reasonable and Foreseeable Actions: Cumulative soil resources would be evaluated as other management decisions combine to impair or impact existing resources over time. As additional projects are proposed and planned, documentation, including NEPA, would identify future cumulative impacts from project activities.

SOCIOECONOMICS RESOURCES

Past and Present Actions: Based on projected population growth through the year 2045, the demand for municipal water would increase while the City's ability to supply water to users would remain fixed. An increase in demand without change in supply would likely cause a rise in the rate charged to water users per unit of water. Rate increases for water would likely have an indirect, long-term, adverse impact on the composition of goods and services purchased by households and businesses throughout the area when cumulatively evaluated. Increased water rates could reduce future commercial and industrial activity in the region, reducing commercial and industrial business and causing an indirect, long-term, adverse impact to the region's economy. The City of Alamogordo has relatively low rate for water delivery services. Water rates for study area residential customers are on the lower end of the range. Despite the conservation measures and success by the City of Alamogordo, an increase in rates would likely be necessary with dwindling resources.

Reasonable and Foreseeable Actions: Trends such as shifts in the economy, employment, growth in non-labor income, population growth, and other socioeconomic metrics are largely independent of the project or reasonable and foreseeable actions. Cumulative impacts would be evaluated locally and regionally as appropriate.

PROPOSED ACTION

WATER RESOURCES

With the exception of water conservation, the cumulative impact on water resources generally would be adverse, as most of the listed projects are diverting or propose to divert more water from the Tularosa Basin to meet projected water demands. Groundwater pumping would add to groundwater drawdown, and more surface water diversions would deplete surface water resources. Numerous shallow wells are projected to go dry by 2045 due to a decline in the water table. The reasonably foreseeable action that would most significantly affect water resources when combined with Alternative B would be the El Paso-Fort Bliss Desalination Facility. Groundwater drawdown from both facilities would have local, long-term, adverse effects on groundwater resources, with the range of drawdown, depending on the model, estimated between 45 and 119 feet. Organic subsidence as a result of over-withdrawal of groundwater is an irretrievable process at a given threshold—the amount of groundwater withdrawal at which this would occur in this basin is unknown.

Table 4-8 summarizes the cumulative impacts on water resources according to other present or reasonably foreseeable actions in the study area. All impacts are described by type of effect on groundwater resources and on surface water resources.

TABLE 4-8. CUMULATIVE IMPACTS ON WATER RESOURCES

PAST, PRESENT, OR REASONABLY FORESEEABLE ACTIONS	CUMULATIVE IMPACTS
Tularosa Basin National Desalination Research Facility	***Groundwater resources:*** The Research Facility would be permitted to pump up to 500 afy from the basin-fill aquifer within the Tularosa Basin. However, because the right to divert up to 500 afy was transferred from an existing owner within the Tularosa Basin, depletion of groundwater under the existing permit would remain unchanged. ***Surface water resources:*** No cumulative impacts are anticipated.
El Paso–Fort Bliss Desalination Facility	***Groundwater resources:*** The Hueco Bolson Aquifer receives about 5,900 afy from inter-basin groundwater flow from the Tularosa Basin (Heywood and Yager 2003). No effect on inter-basin groundwater flow from the Tularosa Basin to the Hueco Bolson Aquifer is anticipated. Groundwater modeling shows that after 50 years, pumping would result in groundwater movement toward the south to the west of the desalination facility and the development of a localized groundwater trough (deeper area of drawdown) around the feed wells. However, because El Paso plans to pump the same total quantity of water from the Hueco Bolson Aquifer with or without the desalination facility, decreased pumping from other wells within the City would offset the increased pumping for the facility. No cumulative effects on the Hueco Bolson Aquifer or the basin-fill aquifer within the Tularosa Basin are anticipated. ***Surface water resources:*** No cumulative impacts are anticipated.
Alamogordo Flood Control Project	***Groundwater resources:*** Groundwater recharge would not be impacted and no cumulative impacts are anticipated from lining canals or constructing sediment basins. ***Surface water resources:*** Lining of canals and sediment detention basins would stabilize channel morphology and reduce suspended sediment. Drainage from the Sacramento Mountains would be controlled and properties would be protected from storm damage. No cumulative effects from this project are anticipated.
Transformation of the 49th Fighter Wing at Holloman Air Force Base	***Groundwater resources:*** A 5 percent reduction in Holloman AFB personnel would have a slight, positive cumulative effect on all water users within the Tularosa Basin. If per capita water use on the AFB remains constant, then less water would be required by the AFB to carry out their missions. Assuming a per capita water use of 165 gpcpd, which was assumed by the City for planning purposes, the reduction of 300 personnel would equate to a reduction in water use of about 55 afy. ***Surface water resources:*** No cumulative effect on surface water resources is anticipated.
Land Use Changes at Fort Bliss Military Reservation, McGregor Range	***Groundwater resources:*** Increased off-road vehicle maneuvering within the McGregor Range would not affect groundwater resources. The potential need to divert more groundwater from the Hueco Bolson Aquifer to accommodate growth on Fort Bliss would be an indirect, adverse cumulative effect. ***Surface water resources:*** Any change in land use or range activities would be carried out in compliance with Fort Bliss's MS4 Permit for storm water management. The potential need to purchase more surface water rights on the Rio Grande to accommodate growth on Fort Bliss would be an indirect, adverse cumulative effect.

TABLE 4-8. CUMULATIVE IMPACTS ON WATER RESOURCES	
PAST, PRESENT, OR REASONABLY FORESEEABLE ACTIONS	**CUMULATIVE IMPACTS**
Tularosa Creek Reservoir	***Groundwater resources:*** Alternative B, in combination with a reservoir on Tularosa Creek, would have a cumulative, adverse impact on groundwater resources within the study area. Increased surface water diversion to the reservoir would likely reduce the amount of surface water that would normally recharge the basin-fill aquifer. Groundwater recharge may be reduced and less water would be available to other water users under Alternative B. ***Surface water resources:*** The reservoir would have an adverse effect on natural flows and conditions within the Tularosa Creek. Alternative B would not modify or improve these effects on surface water and would not add to a cumulative impact to surface water resources.
City of Alamogordo Water Resources Conservation Program	***Groundwater resources:*** The conservation of water resources would have an overall beneficial impact on groundwater resources because of reduced demand. When combined with Alternative B, which would adversely impact groundwater resources, the cumulative impact is less adverse than if the Alamogordo Regional Water Supply Project were implemented without the Conservation Program. Data from 2000-2004 shows a decrease of 76.34 gpcpd, from 226.03 gpcpd to 149.69 gpcpd. ***Surface water resources:*** Conserving water use would reduce dependence on surface water resources. However, when combined with Alternative B, which would not have an effect on surface water resources, the cumulative impact is beneficial to surface water resources.
Holloman Land Exchange	***Groundwater resources:*** Land acquired through the exchange could create an additional water need if the land is developed for residential or municipal use. ***Surface water resources:*** Land acquired through the exchange could create an additional water need if the land is developed for residential or municipal use.
PNM Transmission Line Expansion	***Groundwater resources:*** No cumulative impacts are anticipated. Additional project information is not available at this time. ***Surface water resources:*** No cumulative impacts are anticipated. Additional project information is not available at this time.

GEOLOGY

No significant cumulative effects on geologic resources would be anticipated from combining Alternative B with any past, present, or reasonably foreseeable plans or programs in the study area.

SOILS

No significant cumulative effects on soils would be anticipated from combining Alternative B with any past, present, or reasonably foreseeable plans or programs in the study area.

BIOLOGICAL RESOURCES

Table 4-9 summarizes the cumulative impacts on biological resources according to other present or reasonably foreseeable actions in the study area. Overall the cumulative effect on biological resources in the area from surface disturbing activities and changes in land use would be long-term and adverse in localized areas.

TABLE 4-9. CUMULATIVE IMPACTS ON BIOLOGICAL RESOURCES

PAST, PRESENT, OR REASONABLY FORESEEABLE ACTIONS	CUMULATIVE IMPACTS
Tularosa Basin National Desalination Research Facility	Removing vegetation or potential habitat for wildlife to construct both facilities would cause a direct, long-term, adverse, cumulative effect on biological resources. Retiring irrigated lands may have an impact those species that forage on agricultural crops, but those are primarily species that are readily adaptable in a modified landscape. Native vegetation may re-colonize fallowed agricultural land, thus potentially benefitting native wildlife in the long-term.
El Paso–Fort Bliss Desalination Facility	Removing vegetation or potential habitat for wildlife to construct both facilities would cause a direct, long-term, adverse, cumulative effect on biological resources. However, the loss of habitat would be a small percentage of the total available for wildlife in the region.
Alamogordo Flood Control Project	Removing vegetation or potential habitat for wildlife to construct both facilities would cause a direct, long-term, adverse, cumulative effect on biological resources. However, the loss of habitat would be a small percentage of the total available for wildlife in the region. No other cumulative impacts would be anticipated.
Transformation of the 49th Fighter Wing at Holloman Air Force Base	No cumulative impacts would be anticipated from the changes to the 49th Fighter Wing when combined with the Proposed Action.
Land Use Changes at Fort Bliss Military Reservation, McGregor Range	Off-road vehicle use would likely lead to the long-term destruction of sensitive vegetation within the McGregor Range. Combined with Alternative B, an increase in adverse impacts to vegetation would occur.
Tularosa Creek Reservoir	The development of the reservoir would result in the loss of desert shrub, grassland, and riparian habitat that currently exists within the creek. The combination of both projects would cause a direct, long-term, adverse, cumulative effect on biological resources. Some displacement of wildlife would occur, and a change in fauna is likely supported by a permanent deep water source.
City of Alamogordo Water Resources Conservation Program	Combined with Alternative B, the conservation of water within the City does not change the cumulative impact to biological resources from the Proposed Action. Conservation activities may actually negate some impacts from the Proposed Action if they result in conserving water and reducing the demand from the well fields.
Holloman Land Exchange	Land acquired through the exchange could impact TES habitat or potential habitat if the land is developed for residential or municipal use.
PNM Transmission Line Expansion	Combined with Alternative B, the project could result in the potential loss of habitat. The combination of both projects could have a cumulative effect on biological resources. Not enough information is available about this project to evaluate the cumulative impacts.

CULTURAL RESOURCES

Table 4-10 summarizes the cumulative impacts on cultural resources according to other present or reasonably foreseeable actions in the study area. Cumulative impacts on cultural resources would be expected to be minimal over the long-term due to the requirement that cultural resources surveys be conducted before any surface disturbing activity occurs. As a result of the surveys, any site eligible for nomination to the National Register of Historic Places would be avoided or mitigated.

TABLE 4-10. CUMULATIVE IMPACTS ON CULTURAL RESOURCES	
PAST, PRESENT, OR REASONABLY FORESEEABLE ACTIONS	**CUMULATIVE IMPACTS**
Tularosa Basin National Desalination Research Facility	Constructing new roads or rights-of-way could indirectly impact cultural resources because access to sites would be improved. A greater cumulative effect from ground disturbance from construction activities would be likely. Clearing land of vegetation for short-term construction rights-of-way would also adversely impact the integrity of archaeological sites. Combined with Alternative B, the construction and operation of the Research Facility would have a greater cumulative adverse impact on cultural resources.
El Paso–Fort Bliss Desalination Facility	Constructing new roads or rights-of-way could indirectly impact cultural resources because access to sites would be improved. A greater cumulative effect from ground disturbance from construction activities would be likely. Clearing land of vegetation for short-term construction rights-of-way would also adversely impact the integrity of archaeological sites. Combined with Alternative B, the construction and operation of the El Paso-Fort Bliss Desalination Facility would have a greater cumulative adverse impact on cultural resources.
Alamogordo Flood Control Project	Lining canals, constructing sediment basins, and conducting other ground-disturbing activities have been focused in stream channels. Effects on cultural resources from future actions would be mitigated according to Section 106 of the NHPA. Therefore, this project would not contribute to a cumulative effect on cultural resources.
Transformation of the 49th Fighter Wing at Holloman Air Force Base	Reducing base-assigned personnel and maximizing existing infrastructure would not have a cumulative effect on cultural resources when combined with Alternative B.
Land Use Changes at Fort Bliss Military Reservation, McGregor Range	Increased off-road vehicle maneuvering and changes in land use on Fort Bliss would likely disturb more cultural resources sites. This project, combined with Alternative B, would be expected to adversely impact cultural resources within the study area. However, all impacts to cultural resources sites under Alternative B would be mitigated.
Tularosa Creek Reservoir	Modifications to the structure or flow of water to acequias would increase the likelihood of altering the physical integrity of these historic resources. Ground-disturbing activities associated with constructing the reservoir, pipeline, and access roads would increase the potential to adversely impact cultural resources sites. Combined with Alternative B, the Tularosa Creek Reservoir would have a cumulative and adverse impact on cultural resources within the study area.
City of Alamogordo Water Resources Conservation Program	Conservation and planning activities would not affect cultural resources.
Holloman Land Exchange	No cumulative impacts are anticipated.
PNM Transmission Line Expansion	This project, combined with Alternative B, would be expected to adversely impact cultural resources within the study area. However, all impacts to cultural resources sites under Alternative B would be mitigated.

INDIAN TRUST ASSETS

No foreseeable cumulative impacts on ITAs are anticipated from combining either of the alternatives with the listed past, present or future projects or programs within the study area.

SOCIOECONOMIC RESOURCES

Table 4-11 summarizes the cumulative impacts on socioeconomic resources according to other present or reasonably foreseeable actions in the study area. Cumulative impacts on social and economic resources would be positive in the long term due to the additional water that would be provided for community. This would serve increased population and increased business resulting from actions in Table 4-12.

TABLE 4-11. CUMULATIVE IMPACTS ON SOCIOECONOMIC RESOURCES	
PAST, PRESENT, OR REASONABLY FORESEEABLE ACTIONS	**CUMULATIVE IMPACTS**
Tularosa Basin National Desalination Research Facility	Expenses from water rights purchased and leased for the Research Facility and proposed for purchase or lease under Alternative B would have a beneficial impact on the total economy within the study area. Because farming constitutes 0.4 percent of income in Otero County and about 1 percent of income in Lincoln County, fallowing irrigated agricultural lands as a result of purchasing or leasing water rights for the Research Facility and Alternative B would have a cumulative, beneficial impact.
El Paso–Fort Bliss Desalination Facility	Socioeconomic impacts from the El Paso-Fort Bliss Desalination facility would occur in El Paso, Texas, which is outside the study area for this EIS.
Alamogordo Flood Control Project	Flood control measures that protect property owners from future damage would have a beneficial impact. Flood control might increase the likelihood of removing properties from the 100-year floodplain and the need to hold flood insurance policies. As a result, the potential to reduce household expenses would have a beneficial impact for certain properties within Alamogordo. This project combined with Alternative B would therefore have an indirect, beneficial impact on socioeconomic resources within the study area.
Transformation of the 49th Fighter Wing at Holloman Air Force Base	A 5-percent reduction in Holloman AFB personnel would likely adversely impact socioeconomic resources within the study area. Because the total economic impact of the AFB is nearly 30 times that of agriculture and 25 times that of tourism (Carr 2006), minor changes to numbers of personnel at the AFB have significant effects on the local economy. A reduction in personnel at Holloman AFB would have more adverse cumulative effects on the economy when combined with Alternative B compared to Alternative B on its own.
Land Use Changes at Fort Bliss Military Reservation, McGregor Range	Additional personnel assigned to Fort Bliss would likely reside in El Paso, Texas, outside the study area for this analysis. Increased off-road maneuvering would not impact socioeconomic resources. Therefore, no cumulative effect would be anticipated from the land use changes at Fort Bliss.
Tularosa Creek Reservoir	Construction jobs associated with the reservoir and pipeline would have a short-term, beneficial impact to socioeconomic resources. Construction jobs associated with building facilities considered under Alternative B would also have short-term, beneficial impacts to the economy. Therefore, it is likely that the cumulative impact from both actions would have a short-term, beneficial effect on socioeconomic resources.
City of Alamogordo Water Resources Conservation Program	Conservation and planning activities would not affect socioeconomic resources.
Holloman Land Exchange	No cumulative impacts are anticipated.
PNM Transmission Line Expansion	Construction jobs associated with the reservoir and pipeline would have a short-term, beneficial impact to socioeconomic resources. Construction jobs associated with building facilities considered under Alternative B would also have short-term, beneficial impacts to the economy. Therefore, it is likely that the cumulative impact from both actions would have a short-term, beneficial effect on socioeconomic resources.

LAND USE

Table 4-12 summarizes the cumulative impacts on land use according to other present or reasonably foreseeable actions in the study area. There would be both adverse and beneficial cumulative impacts over the long-term within the study area.

TABLE 4-12. CUMULATIVE IMPACTS ON LAND USE

PAST, PRESENT, OR REASONABLY FORESEEABLE ACTIONS	CUMULATIVE IMPACTS
Tularosa Basin National Desalination Research Facility	The 0.25 acre of agricultural land and about 30 acres of undeveloped land acquired for the Research Facility did not have an identifiable effect on land use within the Tularosa Basin. When combined with Alternative B, no cumulative impact on land use would be anticipated.
El Paso–Fort Bliss Desalination Facility	Any impacts to land use from this project would occur outside the study area for Alternative B.
Alamogordo Flood Control Project	Flood control improvements would not significantly impact land use within the study area for the Alamogordo Flood Control Project. When combined with Alternative B, no cumulative impact would be anticipated.
Transformation of the 49th Fighter Wing at Holloman Air Force Base	Maximizing existing facilities and reducing personnel at Holloman AFB would not affect land use. No cumulative effect is anticipated when combined with Alternative B.
Land Use Changes at Fort Bliss Military Reservation, McGregor Range	A 40 to 50 percent increase in off-road maneuvering within the Tularosa Basin portion of the McGregor range would have an adverse impact on land use within the study area. When combined with lands fallowed under Alternative B, there would be an adverse cumulative effect on land use within the study area.
Tularosa Creek Reservoir	This project would result in improvements in water delivery to irrigators within the TCDC. Improved deliveries would likely reduce the potential to convert agricultural land to fallow land because of insufficient water deliveries. The cumulative effect of combining this project with Alternative B would be an indirect, beneficial impact on some land use compared to Alternative B alone. The development of a reservoir will change land use from riparian and desert habitat to open water.
City of Alamogordo Water Resources Conservation Program	Water conservation would not have an identifiable effect on land use within the study area.
Holloman Land Exchange	No cumulative impacts are anticipated.
PNM Transmission Line Expansion	When combined with lands fallowed under Alternative B, there would be an adverse cumulative effect on land use within the study area.

ENERGY REQUIREMENTS

Table 4-13 summarizes the cumulative impacts on energy requirements according to other present or reasonably foreseeable actions in the study area. Cumulative energy requirements would increase over the long-term but that increase would be minimal among the various actions in the study area.

TABLE 4-13. CUMULATIVE IMPACTS ON ENERGY REQUIREMENTS

PAST, PRESENT, OR REASONABLY FORESEEABLE ACTIONS	CUMULATIVE IMPACTS
Tularosa Basin National Desalination Research Facility	Similar to the RO Facility under Alternatives B, the Research Facility would require power to run well pumps, pipeline booster pumps, and the RO facility. Gas requirements are minimal, as gas would only be used to heat the facilities. It is assumed that PNM/TNMP could accommodate the added electric load required by both the Research Facility and alternatives discussed in this EIS.
El Paso–Fort Bliss Desalination Facility	A dedicated 50-megavolt-ampere substation located near Fort Bliss currently supplies power to the Fort Bliss Main Cantonment Area. No new electrical substations would be required to meet the electrical demand of the Fort Bliss Desalination Facility, which represents a 0.3 percent increase over regional peak electrical demand (USACE 2004b). Gas requirements are minimal. Combining this facility with the alternatives in this EIS would not have any cumulative effects on energy resources.
Alamogordo Flood Control Project	The Alamogordo Flood Control Project would not require additional energy. Therefore, there would be no cumulative impact when combed with the alternatives in this EIS.
Transformation of the 49th Fighter Wing at Holloman Air Force Base	A reduction in Air Force personnel would reduce the short- and long-term energy demand of Holloman AFB, which is serviced by the Amrad station. When combined with the alternatives under this EIS, the cumulative impacts to energy requirements would not be greater than any of the individual alternatives in this EIS.
Land Use Changes at Fort Bliss Military Reservation, McGregor Range	Changes in land use would not require additional energy resources to carry out the mission of Fort Bliss. Therefore, no cumulative impacts would be expected when combined with the alternatives under this EIS.
Tularosa Creek Reservoir	The construction and operation of a reservoir would not require additional energy resources. No cumulative impacts would be expected when combined with alternatives under this EIS.
City of Alamogordo Water Resources Conservation Program	Water conservation would not require additional energy resources. Therefore, no cumulative impacts from combining this program with alternatives under this EIS would be expected.
Holloman Land Exchange	No cumulative impacts are anticipated.
PNM Transmission Line Expansion	When combined with the alternatives under this EIS, the cumulative impacts to energy requirements would not be greater than any of the individual alternatives in this EIS.

TRANSPORTATION

Although short-term lane closures could occur during construction activities, the alternatives would not have any cumulative effects on transportation when combined with other projects or programs in the study area.

AIR QUALITY

Table 4-14 summarizes the expected cumulative impacts on air quality according to other present or reasonably foreseeable actions in the study area. Cumulative impacts to air quality would be minimal and short-lived. Impacts would generally be confined to localized areas.

TABLE 4-14. CUMULATIVE IMPACTS ON AIR QUALITY	
PAST, PRESENT, OR REASONABLY FORESEEABLE ACTIONS	**CUMULATIVE IMPACTS**
Tularosa Basin National Desalination Research Facility	Removing and transporting concentrate from the Research Facility could cause short-term, localized increases in fugitive dust. However, no impacts are anticipated over the recommended background level of 20 $\mu g/m^3$ for PM_{10} in Otero County. Dust control measures would be used to mitigate potential impacts resulting from fugitive dust from managing concentrate ponds at the Research Facility.
El Paso–Fort Bliss Desalination Facility	Any short-term impacts on air quality from facilities construction or operation would occur outside the Tularosa Basin, the study area for this EIS.
Alamogordo Flood Control Project	No long-term impacts to air quality are anticipated from constructing flood controls.
Transformation of the 49th Fighter Wing at Holloman Air Force Base	No long-term impacts to air quality are anticipated from maximizing existing infrastructure on Holloman AFB.
Land Use Changes at Fort Bliss Military Reservation, McGregor Range	Off-road vehicle maneuvering would increase dust levels, but air quality standards relating to these activities would be enforced. The impact of land use on fugitive dust emissions is anticipated to be local, short-term elevated air pollutant concentrations that would not result in any long-term impacts on regional air quality. When combined with Alternative B, no cumulative effects are anticipated.
Tularosa Creek Reservoir	No impacts on air quality are anticipated from constructing a reservoir for off-stream surface water storage.
City of Alamogordo Water Resources Conservation Program	No impacts to air quality are expected from this municipal water conservation program.
Holloman Land Exchange	No cumulative impacts are anticipated.
PNM Transmission Line Expansion	The impact of land use on fugitive dust emissions is anticipated to be local, short-term elevated air pollutant concentrations that would not result in any long-term impacts on regional air quality. When combined with Alternative B, no cumulative effects are anticipated.

VISUAL RESOURCES

Additional facilities proposed under the listed projects or programs would not cause any visual impacts. The overall landscape changes within the Tularosa Basin would likely remain the same as under current conditions, although there could be a short-term increase in the area of bare ground during construction activities. The alternatives would not have any identifiable cumulative impacts on visual resources when combined with other projects or programs in the study area.

4.3 MITIGATION MEASURES

4.3.1 WATER RESOURCES

Water rights holders are protected under State water law (Chapter 72, Article 12, NMSA 1978). Existing water rights holders in the Tularosa Basin are very concerned about incremental drawdown effects of the 10 city wells. These water rights holders identified as being significantly impacted by groundwater pumping under Alternative B, would be protected by a monitoring program required by the NMOSE. Under this program, the City would measure water levels and TDS within the monitoring wells (yet to be designated) and surface flows in

July and January of each calendar year. The City would report these measurements to the NMOSE, in writing, on or before January 31 and July 31 of each calendar year.

If the NMOSE, through its monitoring of water level and quality, identifies the need for mitigation, the NMOSE would require the City to initiate the necessary measures, including if necessary a cessation of pumping, to avoid potential loss or adverse impact to water resources or water-dependent natural resources. If priority water rights owners believe their rights are being impaired by the City's pumping at the Snake Tank water wells, they have recourse to a "priority administration" conducted by the NMOSE. New Mexico law provides for the NMOSE to conduct a priority administration pursuant to NMSA 1978, § 72-2-9.1 (2003), to administer water allocations in accordance with the water right priorities recorded with or declared or otherwise available to the NMOSE. This law provides that in periods of shortage when the need for administration of priorities is most urgent, it is in the public interest for the NMOSE to apportion water among water right owners based on the best evidence available to them at the time. The priority administration procedure affords each party the opportunity to establish its water rights priority and to contest the priority of others. Parties who believe their water rights are impaired by the City of Alamogordo's pumping from the Snake Tank well field also have recourse to private litigation in the courts who could enjoin the City or the NMOSE to cease or reduce pumping from the Snake Tank well field. To mitigate potential loss to groundwater resources, the City could also reach agreements with the individual water rights holders. Depending on the individual agreement, options for mitigation could include deepening wells or delivering water of equal quality to water rights holders when the available water column in a well is reduced by more than 70 percent or there is less than 10 feet of water above or below the pump. To mitigate the potential loss to surface water resources, including springs, the City would be required by the NMOSE to adjust the system's pumping schedule according to the monitoring results.

4.3.2 SOILS

Mitigation measures for soils under each alternative would follow the best management practices (BMPs) identified in the storm water pollution prevention plan for construction activities. These BMPs would include dust suppression and soil stabilization measures that would minimize erosion and storm water pollution during construction. Areas disturbed during construction would be reseeded with native vegetation to minimize erosion.

4.3.3 VEGETATION

The following mitigation measures, if implemented, would minimize impacts to vegetation under the alternatives:

- Grading the sites affected following completion of construction activities.
- Replanting or reseeding the disturbed areas with an acceptable mix of native plants typically found in this region of the Chihuahuan Desert.
- Monitoring restoration efforts to assess their overall success and progress.

4.3.4 GRAZING

The City of Alamogordo has committed to maintaining current base waters available and accessible for livestock on BLM land so that no current grazing allotments in the study area would be terminated as a result of implementation of the proposed project.

4.3.5 WILDLIFE

To minimize adverse impacts to wildlife, the following mitigation measures are recommended for the alternatives:

- Limiting construction activities to outside the general migratory bird nesting season of March through August or surveying areas proposed for construction during the nesting season and avoiding any occupied areas until nesting is complete.
- Minimizing trapping of wildlife during trenching operations, where possible, by trenching and burying the pipeline concurrently, leaving the least possible amount of trench open overnight, and providing escape ramps for trapped wildlife. If trenches cannot be backfilled immediately, constructing escape ramps should be located at least every 295 feet. Trenches that have been left open overnight, especially where endangered species occur, should be inspected and any animals found removed prior to backfilling.
- Limiting heavy equipment travel to the immediate construction right-of-way and avoiding areas of heavy growth and native habitat when feasible.
- Reducing the height of the elevated water storage tank to its lowest functional limit to reduce the possibility of collisions by airborne wildlife.

4.3.6 CULTURAL RESOURCES AND HISTORIC PROPERTIES

Of the sites identified during the survey of Alternative B, historic railroad station LA 86735 is recommended as eligible to the NRHP under Criteria A and D and has subsequently been determined as eligible to the NRHP under Criterion D. LA 150031, a prehistoric site, is also recommended and has since been determined eligible under Criterion D to the NRHP. Project planning may be able to avoid these two sites recommended as eligible to the NRHP that may be directly or indirectly impacted under Alternative B. No impacts to cultural resources would occur under Alternative A.

Where avoidance is not possible, impacts to the two sites would be mitigated. Mitigation may include having an archaeologist present to monitor construction activities, testing the sites to determine the need for further investigation through data recovery, and/or performing subsequent archaeological data recovery (excavation) within entire sites or in potentially affected portions of the sites. All or portions of a site may be destroyed as a result of archaeological excavations, but the site would still retain its eligibility to the NRHP under Criterion D for information potential in the form of recovered scientific data. As part of mitigation, there will be a public presentation in the form of a brochure, presentation meetings, or public report detailing the results of these archaeological excavations. Mitigation measures for the two archaeological sites potentially impacted are described below.

- LA 86735, recommended eligible under Criteria A and D and now determined eligible to the NRHP under Criterion D, may be disturbed by the installation of the main water pipeline segment of the project. A number of mitigation alternatives are possible at this site, including avoidance options and preparation of a Memorandum of Agreement (MOA). Mitigation can be achieved by avoiding the site by running a section of the pipeline either east of the railroad tracks or west of U.S. 54. An alternative would be placing the pipeline along the eastern slope limits of U.S. 54, although intact portions of the site may be buried under the U.S. 54 slope limits-this alternative would probably entail shutting down portions of U.S. 54, as construction activity to the east of the slope limits would impact the site. Avoidance measures would include flagging, barrier fencing, and monitoring during construction activities occurring within 650 feet of site boundaries. Another possible mitigation measure would be to specify that, pending the location of the pipeline, the City would prepare an MOA with the State Historic Preservation Officer (SHPO) and the NM Department of Transportation that would include a testing and/or a data recovery plan if the pipeline is to be placed through the site.

- LA 150031, recommended eligible under Criterion D, is located in the path of a proposed well pad access road that would be used to bypass and rejoin a road currently running through the private land holdings of Stover Ranch. Avoidance of the site is recommended by rerouting the road from its proposed location to approximately 164 feet to the west and down slope of the site. The use of flagging and barrier fencing during construction activities is recommended. However, testing of the site is recommended if avoidance is not possible.

4.3.7 SOCIOECONOMIC RESOURCES

Mitigation measures for socioeconomic resources under the Proposed Action include:

- Using existing road and utility rights-of-way as much as is practicable to reduce permitting and land acquisitions costs and to reduce disruption of commercial facilities.
- Adopting a hiring preference for local construction personnel to build the project.
- Hiring and training local professional or service personnel to operate and maintain facilities so that direct and secondary spending remains in the local economy.

If determined that the Snake Tank wells were incrementally increasing drawdown and affecting other wells (i.e., senior water rights), the City would be required to mitigate their use by either compensating for use of the water and/or reducing use of the wells. Additionally, all water purchased or leased by the City in the future will have to be approved through the NMOSE hearing process. The population in Otero County is not growing at any increased rate. The most recent 2007 numbers show an increase between 2000 and 2006 at less than 1 percent. A more reliable supply of water for municipal and/or agricultural use will not in itself increase population at a faster rate.

4.3.8 ENVIRONMENTAL JUSTICE

No mitigation measures for environmental justice issues are identified for the Proposed Action.

4.3.9 TRANSPORTATION

Measures to mitigate impacts on land use for the Proposed Action include:

- Directional drilling to minimize traffic disruption.
- Constructing road crossings for underground pipelines at times of low traffic use.
- Improving the entrance to the well field by widening the highway to accommodate a westbound turning lane to northbound U.S. 54.
- Improving the southbound entrance to and exit from the well field by adding entrance and exit lanes to U.S. 54.

4.3.10 LAND USE

No mitigation measures for land use issues are identified for the Proposed Action.

4.3.11 ENERGY REQUIREMENTS

No mitigation measures for energy requirements are identified for the Proposed Action.

4.3.12 AIR QUALITY

Frequent watering of exposed soil during construction would minimize fugitive dust emissions from construction activities for the Proposed Action.

4.3.13 VISUAL RESOURCES

Impacts to the viewshed in the study area from the proposed buildings could be reduced by several methods, including painting the water tank and structures in a flat earth tone to match the surrounding landscape.

4.4 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts are environmental consequences of an action that cannot be avoided either by changing the action or through mitigation. The majority of adverse impacts under any alternative can be reduced or eliminated by the mitigation measures identified for each resource. However, unavoidable adverse impacts for the Proposed Action include the following:

- Constructing proposed facilities would disturb biological resources because vegetation would need to be cleared.

- Construction activities and vehicle use during construction of proposed facilities would cause short-term air pollution and disturbance of soil stability.
- Operation of a desalination facility would result in an increase in energy use. In addition, the treatment process would continuously produce concentrate that would need to be reused or disposed of. Transporting the concentrate from the facility to the landfill would have impacts on air quality due to vehicle use.

4.5 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

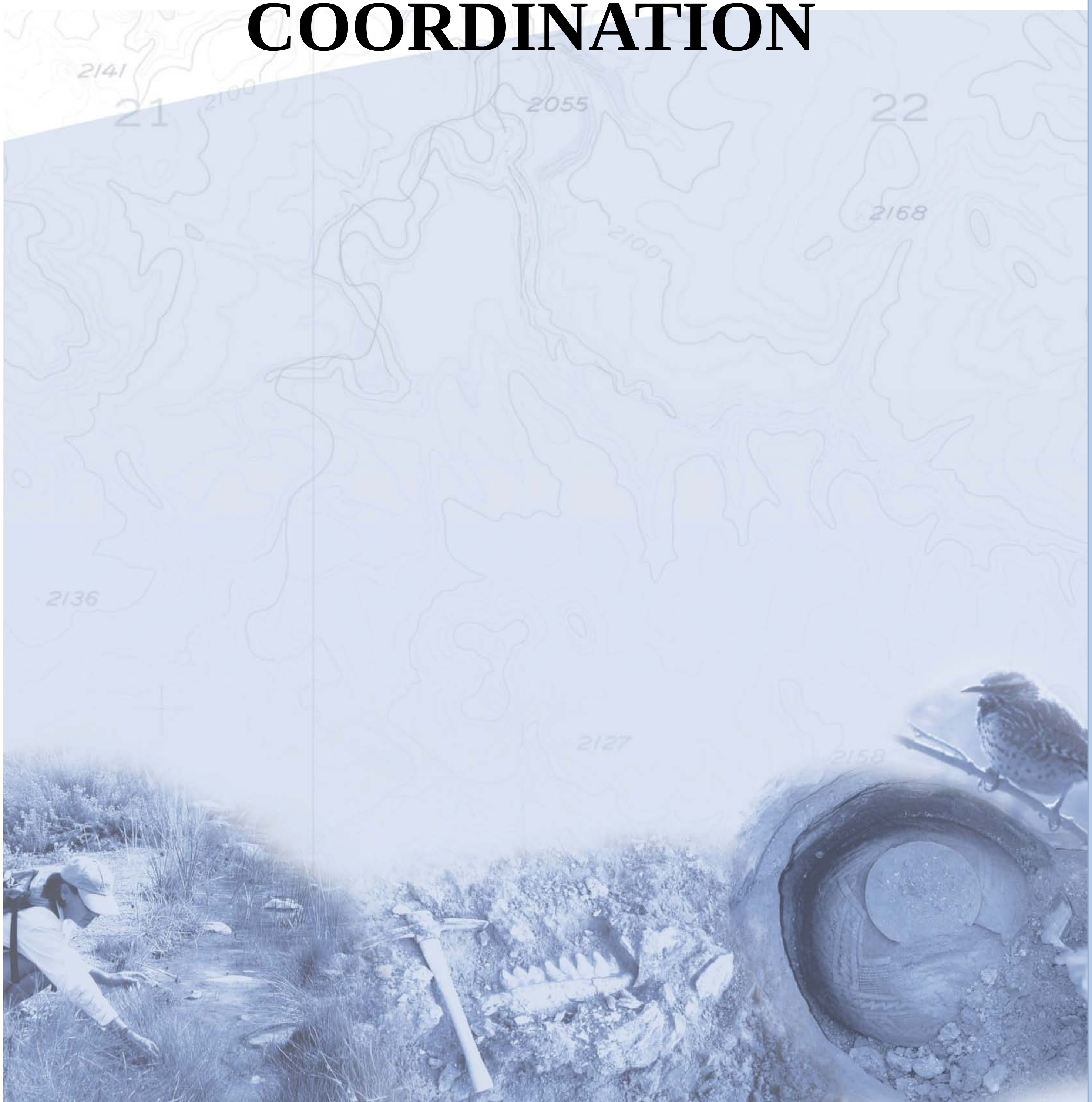
This section identifies losses or gains in the short-term uses and long-term productivity of the environment caused by the Proposed Action. Under Alternative B, there would be disruption of short-term uses of groundwater by existing water rights holders. However, the proposed mitigation measures (see Section 4.4) would help offset these losses.

4.6 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irretrievable commitment of resources means the temporary loss of production or use of resources as a result of the decision.

Irreversible commitment of resources means a permanent loss of production or a resource. Any groundwater pumped that exceeds current annual recharge rates would be an irreversible impact on water resources. Disposing of concentrate generated from the desalination process in a landfill may have an irreversible impact. Although the decision as to how concentrate is disposed of would be managed, the concentrate itself would be irreversible. Any loss of archaeological sites would also be irreversible.

5.0 CONSULTATION AND COORDINATION



5.0 CONSULTATION AND COORDINATION

5.1 BUREAU OF LAND MANAGEMENT

NAME	HIGHEST DEGREE/CERTIFICATION	PROJECT ROLE	YEARS OF EXPERIENCE
Lorraine Salas	A.D., Pre-Business	Project Manager, Realty Specialist (2007-CY)	26
Jason Allen	M.S., Agricultural Extension and Education	Project Manager, Realty Specialist (2006-2007)	5
Bruce Call	B.S., Agriculture	Soils, Water, and Air Quality Review	29
Matt Craddock	B.S., Forest Recreation	Document Review	29
Margie Guzman	B.S., Wildlife Science	Wildlife, Special Status Species Review	20
Bill Childress	B.S. Physical Geography, Minor Soils and Range	District Manager, Management Oversight	35
Jackie Neckels	B.A., Journalism and Mass Communications	Recreation and Visual Resources Review	17
Lisa Phillips	B.S., Rangeland Resources	Vegetation, Livestock Grazing, and Noxious Weed Review	12
Tom Phillips	B.S., Range Science	Recreation and Visual Resources Review	
Jeanette Pranzo	M.S., Economics	Socioeconomics Review	34
Tim Sanders	M.S., Agricultural Economics	Management Oversight	28
Pam Smith	B.A., Anthropology	Cultural Resources Review	31
Rusty Stovall	M.S., Geography	GIS Support	14
Rena Gutierrez	B.A. Journalism and Mass Communications	Document Management/Review	32
Paul Summers	B.S. Geology (31 yrs hydrogeology)	Water and Hydrological Review	31
Edward Seum	B.A. Geology and Mineralogy	Document Review	25
Dwayne Sykes	B.S., Wildlife Science	New Mexico State Office NEPA Coordination and Review	31
Mark R. Spencer, AICP	B.S., M.P. (Planning- Env. Studies)	New Mexico State Office NEPA Coordination and Review	21
Megan Stouffer	B.A. MPA (Planning/Env. Studies)	New Mexico State Office NEPA Coordination and Review	4

5.2 BUREAU OF RECLAMATION

NAME	HIGHEST DEGREE/CERTIFICATION	PROJECT ROLE	YEARS OF EXPERIENCE
Rob Doster	Ph.D., Biology	Natural Resources (ESA/BA) Review and Editing	15
Hector Garcia	M.A., Biology and Anthropology	Project Manager	25
Jeffrey Hanson	Ph.D., Anthropology	Cultural Resources Review	27
Mike Landis	M.S., Civil Engineering/Professional Engineer in Texas	Engineering Review and Editing	22
Tamara Massong	M.S., Geology	Hydrology Review and Editing	10
Lori Robertson	M.A., Biological Science	Document Review	22

5.3 SWCA AND SUBCONSULTANTS

NAME	HIGHEST DEGREE/CERTIFICATION	PROJECT ROLE	YEARS OF EXPERIENCE
SWCA			
Jean Ballagh	B.A., History	Technical Editor	30
Krista Bonfantine	B.S., Biology	Technical Support – Natural Resources	5
Christopher Carlson	B.A., Anthropology	Cultural Resources Crew Chief	13
Peter Castiglia	M.S., Earth and Planetary Sciences	Project Manager CY 2004–2007	6
Tracylee Clarke	Ph.D., Environmental Communication	Public Involvement Lead	12
Peter David	M.S. Wildlife Biology	Permits and Biology Lead	25
Joseph Fluder	M.S., Geography	Natural Resources/Project Management CY 2009-2010	11
Chris Grosso	B.S., Wildlife Management	Natural Resources Lead	12
Hansene Gustafson	B.A., Anthropology	Technical Support – Cultural Resources	10
Janelle Harden	B.U.S., Undergraduate Studies	Technical Support – Administrative Record	4
Anne Huebner	Ph.D., Nat. Res. Economics	Project Manager/NEPA CY 2007–2008	25
Peter David	M.S., Biology	Technical Writing and Coordination – Natural Resources	25
Burt McAlpine	B.S., Wildlife Biology	Geographic Analysis, Cartography	8
Mike Pease	Ph.D., Environmental Resources and Policy	Water Resources/Natural Resources	8
Claudia Oakes	Ph.D., Geography	Contract Manager	23
Jim Railey	Ph.D., Anthropology	Cultural Resources Lead	30
Daniel St. Germain	M.S., Geography	Geographic Analysis, Cartography	5
Heather Timmons	B.S., Biology	Geographic Analysis, Cartography	5
CDM			
Sarah Guemez	M.S., Environmental and Water Resources Engineering/ Professional Engineer in Texas	Staff Engineer	4
Paul Karas	M.S., Geology/ Certified Professional Geologist and Certified Hazardous Material Manager	Lead Hydrogeologist	20
Kathleen Watson	B.S., Civil Engineering Environmental Option/ Professional Engineer in New Mexico and Texas	Project Manager	13

6.0 REFERENCES

6.0 REFERENCES

American Meteorological Society. 1998. Planned and Inadvertent Weather Modification (Adopted by the Council 2 October 1998). Bulletin of the American Meteorological Society 79:2771–2772. Electronic document: http://www.ametsoc.org/policy/wxmod98.html. Accessed October 11, 2007.

Anderson, J.R., E.E. Hardy, J.T. Roach, and R.E. Witmer. 1976. A land use and land cover classification system for use with remote sensor data. U.S. Geological Survey, Professional Paper 964. Online resource, no longer available on the USGS website.

Application of Brown. 1958. 65 N.M. 74, 78-79, 332 P.2d 475, 478.

Bailey, R.G. 1980. Description of the Ecoregions of the United States. U.S. Department of Agriculture, Miscellaneous Publication No. 1391, 77pp.

Biota Information System of New Mexico (BISON-M). 2004. New Mexico species of concern listed by county. New Mexico Department of Game and Fish. Online resource, no longer available on the NMDGF website.

Blandford, T.N. 2006. Statement of Opinions of T. Neil Blandford Concerning the City of Alamogordo Permit T-3825, Tularosa Basin, New Mexico. Consultant's Report prepared for the City of Alamogordo, 14 pp.

Brown, D.E. 1994. Biotic Communities of the Southwestern United States and Northwestern Mexico. Salt Lake City: University of Utah Press.

Bureau of Business and Economic Research (BBER). 2004. Revised Population Projections for New Mexico and Counties, BBER, University of New Mexico, Albuquerque, New Mexico. Revised May 3, 2004. Electronic document: http://www.unm.edu/~bber/demo/Table1.htm. Accessed October 11, 2007.

BBER. 2005a. Revised Total Population Projections by County, 2000 to 2030. Electronic document: http://www.unm.edu/~bber/demo/Table1.htm. Accessed October 11, 2007.

BBER. 2005b. Covered wage and salary employment by major industrial sector and county according to the North American Industrial Classification System. Electronic document: http://www.unm.edu/~bber/econ/cewnaics.htm. Accessed October 11, 2007.

California Department of Food and Agriculture. 2005. Encycloweedia: noxious weed index, camelthorn (*Alhagi pseudalhagi*). Electronic document: http://www.cdfa.ca.gov/phpps/ipc/weedinfo/alhagi.htm. Accessed October 11, 2007.

Carman, S. Personal communication 2007

Carr, E. 2006. The Importance of a Sustainable and Dependable Water Supply for Alamogordo and the Region. Expert Report of Ed Carr, Executive Director, Otero County Economic Development Council, Inc., 26 pp.

Comprehensive Wildlife Conservation Strategy for New Mexico (CWSC). 2006. New Mexico Department of Game and Fish, Santa Fe, New Mexico. 526 pp + appendices.

Derr, P.S. 1981. Soil Survey of Otero Area, New Mexico: Parts of Otero Eddy, and Chaves Counties. U.S. Department of Agriculture, Soil Conservation Service, and Forest Service in cooperation with the New Mexico State University Agricultural Experiment Station.

Dick-Peddie, W.A. 1993. New Mexico Vegetation Past, Present and Future. University of New Mexico Press, Albuquerque, New Mexico.

Economagic. 2006. Economagic.com: Economic Time Series Page, Series Title: Unemployment Rate: Otero County, NM, New Mexico; Percent; NSA. Electronic document: http://www.economagic.com/em-cgi/data.exe/blsla/laucn35035003. Accessed October 11, 2007.

El Paso Electric Company (EPE). 2002. Transmission Interconnection Feasibility Study, Systems Operations Department, System Planning Section, March 2002. Electronic document: http://www.epelectric.com/Site/transmission.nsf/385b7260d19449a78725714b006dbfd8/5f0ac65cd2f6df278725714b005f7598/$FILE/Transmission%20Interconnection%20Study%20-%20200%20MW%20HVDC%20at%20Eddy%20County.pdf. Accessed October 11, 2007.

El Paso Water Utilities Public Service Board. 2004. Financial Information Rate Survey, Residential Water and Sewer Rates–November 2004. Online resource, no longer available on the El Paso Water Utilities website.

Federal Register (FR). 1991. Endangered and Threatened Wildlife and Plants; Animal Candidate Review for Listing as Endangered or Threatened Species, Proposed Rule. Department of the Interior. Thursday, November 21, 1991. Vol. 56, No. 225.

FR 1996. Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa That Are Candidates for Listing as Endangered or Threatened Species. Notice of Review. February 28, 1996. Vol. 61, No. 40.

FR. 2004. Endangered and Threatened Wildlife and Plants: Proposed Designation of Critical Habitat for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*); Proposed Rule. Vol. 69, No. 196 / Tuesday, October 12, 2004, pp. 60706–60786.

FR. 2005. Endangered and Threatened Wildlife and Plants; Establishment of a Nonessential Experimental Population of Northern Aplomado Falcons in New Mexico and Arizona and Availability of Draft Environmental Assessment. Proposed Rule. Vol. 70, No. 26, Wednesday, February 09, 2005. pp. 6819–6828.

Garza, S., and J.S. McLean. 1977. Freshwater Resources in the Southeastern Part of the Tularosa Basin. New Mexico State Engineer Office Technical Report No. 40. 67 pp.

Global Security. 2005. Military FM 19–25, Chapter 25, Roadway Capacity Studies, Formula Used to Estimate Theoretical and Actual Traffic Capacities for Roadways. Electronic document: http://www.globalsecurity.org/military/library/policy/army/fm/19-25/CH25.htm. Accessed October 11, 2007.

Hansen, J., Mki. Sato, R. Ruedy, P. Kharecha, A. Lacis, R.L. Miller, L. Nazarenko, K. Lo, G.A. Schmidt, G. Russell, I. Aleinov, S. Bauer, E. Baum, B. Cairns, V. Canuto, M. Chandler, Y. Cheng, A. Cohen, A. Del Genio, G. Faluvegi, E. Fleming, A. Friend, T. Hall, C. Jackman, J. Jonas, M. Kelley, N.Y. Kiang, D. Koch, G. Labow, J. Lerner, S. Menon, T. Novakov, V. Oinas, Ja. Perlwitz, Ju. Perlwitz, D. Rind, A. Romanou, R. Schmunk, D. Shindell, P. Stone, S. Sun, D. Streets, N. Tausnev, D. Thresher, N. Unger, M. Yao, and S. Zhang. 2007. Dangerous human-made interference with climate: A GISS modelE study. Atmospheric Chemistry and Physics **7**:2287–2312.

Havenor, K. 2006. Effects of City of Alamogordo Proposed Well Field For Desalination Plant on Surface and Groundwater Supply to the Tularosa Community Ditch Association Area, Consultant's Report prepared for the Tularosa Community Ditch Corporation, October 1, 2006, 180 pp.

Heywood, C.E., and Yager, R.M. 2003. Simulated Groundwater Flow in the Hueco Bolson, an Alluvial-basin Aquifer System near El Paso, Texas. U.S. Geological Survey Water-Resources Investigations Report 024108, 73 pp.

Hood, J.W., and Herrick, E.H. 1965. Water resources of the Three Rivers Area, Otero and Lincoln Counties, New Mexico. U.S. Geological Survey, Hydrologic Investigations Atlas HA-192.

Huff, G.F. 2005. Simulation of Ground-Water Flow in the Basin-Fill Aquifer of the Tularosa Basin, South-Central New Mexico, Predevelopment through 2040. US Geological Survey Scientific Investigations Report 2004-5197. 87 pp.

Jagielski, K., and J. O'Brien, 1994. Calculations Methods for Criteria Pollutant Emission Inventories. U.S. Air Force, Brooks Air Force Base. Armstrong Laboratory, AL/OE-TR-1994-0049. July.

John Shomaker and Associates, Inc. (JSAI) 2003. Predicted Drawdown Effects and Evaluation of Potential Saline Encroachment Due to Pumping Under City of Alamogordo Application Nos. T-3825 Through T-3825-S-9, Approximately 10 Miles North of Tularosa, Otero County, New Mexico. Consultant's Report prepared for the City of Alamogordo. 41 pp.

JSAI. 2006. Predicted Drawdown Effects and Evaluation of Potential Saline Encroachment Due to Pumping Under City of Alamogordo Application Nos. T-3825 Through T-3825-S-9, Approximately 10 Miles North of Tularosa, Otero County, New Mexico. Consultant's Report prepared for the City of Alamogordo.

JSAI. 2009. Hydrogeologic Assessment of Proposed Injection Wells for Alamogordo Regional Water Supply Project. Alamogordo, NM. Consultant's Report prepared for the City of Alamogordo.

Lee, R.D. 1999. New Mexico's Invasive Weeds. New Mexico State University, College of Agriculture and Home Economics Cooperative Extension Service, Box 30003, MSC 3AE, Las Cruces, New Mexico, 88005.

Livingston Associates, P.C. 1996. Preliminary Aquifer Storage Recovery Study, City of Alamogordo Consultant's Report, 27 pp.

Livingston Associates, P.C. 2003a. City of Alamogordo. Regional Desalination Right of Way Study. June 2003. 42 pp.

Livingston Associates, P.C. 2003b. City of Alamogordo, NM, Application Nos. T-3825 Through T-3825-S9 and the Alamogordo Brackish Water Desalination Project. Consultant's Report prepared for the City of Alamogordo, March 2003. 35 pp.

Livingston Associates, P.C., and John Shomaker and Associates, Inc. (Livingston and Shomaker). 2002a. Section 8.2, Future Water Supply Alternatives In: Tularosa Basin and Salt Basin Regional Water Plan: 2000 to 2040, Volume I, 244 pp.

Livingston and Shomaker. 2002b. Tularosa and Salt Basin Regional Water Plan, 2000–2040. Consultant's Report for South Central Mountain RCDC Council, Inc.

Livingston and Shomaker. 2003. City of Alamogordo Desalination Feasibility Study and Pilot Project: Phase 1 and Phase 2. Consultant's Report, 40 pp.

Livingston and Shomaker. 2006. City of Alamogordo 40-Year Water Development Plan 2005–2045. Consultant's Report prepared for the City of Alamogordo, 56 pp.

Livingston, E.C., and Finch, S.T., Jr. 1998. Aquifer storage and recovery study for the city of Alamogordo, New Mexico. Water Resources Research Institute Proceedings: 42nd Annual New Mexico Water Conference, Abstracts with programs.

Machette, M.N., Personius, S.F., Kelson, K.I., Dart, R.L., and K.M. Haller, 2000. Map and Data for Quaternary Faults and Folds in New Mexico. U.S. Geologic Survey, Open-File report 98-521.

Mathers v. Texaco, Inc. 1966. 77 N.M. 239, 245, 421 P.2d 771, 776.

McKinney, W.L., and Martinez, E.H. 2002. Draft Fatal Flaw Analysis Desalination Project Proposed Sites City of Alamogordo, New Mexico. Consultant's Report, City of Alamogordo, 17 pp.

McLean, J.S. 1970. Saline ground water resources of the Tularosa Basin, New Mexico. U.S. Geological Survey, Office of Saline Water Report No. 561. 128 pp.

Meyer, R.A., and S.O. Williams, III. 2005. Recent Nesting and Current Status of Aplomado Falcon (*Falco femoralis*) in New Mexico. La Tierra Environmental Consulting, LLC, Las Cruces, and NMDGF, Santa Fe, New Mexico.

Minnesota Department of Transportation. 2005. The Highway Project Development Process Handbook, Part II, Section D, Subject Guidance: Visual Quality. St. Paul: Minnesota Department of Transportation. Electronic document: http://www.dot.state.mn.us/tecsup/xyz/plu/hpdp/book2sg/visual/. Accessed October 11, 2007.

Montgomery v. Lomos Altos Inc., 2007. NMISC-2 22, 141 N.M. 21, 28.

Morrison, T.D. 1989. A regional model of the bolson-fill aquifer near Tularosa and Alamogordo, New Mexico: New Mexico State Engineer Office, Technical Division Hydrology Report No. 89-3, 71 pp.

Myers, R.G., and C.A. Naus. 2004. A Summarized Review of Selected Hydrological Characteristics of the White Sands Pupfish (*Cyprinodon tularosa*) Habitats, Tularosa Basin, New Mexico. In cooperation with the U.S. Geological Survey and White Sands Missile Range.

The National Academies of Science. 2006. Surface Temperature Reconstructions for the Last 2,000 Years Committee on Surface Temperature Reconstructions for the Last 2,000 Years. Board on Atmospheric Sciences and Climate Division on Earth and Life Studies.

National Oceanic and Atmospheric Administration (NOAA). 2005. Climate summary for El Paso, Texas. Electronic document: http://www.ncdc.noaa.gov/oa/climate/research/cag3/x6.html (September 2007). Accessed October 11, 2007.

Natural Resources Conservation Service (NRCS). 1975. Soil Survey of Otero Area, New Mexico; Parts of Otero, Eddy, and Chaves Counties. USDA NRCS and Forest Service, in cooperation with the New Mexico State University Agricultural Experiment Station, Las Cruces, New Mexico. U.S. Government Printing Office, Washington, D.C.

NRCS. 2005. Land designations for Otero County, New Mexico. Online resource, no longer available on NRCS website.

NRCS. 2006. Discount Rates for Water Resource Projects. Electronic document: http://www.economics.nrcs.usda.gov/cost/discountrates.html (May 2007). Accessed October 11, 2007.

NRCS. 2009. The PLANTS Database. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. Electronic document: http://plants.usda.gov. Accessed March 30, 2009.

NatureServe. 2004. Ecological System Comprehensive Report, North American Warm Desert Cienega. Electronic document: http://www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722925. Accessed October 11, 2007.

New Mexico Bureau of Geology and Mineral Resources. 2006. Oil and Gas Program, Importance of Oil and Gas in New Mexico. Electronic document: http://geoinfo.nmt.edu/resources/petroleum/home.html. Accessed October 11, 2007.

New Mexico Department of Agriculture (NMDA). 1999. Agency memo, 20 September–New Mexico Invasive Plants, 1998 Listing Options.

New Mexico Department of Game and Fish (NMDGF). 2006a. Cooperative agreement for protection and maintenance of White Sands pupfish between U.S. Army–White Sands Missile Range, U.S. Air Force–Holloman Air Force Base, National Park Service–White Sands National Monument, U.S. Fish and Wildlife Service, and New Mexico Department of Game and Fish. New Mexico Department of Game and Fish, Santa Fe, New Mexico. 1 May.

NMDGF. 2006b. Comprehensive wildlife conservation strategy for New Mexico. Santa Fe, New Mexico. 14 February. 681 pp.

New Mexico Department of Transportation (NMDOT). 2004. New Mexico Traffic Flow Maps of Urban Areas (2004) AADT. NMDOT, Santa Fe, New Mexico. Electronic document: http://nmshtd.state.nm.us/upload/images/maps/Traffic-Flow-Maps/default.asp. Accessed October 11, 2007.

New Mexico Environment Department (NMED). 2005a. NMED Construction Programs Bureau, Municipal Water and Wastewater User Charge Survey (Based on 6,000 gallons/month) May 1, 2005. Online resource, no longer available on NMED website.

NMOSE. 1996. Technical Report 48, Water Conservation and Quantification of Water Demands in Subdivisions, A Guidance Manual for Public Officials and Developers, Wilson, B. C.,

NMOSE. 2003. Technical Report 51, Water Use by Categories in New Mexico Counties and River Basins, and Irrigated Acreage in 2000, Wilson, B. C.; Lucero, A. A.; Romero, J. T., P. E., and Romero, P. J.

NMOSE. 2004a. Report and Recommendation of Hearing Examiner in the Matter of the Application by City of Alamogordo for Permit to Appropriate Underground Waters for the Shallow Aquifer located in the Tularosa Basin, Hearing No. 02-035, NMOSE File No. T-3825 thru T-3825-S-9.

NMOSE. 2004b. Hearing Decision 02-035, In the Matter of the Application by City of Alamogordo for Permit to Appropriate Underground Waters from the Shallow Aquifer Located in the Tularosa Basin of New Mexico, 18 pp.

NMOSE. 2005a. Report and Recommendations of the Hearing Examiner, Hearing No. 02-35, NMOSE File No. T-3825 through T-3825-S-9. Electronic document: http://www.swca.com/arwsp/documents/OSE_Decision.pdf. Accessed October 11, 2007.

NMOSE. 2005b. Waters Web Query System. Electronic document: http://iwaters.ose.state.nm.us:7001/iWATERS/. Accessed October 11, 2007.

NMOSE. 2006. Summary of water use in acre-feet, in Otero county, 2000. Electronic Document: http://www.ose.state.nm.us/water-info/water-use/county00/otero.html. Accessed March 3, 2009.

NMOSE. 2009. Induced 40-Year Drawdown due to City Pumping of 4000 AFY. Unpublished map prepared for Alamogordo Regional Water Supply Project Draft Environmental Impact Statement.

New Mexico Statutes Annotated (NMSA). 1978. Section 72-1-10 — Water utility authority; created; membership; administration of utility.

Orr, B.R., and R.G. Myers. 1986. Water Resources in Basin Fill Deposits in the Tularosa Basin, New Mexico. U.S. Geological Survey Water-Resources Investigation Report No. 85-4219. Albuquerque. 143 pp.

Pittenger, J. S., and D.L. Propst. 1994. White Sands pupfish conservation plan. Report, New Mexico Department of Game and Fish, Conservation Services Division. Santa Fe, New Mexico.

Pittenger, J.S., and C.L. Springer. 1999. Native range and conservation of the White Sands pupfish (*Cyprinodon tularosa*). Southwestern Naturalist 44:157–165.

Pray, L.C. 1961. Geology of the Sacramento Mountains Escarpment, Otero County, New Mexico. New Mexico Bureau of Mines and Mineral Resources, Bulletin 35, New Mexico Institute of Mining and Technology, Socorro, New Mexico.

Public Service Company of New Mexico (PNM). 2006. E-mail letter from PNM Transmission Operations to PNM Wholesale Power Marketing. Ensuring electric load obligations for the combined PNM and TNMP systems consolidation. Electronic document: http://www.oatioasis.com/PNM/PNMdocs/Letter_to_WPM_10-24-06_SNM_ATC.pdf. Accessed October 11, 2007.

Railey, Jim A., and Richard D. Holmes. 2002. Cultural and Social-Evolutionary History. In Across the Desert Floor: Cultural Resource Investigations Along U.S. 54, Otero County, New Mexico, edited by Jim A. Railey, pp. 17–78. New Mexico State Highway and Transportation Department, Technical Report 2002-1.

Renz, M., and F. Sholedice. 2006. Troublesome Weeds of New Mexico. Las Cruces, New Mexico: New Mexico State University College of Agriculture and Home Economics.

Resource Conservation and Development Council (RCDC). 2002. Tularosa Basin and Salt Basin regional water plan 2000–2040. Electronic document, http://www.seo.state.nm.us/water-info/NMWaterPlanning/regions/tularosa/tularosa_vol1.pdf. Accessed October 11, 2007.

Schmittle, M.K. 2005. City of Alamogordo Water Conservation Program Overview, 2nd Edition, 15 pp.

Shomaker, J.W. 2006. Geologic setting and hydrologic implications, Maxwell Spring and nearby springs, Otero County, New Mexico. Consultant's Report prepared for the City of Alamogordo, November 10, 2006, 3 pp.

South Central Mountain Resource Conservation and Development Council, Inc.. 2002. Executive summary for the Tularosa Basin and Salt Basin regional water plan, 2000–2040. Carrizozo, New Mexico.

South Coast Air Quality Management District. 1993. CEQA Air Quality Handbook. South Coast Air Quality Management District. Diamond Bar, California. April.

Southwest Regional GAP Analysis Project (SWReGAP). 2005. Provisional landcover and related datasets. Electronic document, http://earth.gis.usu.edu/swgap/index.html. Accessed October 11, 2007.

Stokes v. Morgan. 1984. 101 N.M. 195, 202, 680 P.2d 335, 342.

Texas Water Development Board and New Mexico Water Resources Research Institute (Texas and New Mexico). 1997. Transboundary Aquifers of the El Paso/Ciudad Juarez/Las Cruces Region, prepared for the U.S. Environmental Protection Agency, Region VI.

Transportation Research Board. 1994. Highway Capacity Manual, Third Edition, Special Report 209, 1994 update to 1985 edition.

Twelfth Judicial District Court. 2008. State of New Mexico Conclusions of Law, ¶ 11, Minute Order, CV-05-019, James Waylon Counts, Water Judge, Settlement.

U.S. Army. 2000. Fort Bliss, Texas and New Mexico, Mission and Master Plan Final Programmatic Environmental Impact Statement. Volumes I–III. Directorate of the Environment, U.S. Army Air Defense Artillery Center and Fort Bliss.

U.S. Army Corps of Engineers (USACE). 2004a. Figure 2-5, Typical Evaporation Pond Profile, In Chapter 2: Alternatives Considered Including the Proposed Action and No Action Alternative, Proposed Leasing of Lands at Fort Bliss, Texas, for the Proposed Siting, Construction, and Operation by the City of El Paso of a Brackish Water Desalination Plant and Support Facilities, Final Environmental Impact Statement, pp 2–9.

USACE. 2004b. Final Environmental Impact Statement, Proposed Leasing of Lands at Fort Bliss, Texas, for the Proposed Siting, Construction, and Operation by the City of El Paso of a Brackish Water Desalination Plant and Support Facilities. Prepared by the USACE, Fort Worth, Texas.

U.S. Bureau of Land Management (BLM). 1986. White Sands Resource Area Resource Management Plan, October 1986. BLM Las Cruces District Office, 51 pp.

BLM. 2004a. BLM Manual 8400, Visual Resource Management and Manual Section 8431 Visual Resource Contrast Rating. Electronic document: http://www.blm.gov/nstc/VRM/8400.html. Accessed October 11, 2007.

BLM. 2004b. BLM Manual H-8410-1, Visual Resource Inventory. Electronic document, http://www.blm.gov/nstc/VRM/8410.html#Anchor-49575. Accessed October 11, 2007.

BLM. 2004c. New Mexico land ownership, edition 11, vector digital data. BLM New Mexico State Office: Santa Fe, New Mexico. Electronic document: http://nmso3gis4/gis/personal_dirs/w03grave/web/coverages/nm_own. Accessed October 11, 2007.

BLM. 2005. Draft Resource Management Plan Amendment and Environmental Impact Statement for McGregor Range in Southern Otero County, New Mexico.

BLM. 2007. Aguirre Springs Campground. Electronic document, http://www.nm.blm.gov/recreation/las_cruces/aguirre_spring_campground.htm. Accessed October 11, 2007.

U.S. Bureau of Reclamation (Reclamation). 1983. Tularosa Basin Water and Energy Study, New Mexico. U.S. Bureau of Reclamation Appraisal Report, 213 pp.

Reclamation. 1993. Operation of Glen Canyon Dam Draft Environmental Impact Statement. U.S. Department of the Interior, Bureau of Reclamation, Technical Service Center, Denver, Colorado.

U.S. Census Bureau. 2000. Otero County, New Mexico Quick Facts. Electronic document, http://quickfacts.census.gov/qfd/states/35/35035.html. Accessed October 11, 2007.

U.S. Environmental Protection Agency (EPA). 2005a. EPA Office of Environmental Justice, Region 6. Electronic document, http://www.epa.gov/region6/6dra/ejtribal/index.htm. Accessed October 11, 2007.

EPA. 2005b. Potential Environmental Justice (EJ) Index Pilot, Superfund Information Management, U.S. EPA, Region 6, Dallas, Texas.

U.S. Environmental Protection Agency (EPA). 2008. The Green Book Nonattainment Areas for Criteria Pollutants. Electronic document: http://www.epa.gov/oar/oaqps/greenbk/. Last accessed, March 4, 2009.

U.S. Fish and Wildlife Service (USFWS). 1989. Final Rule to Determine *Argemone plelacantha* ssp. *pinnatisecta* (Sacramento prickly poppy) To Be an Endangered Species. Federal Register 54(163):35302–35305.

USFWS. 2005a. Endangered, Threatened, and Candidate Species Listed by County for the State of New Mexico. Otero County, New Mexico.

USFWS. 2005b. National Wetlands Inventory Map. Electronic document, http://nwi.fws.gov/. Accessed October 11, 2007.

U.S. Geological Survey (USGS). 1990. U.S. GeoData 1:250,000 and 1:100,000 Scale Land Use and Land Cover and Associated Maps Digital Data. USGS, Reston, Virginia.

U.S. Public Health Service. 1962. Drinking Water Standards. U.S. Public Health Service Pub. 956, 61 pp.

Waltemeyer, S.D. 2001. Estimates of mountain-front stream flow available for potential recharge to the Tularosa Basin, New Mexico. U.S. Geological Survey Water-Resources Investigation Report No. 01-4013. 8 pp.

Western Regional Climate Center. 2008. Cloudcroft, New Mexico. Electronic document: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm1931. Last Accessed March 5, 2009.

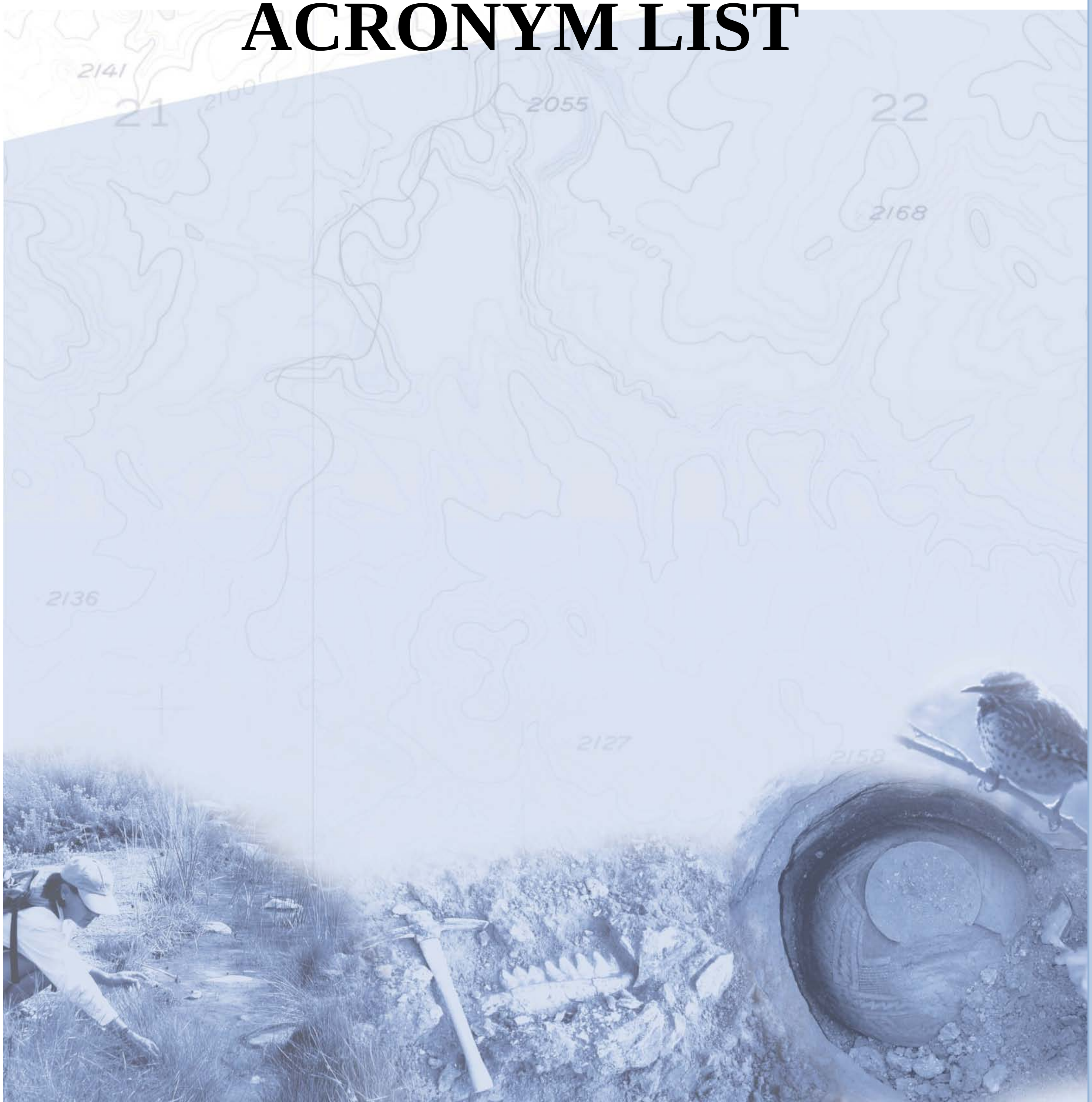
Western Resource Advocates. 2005. Smart Water: A Comparative Study of Urban Water Use Across the Southwest. Electronic document: http://www.westernresources.org/water/smartwater.php. Accessed October 11, 2007.

Whitson, Tom D. 2000. Weeds of the west, 9th edition. Western Society of Weed Science, P.O. Box 963, Newark, California, 94560.

Wilson, Brian C., 1993. Tularosa Groundwater Basin in Otero County, New Mexico; Quantification of Irrigation Water Requirements for the Administration of Water Rights. State Engineer Office Water Use Section report.

Zeiher, K., E.H., Ho, B., and Williams, K.D. 2003. Novel antiscalant dosing control. Desalination 157:209–216.

7.0 ABREVIATION AND ACRONYM LIST



7.0 ABBREVIATION AND ACRONYM LIST

AADT	Annual Average Daily Traffic
AFB	Air Force Base
AEC	Alamogordo-Gypsum Complex
afy	acre-feet per year
afy/ac	acre-feet per year per acre
AIRFA	American Indian Religious Freedom Act
APE	area of potential effect
ASR	Aquifer Storage and Recovery
bgs	below the current ground surface
BBER	Bureau of Business and Economic Research
BISON-M	Biota Information System of New Mexico
BLM	U.S. Bureau of Land Management
BMPs	best management practices
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CIR	consumptive irrigation requirement
City	City of Alamogordo
CO	carbon monoxide
CO_2	carbon dioxide
CWCS	Comprehensive Wildlife Conservation Strategy
°C	degrees Celsius
°F	degrees Fahrenheit
DVECO	Economic Status – Degree of Vulnerability
DVMAV	Minority Status – Degree of Vulnerability
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ Index	Environmental Justice Index
EPA	U.S. Environmental Protection Agency
EPE	El Paso Electric Company
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	flood insurance rate map
FLPMA	Federal Land Policy and Management Act of 1976
FR	Federal Register
GHGs	greenhouse gases
GIS	geographic information system
gpcpd	gallons per capita per day
gpd	gallons per day

gpm	gallons per minute
HDPE	high-density polyethylene
HOB	Holloman-Gypsum Land-Yesum Complex
HVCS	High Voltage Converter Station
IPCC	Intergovernmental Panel on Climate Change
ITA	Indian Trust Asset
JSAI	John Shomaker and Associates, Inc.
LA	Laboratory of Anthropology
LOS	Level of Service
$\mu g/m^3$	micrograms per cubic meter
mg/L TDS	milligrams per liter in total dissolved solids
MOA	Memorandum of Agreement
MW	megawatts
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMAC	New Mexico Administrative Code
NMDA	New Mexico Department of Agriculture
NMDGF	New Mexico Department of Game and Fish
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NMOSE	New Mexico Office of the State Engineer
NMRPTC	New Mexico Rare Plant Technical Council
NMSA	New Mexico Statutes Annotated
NMSLO	New Mexico State Land Office
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
O_3	ozone
Pb	lead
PEIS	Programmatic Environmental Impact Statement
PF	population ranking
PL	Public Law
PM_{10}	particulate matter 10 microns or less in size
$PM_{2.5}$	particulate matter 2.5 microns or less in size
PNM	Public Service Company of New Mexico
ppm	parts per million

project	Alamogordo Water Supply Project
PSD	Prevention of Significant Deterioration
psi	per square inch
psig	per square inch gauge
PVC	polyvinyl chloride
RCDC	Resource Conservation and Development Council
Reclamation	U.S. Bureau of Reclamation
Research Facility	Tularosa Basin National Desalination Research Facility
RO	reverse osmosis
SCADA	supervisory control and data acquisition
Secretary	Secretary of the Interior
SEIS	Supplemental Programmatic Environmental Impact Statement
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	sulfur dioxide
SRCP	State Register of Cultural Properties
State Land	State of New Mexico Trust Lands
SWCA	SWCA Environmental Consultants
SWPPP	Stormwater Pollution Prevention Plan
SWReGAP	Southwest Regional Gap Analysis Project
TCDC	Tularosa Community Ditch Corporation
TCPs	traditional cultural properties
TDB	Tome Silt Loam
TDS	total dissolved solids
TFC/Pas	thin-film composite/polyamides
Title XVI	Reclamation Wastewater and Groundwater Study and Facilities Act, Public Law (PL) 102-575, Title XVI, as amended
TNMP	Texas–New Mexico Power Company
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
U.S. 54	U.S. Highway 54
VOC	volatile organic compound
VRM	visual resource management
WATERS	Water Administration and Technical Engineering Resource System
WRCC	Western Regional Climate Center
WSMR	White Sands Missile Range
WSRMP	White Sands Resource Area Resource Management Plan

8.0 GLOSSARY

8.0 GLOSSARY

A

Acre-foot: The volume (as of irrigation water) that would cover one acre to a depth of one foot (43,560 cubic feet).
Adaptive Management: A systematic process for continually improving management policies and practices by learning, through monitoring and evaluation, of the outcomes of actions over time.
Affected Environment: Surface or subsurface resources (including social and economic elements) within or adjacent to a geographic area that potentially could be affected by a proposed action or plan. The environment of the area affected or created by the alternatives under consideration (40 CFR 1502.15).
Agency: Any Federal, state, or county government organization participating with jurisdictional responsibilities.
Air Quality: A measure of the health-related and visual characteristics of the air often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances.
Air Quality Class I and II Areas: Regions in attainment areas where maintenance of existing good air quality is of high priority. Class I areas are those that have the most stringent degree of protection from future degradation of air quality, such as National parks. Class II areas permit moderate deterioration of existing air quality, such as lands administered by the Bureau of Land Management (BLM).
Allotment (range): A designated area of land available for livestock grazing upon which a specified number and kind of livestock may be grazed under management of an authorized agency.
All-Terrain Vehicle (ATV): A small, amphibious motor vehicle, 42 inches in width or smaller, with wheels or tractor treads for traveling over rough ground, snow, or ice, as well as on water.
Alternative: A combination of management prescriptions applied in amounts and locations to achieve a desired management emphasis as expressed in goals and objectives. One of a number of plans or projects proposed for decision making.
Ambient (air): The surrounding atmospheric conditions to which the general public has access.
Analysis: The examination of existing and/or recommended management needs and their relationships to discover and display the outputs, benefits, effects, and consequences of initiating a proposed action.
Aquifer: A water-bearing rock unit (unconsolidated or bedrock) that will yield water in a usable quantity to a well or spring.
Archaeological Site: A discrete location that provides physical evidence of past human use.
Archaeology: The scientific study of the life and culture of past, especially ancient, peoples, as by excavation of ancient cities, relics, artifacts, etc.
Area of Critical Environmental Concern (ACEC): A BLM designation pertaining to areas where specific management attention is needed to protect and prevent irreparable damage to important historical, cultural, and scenic values, fish or wildlife resources, or other natural systems or processes, or to protect human life and safety from natural hazards.

Arroyo: A term applied in the arid and semiarid regions of the southwestern United States to the small, deep, flat-floored channel or gully of an ephemeral stream or of an intermittent stream usually with vertical or steeply cut unconsolidated material at least 2 feet (60 centimeters) high; it is usually dry, but may be transformed into a temporary watercourse or short-lived torrent after heavy rainfall.
Artifact: A human-made object.
Aspect: The direction in which a slope faces.
Attainment (Air): Designation of a geographical area by the U.S. Environmental Protection Agency (EPA) where the air quality is deemed to be better than the National Ambient Air Quality Standards (NAAQS). This designation is based on the measured ambient criteria pollution data available for the geographic area. Areas where the measured ambient criteria pollution data are worse than the NAAQS are identified as non attainment. An area can be designated as unclassified when there are insufficient ambient criteria pollutant data for the EPA to form a basis for attainment status.

B

Basin: A depressed area having no surface outlet (*topographic basin*); a physiographic feature or subsurface structure that is capable of collecting, storing, or discharging water by reason of its shape and the characteristics of its confining material (*water*); a depression in the earth's surface, the lowest part often filled by a lake or pond (*lake basin*); a part of a river or canal widened (*drainage, river, stream basin*).
Basin and Range: Topography characterized by a series of tilted fault block mountain ranges and broad intervening basins.
Best Management Practices: Measures or activities that are added to typical operation, construction, or maintenance efforts that help to protect environmental resources by avoiding or minimizing impacts of an action.
Big Game: Large species of wildlife that are hunted (such as elk, deer, pronghorn antelope).
Biodiversity: The variety of life and its processes, and the interrelationships within and among various levels of ecological organization.

C

Clean Air Act: Federal legislation governing air pollution. The Clean Air Act established National Ambient Air Quality Standards for carbon monoxide, nitrogen oxide, ozone, particulate matter, sulfur dioxide, and lead. Prevention of Significant Deterioration classifications define the allowable increased levels of air quality deterioration above legally established levels include the following:
Class I – minimal additional deterioration in air quality (certain National parks and wilderness areas)
Class II – moderate additional deterioration in air quality (most lands)
Class III – greater deterioration for planned maximum growth (industrial areas)
Clean Water Act: National environmental law enforced by the U.S. Environmental Protection Agency that regulates water pollution.

Corridor: For purposes of this document, a wide strip of land within which a proposed linear facility (e.g., pipeline, transmission line) could be located.
Council on Environmental Quality: An advisory council to the President of the United States established by the National Environmental Policy Act of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.
Critical Habitat: An area occupied by a threatened or endangered species "on which are found those physical and biological features (1) essential to the conservation of the species, and (2) which may require special management considerations or protection" (16 USC 1532 (5)(A)(I)1988). Unoccupied by suitable habitat for the threatened or endangered species is not automatically included unless such areas are essential for the conservation of the species (50 CFR 424.12(e)).
Cubic Feet Per Second (cfs): As a rate of stream flow, a cubic foot of water passing a reference section in 1 second of time. One cfs flowing for 24 hours will yield 1.983 acre-feet of water.
Cultural Resources: Remains of human activity, occupation, or endeavor, as reflected in districts, sites, buildings, objects, artifacts, ruins, works of art, architecture, and natural features important in human events.
Cumulative Impacts: The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions. Cumulative impacts are evaluated as part of the EIS, and may include consideration of additive or interactive effects regardless of what agency or person undertakes the other actions.

D

Developed Recreation: Recreation that requires facilities that, in turn, result in concentrated use of the area. For example, off-road vehicles require parking lots and trails. Campgrounds may have roads, picnic tables, and toilet facilities.
Dispersed Recreation: Recreation that does not occur in a developed recreation site, such as hunting, backpacking, and scenic driving.

E

Easement: A right afforded a person, agency, or organization to make limited use of another's real property for access or other purposes.
Ecological Site (range): A distinctive kind of rangeland in its ability to produce a characteristic natural plant community.
Emission: Effluent discharged into the atmosphere, usually specified by mass per unit time.
Endangered Species: A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are rarely identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.
Environmental Impact Statement (EIS): A document prepared to analyze the impacts on the environment of a proposed action and released to the public for review and comment. An EIS must meet the requirements of National Environmental Policy Act, Council on Environmental Quality, and the directives of the agency responsible for the proposed action.

Ephemeral Stream: A stream that flows only in direct response to precipitation, and whose channel is at all times above the water table.
Erosion: The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitation creep.
Escarpment: Steep slope at the edge of a plateau.
Evaporation: Conversion of water from the liquid phase to the gaseous phase.
Exclusion Area: An environmentally sensitive area where rights-of-way should be excluded, and would be granted only in cases where there is a legal requirement to provide such access.

F

Federal Candidate Species: Sensitive wildlife species currently under consideration for inclusion to the list of Federal threatened or endangered species.
Federal Land Policy and Management Act of 1976 (FLPMA): Public Law 94-570 signed by the President of the United States on October 21, 1976. Established public land policy for management of lands administered by BLM. FLPMA specifies several key directions for the BLM, notably (1) management on the basis of multiple use and sustained yield; (2) land plans prepared to guide management actions; (3) public land management for the protection, development, and enhancement of resources; (4) public land retention in Federal ownership; and (5) public participation in reaching management decisions.
Federal Lands: Lands, or interests in lands (such as easements and rights-of-way), owned by the United States.
Federal Listed Species: Animal or plant species listed by the U.S. Fish and Wildlife Service as threatened or endangered.
Fire Suppression Tactics: The tactical approaches regarding suppression of a wildland fire. These range from Control, Confine, Contain, and Monitor. Control is the most aggressive tactic, while Monitor is the least aggressive tactic.
Floodplain: Any land area susceptible to being inundated by water from any source. This term typically refers to the 100-year overflow area. The term 100-year flood is used to describe that there is a one percent estimated probability that a flood event will happen in any given year. The 100-year overflow area would be the area affected by a 100-year flood.
Fluid Minerals: In this case, oil, gas, and geothermal resources.
Forage: All browse and herbaceous foods available to grazing animals, which may be grazed or harvested for feeding.
Foreground View: The landscape area visible to an observer within a mile.
Fugitive Dust: Airborne particles emitted from any source other than through a stack or vent.

G

Game Species: Any species of wildlife or fish that is managed for hunting.

H

Habitat: A specific set of physical conditions in a geographic area(s) that surrounds a single species, a group of species, or a large community. In wildlife management, the major components of habitat are food, water, cover, and living space.
Habitat Fragmentation: The disruption (by division) of extensive habitats into smaller habitat patches. The effects of habitat fragmentation include loss of habitat area and the creation of smaller, more isolated patches of remaining habitat.
Habitat Type: An aggregation of all land areas potentially capable of producing similar plant communities at climax.
Hazardous Waste: The Resource Conservation and Recovery Act defines hazardous waste as a solid waste that may cause an increase in mortality or serious illness or pose a substantial threat to human health and the environment when improperly treated, stored, transported, disposed of, or otherwise managed. A waste is hazardous if it exhibits characteristics of ignitability, corrosivity, reactivity, and/or toxicity.
Historic Site: Archaeological or archivally known sites related to the activities of non-native peoples in the period after the European discovery of the New World (ca. A.D. 1492).

I

Impact: A modification of the existing environment caused by an action (such as construction or operation of facilities).
Indirect Impacts: Secondary effects that occur in locations other than the initial action or later in time.
Infrastructure: The facilities, services, and equipment needed for a community to function including roads, sewers, water lines, police and fire protection, and schools.
Intermittent Stream: A stream or reach of a stream that is below the local water table for at least some part of the year.

J

Jurisdiction: The legal right to control or regulate use of land or a facility. Jurisdiction requires authority, but not necessarily ownership.

L

Land Tenure: The holding of property, including surface and/or mineral estate.
Landscape: An area composed of interacting ecosystems that are repeated because of geology, landform, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern, which are determined by interacting ecosystems.
Landscape Character: Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.
Landscape Setting: The context and environment in which a landscape is set; a landscape backdrop.

Land-Surface Subsidence: Land subsidence is the lowering of the land-surface elevation from changes that take place underground. Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils (hydrocompaction). Land subsidence occurs in nearly every state of the United States.
Leasable Minerals: Those minerals or materials designated as leasable under the Mineral Leasing Act of 1920. They include coal, phosphate, asphalt, sulfur, potassium and sodium minerals, and oil, gas, and geothermal.
Lease: An authorization or contract by which one party (lessor) conveys the use of property, such as water rights or real estate, to another (lessee) in return for rental payments. In addition to rental payments, lessees also pay royalties (a percentage of value) to the lessor from resource production. Leases are one of three forms of a land use authorization (the others are permits and easements). Leases are used to authorize uses of public land involving substantial construction, development, or land improvement and the investment of large amounts of capital, which are to be amortized over time. A lease conveys a possessory interest and is revocable only in accordance with its terms and applicable regulations. Leases are issued for a term that is consistent with the time required to amortize the capital investment.
Locatable Mineral: Any valuable mineral that is not saleable or leasable including gold, silver, copper, uranium, etc, that may be developed under the General Mining Law of 1872.

M

Middleground View: One of the distance zones of a landscape being viewed. This zone extends from the limit of the foreground to 3 to 5 miles from the observer.
Military Lands Withdrawal Act (PL 106-65): The withdrawal of large tracks of public land for military purposes.
Mineral Estate (Mineral Rights): The ownership of minerals, including rights necessary for access, exploration, development, mining, ore dressing, and transportation operations.
Mineral Reserves: Known mineral deposits that are recoverable under present conditions but are as yet undeveloped.
Mineral Rights: Mineral rights outstanding are third-party rights, an interest in minerals not owned by the person or party conveying the land to the United States. It is an exception in a deed that is the result of prior conveyance separating title of certain minerals from the surface estate. Reserved mineral rights are the retention of ownership of all or part of the mineral rights by a person or party conveying land to the United States. Conditions for the exercising of these rights has been defined in the Secretary of the Interior's "Rules and Regulations to Govern Exercising of Mineral Rights Reserved Conveyance to the United States" attached to and made a part of deeds reserving mineral rights.
Minority and Low-Income Populations: Identification of communities containing disproportionately high percentages of minority and low-income populations based on the composition of the surrounding community.

<u>Mitigation</u>: The abatement or reduction of an impact on the environment by (1) avoiding a certain action or parts of an action, (2) employing certain construction measures to limit the degree of impact, (3) restoring an area to preconstruction conditions, (4) preserving or maintaining an area throughout the life of a project, (5) replacing or providing substitute resources to the environment or (6) gathering archaeological and paleontological data before disturbance.

N

<u>National Ambient Air Quality Standards (NAAQS)</u>: The allowable concentrations of air pollutants in the air specified by the Federal government. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare) from any unknown or expected adverse effects of air pollutants.

<u>National Environmental Policy Act of 1969 (NEPA)</u>: An act that encourages productive and enjoyable harmony between humans and their environment and promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humans; enriches the understanding or the ecological systems and natural resources important to the Nation, and established the Council on Environmental Quality.

<u>National Register of Historic Places (National Register, NRHP)</u>: A listing of architectural, historical, archaeological, and cultural sites of local, state, or National significance. The list of sites was established by the Historic Preservation Act of 1966 and is maintained by the National Park Service.

<u>Noxious Weed</u>: A weed arbitrarily defined by law as being especially undesirable, troublesome, and difficult to control.

O

<u>Off-Highway Vehicle (OHV)</u>: A vehicle (including four-wheel drive, trail bikes, all-terrain vehicles, and snowmobiles but excluding helicopters, fixed-wing aircraft, and boats) capable of traveling off road over land, water, ice, snow, sand, marshes, and other terrain.

P

<u>Paleontology</u>: A science dealing with the life of past geological periods as known from fossil remains.

<u>Patent</u>: A grant made to an individual or group conveying fee simple title to public land.

<u>Perennial Stream</u>: A stream receiving water from both surfaces and underground sources that flows throughout the entire year.

Permit: Permits are one of three forms of a land use authorization (the others are leases and easements). Permits are short-term, revocable authorization to use public land for specific purposes that involve either little or no land improvement, construction, or investment, which can be amortized within the term of the permit. A permit conveys no possessory interest. The permit is renewable at the discretion of the authorized officer and may be revoked in accordance with its terms and applicable regulations.
Physiographic Province: A region, all parts of which are similar in geologic structure and climate and which has consequently had a unified geomorphic history; a region whose pattern of relief features or landforms differs significantly from that of adjacent regions.
Planning Area: In the case of this EIS, the area that is inventoried and analyzed for potential impacts. The Planning Area may include land owned or administered by entities other than BLM (see also Region of Influence).
Playa: Ephemeral ponds that are supplied by rainfall runoff and last until evaporation eliminates surface water.
Prehistoric: Archaeological sites resulting from the activities of aboriginal peoples native to this region, and because dating is often difficult, extending up to the reservation era (ca. A.D. 1868).
Prescribed Fire: Fire set intentionally in wild land fuels under prescribed conditions and circumstances. Prescribed fire should be used to mitigate the suppression of natural fires.

R

Rangeland: Land used for grazing by livestock and big game animals on which vegetation is dominated by grasses, grass-like plants, forbs, or shrubs.
Raptor: Bird of prey with sharp talons and strongly curved beak (e.g., hawk, owl, vulture, eagle).
Reclamation: The process of converting disturbed land to its former use or other productive uses.
Record of Decision (ROD): A document separate from, but associated with, an EIS that publicly and officially discloses the responsible official's decision on the proposed action.
Recreation Opportunity Spectrum (ROS): A framework for inventory, planning, and management of recreational resources. The ROS allows managers to characterize all possible combinations of recreational opportunities and resources and arrange combinations of activity, settings, and experience opportunities along a continuum.
Recreation and Public Purposes (R&PP) Act: This act authorizes the Secretary of the Interior to lease or convey public land for R&PP, under specified conditions, to states or their political subdivisions and to nonprofit corporations and associations.
Region of Influence: In the case of this EIS, the area that is inventoried and analyzed for potential impacts. The Region of Influence may include land owned or administered by entities other than BLM (see also Planning Area).
Resource Management Plan (RMP): A land use plan that establishes land use allocations, multiple-use guidelines, and management objectives for a given planning area. The RMP planning system has been used by the BLM since 1980.
Right-of-Way: The Federal land authorized to be used or occupied for the construction, operation, maintenance, and termination of a project, pursuant to a right-of-way authorization.

Riparian: Situated on or pertaining to the bank of a river, stream, or other body of water. The term is used to refer to the types of plants that grow along, around, or in wet areas.
Riparian Habitat: Riparian habitat is defined as an area of land directly influenced by permanent (surface of subsurface) water. They have visible vegetation or physical characteristics reflective of permanent water influence.
Roads: Vehicle routes which are improved and maintained by mechanical means to ensure relatively regular and continuous use. (A way maintained strictly by the passage of vehicles does not constitute a road.)

S

Saleable Minerals: Minerals that may be sold under the Material Sale Act of 1947, as amended. Included are common varieties of sand, stone, gravel, and clay.
Saline Water: Water containing high concentrations of salt.
Salinity: A measure of the amount of dissolved salts in water.
Scoping: A term used to identify the process for determining the scope of issues related to a proposed action and for identifying significant issues to be addressed in an EIS.
Sediment: Soil or mineral transported by moving water, wind, gravity, or glaciers, and deposited in streams or other bodies of water, or on land.
Sensitive Species: Species not yet officially listed but that are undergoing status review for listing on the U.S. Fish and Wildlife Service official threatened and endangered list; species whose populations are small and widely dispersed or restricted to a few localities; and species whose numbers are declining so rapidly that official listing may be necessary.
Soil Productivity: The capacity of a soil to produce a plant or sequence of plants under a system of management.
Soil Series: A group of soils having genetic horizons (layers) that, except for texture of the surface layer, have similar characteristics and arrangement in profile.
Special Status Species: Wildlife and plant species either Federally-listed or proposed for listing as endangered or threatened; State-listed or BLM determined priority species.
Split Estate: Refers to land where the mineral rights and the surface rights are owned by different parties. Owners of the mineral rights generally have a superior right.
Sustainability: The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

T

Threatened or Endangered Species: Animal or plant species that are listed under the Federal Endangered Species Act of 1973, as amended (Federally-listed), or under the New Mexico Endangered Species Act (State-listed).
Threatened Species: Any animal or plant species likely to become endangered within the foreseeable future throughout all of a significant portion of its range. These species are listed by the U.S. Fish and Wildlife Service.
Total Dissolved Solids (TDS): A term that describes the quantity of dissolved material in a sample of material.

Total Suspended Particulates: All particulate matter, typically less than 70 microns in effective diameter.
Transportation Right-of-Way: Land associated with highways and railroads.

U

Utility Corridor: A linear corridor usually designated for facilities such as power lines, pipelines, fiber optic cables, roads, etc.

V

Valid Existing Rights: Legal interests that attach a land or mineral estate and cannot be divested from the estate until those interests expire or are relinquished.
Visual Resource Management (VRM): The inventory and planning actions taken to identify visual resource values and to establish objectives for managing those values; also includes management actions taken to achieve the established objectives.
Visual Resource Management Classes: VRM classes identify the visual quality objectives (VQOs) as the degree of acceptable visual change within a particular landscape. A classification is assigned to public land based on guidelines established for scenic quality, visual sensitivity, and visibility. The classes are as follows:

- VRM Class I – This classification preserves the existing characteristic landscape and allows for natural ecological changes only. Includes congressionally authorized areas, such as wilderness and areas approved through an RMP where landscape modification activities should be restricted.
- VRM Class II – This classification retains the existing characteristic landscape. The level of change in any of the basic landscape elements (form, line, color, texture) due to management activities should be low and not evident.
- VRM Class III – This classification partially retains the existing characteristic landscape. The level of change in any of the basic landscape elements due to management activities may be moderate and evident.
- VRM Class IV – This classification applies to areas where the characteristic landscape has been so disturbed that rehabilitation is needed. Generally considered an interim short-term classification until rehabilitation or enhancement is completed.

Visual Resources: The visible physical features of a landscape (topography, water, vegetation, animals, structures, and other features) that constitute the scenery of an area.
Visual Sensitivity: Visual sensitivity levels are a measure of public concern for scenic quality and existing or proposed visual change.

W

Water Table: The surface in a groundwater body where the water pressure is atmospheric. It is the level at which water stands in a well that penetrates the water body just far enough to hold standing water.
Watershed: All land and water within the confines of a drainage divide.

Wetlands: Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. BLM Manual 1737, *Riparian-Wetland Area Management*, includes marshes, shallow swamps, lakeshores, bogs, muskegs, wet meadows, estuaries, and riparian areas as wetlands.

Wilderness Study Area (WSA): An area determined to have wilderness characteristics as described in section 603 of FLPMA and section 2C of the Wilderness Act of 1964 (78 Stat. 891). WSAs are subject to interdisciplinary analysis through the BLM's land use planning system and public comment to determine their wilderness suitability. Suitable areas are recommended to the President and Congress for designation as wilderness.

Wilderness, Wilderness Area: An area formally designated by Congress as a part of the National Wilderness Preservation System.

Withdrawal: An action that restricts the use of public land and segregates it from the operation of some or all of the public land and mineral law. Withdrawals also are used to transfer jurisdiction of management of public land to other Federal agencies.

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