COVER SHEET

Proposed actions: Approval or disapproval of the Warm Springs Project, including a Federal *mining plan approval* associated with the Smoky Hollow underground coal mine and various Federal *rights-of-way* associated with improvements to the Smoky Mountain Road System and a 138-kilovolt (kV) power transmission line, a microwave communication system, and two unit-train loadout facilities that would be necessary to develop and operate the proposed mine and deliver the produced coal to market.

Type of statement: Draft environmental impact statement

Lead agencies:

U.S. Department of the Interior,
Bureau of Land Management

U.S. Department of the Interior,
Office of Surface Mining Reclamation and Enforcement

Cooperating agencies:

U.S. Department of the Interior,
National Park Service

State of Utah, Department of Natural Resources,
Division of Oil, Gas, and Mining

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1999 Broadway Street, Suite 3320
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(telephone: 303-672-5601)

Abstract: This environmental impact statement (EIS) identifies and analyzes the probable impacts to the human environment that would result if (1) Andalex Resources, Inc. (Andalex), and the other applicants received the necessary permits and approvals for , and subsequently developed, the Warm Sprigs Project (the Project), including the proposed Smoky Hollow underground coal mine, improvements to the Smoky Mountain Road System, and those associated facilities necessary to both operate the mine and deliver the produced coal to market; or, (2) the Agencies denied one ore more critical permits or approvals and Andalex and the other applicants subsequently abandoned the Project. This EIS also analyzes the probable cumulative impacts that would result form approval or disapproval of the proposed Warm Springs Project in combination with other projects and activities proposed for the area in the reasonably foreseeable future.

The Smoky Hollow Mine would be a new underground coal mine located about 6 miles north of the Glen Canyon NRA, 13 miles northeast of the city of Big Water, and 15 miles north of the Arizona/Utah State line. The mine, the improvements to the Smoky Mountain Road System, most of the power transmission line, and the microwave communication system would be located in eastern Kane County, Utah. The remainder of the powerline would be located in Coconino County, Arizona. The unit-train loadout facilities would be located in Iron County, Utah, and Clark County, Nevada. A privately owned truck maintenance facility would be located in either Coconino County, Arizona, or Washington County, Utah.

PREFACE

The best way to read an environmental impact statement (EIS) depends on your interests. It is not usually read like a book, from the first page to the last. You may be more interested in impacts, while others might have more interest in the details of the proposed Project or opportunities made available for public involvement during the environmental process. Many readers probably just want to know what is being proposed and how it will affect them.

The following paragraphs outline information contained in the chapters and appendices so that readers may find specific parts or areas of interest without having to read the entire document.

- The **Summary** is a short briefing discussion to provide the reader and the decisionmakers with a sketch of the more important aspects of the EIS. The reader can obtain additional, more detailed information from the actual text of the EIS.
- **Chapter 1** describes the Project, the Agencies involved, the major issues associated with the Project, and the underlying purpose of and need for the EIS.
- **Chapter 2** identifies the pertinent components of the primary alternative decisions analyzed in Chapter 4 and identifies any conditions for additional mitigation. Those alternatives, considered but not analyzed in detail, are identified along with the Agencies' rationale for not including them in the detailed analysis. This chapter also provides a comparative analysis of the environmental impacts of the primary alternatives to provide a clear basis of choice among options for the decisionmaker and public.
- **Chapter 3** describes the current condition of those resources that could be affected by the alternative decisions under analysis in Chapter 4.
- **Chapter 4** is the most important section of the EIS. Here is the discussion of the anticipated impacts to the human environment, both with and without the Project.
- **Chapter 5** lists the primary agencies consulted during the preparation of the EIS, provides a summary of past public participation activities, and identifies those additional opportunities for public participation that are still to come. It also discusses those issues brought up by the public during various scoping activities that were considered but not analyzed in detail in Chapter 4, along with the Agencies' rationale for not including them in the detailed analysis.
- **Chapter 6** lists the qualifications of the interdisciplinary team members responsible for preparation of the EIS.
- **Chapter 7** lists references cited in the EIS.

- **Chapter 8** provides definitions for many of the technical or unusual terms or acronyms used in the EIS.

- **Appendix A** provides a complete, concise description of the proposed Warm Springs Project, including pertinent enhancement measures that would be implemented.

- **Appendix B** is a description of the various projects, in progress or expected to occur in the reasonably foreseeable future, that were considered in the cumulative analysis.

- **Appendix C** explains the different aspects of coal mining (room-and-pillar and longwall mining) and explains the mechanisms involved with subsidence and the subsidence event.

- **Appendix D** discusses the roles that various Federal, State, and local agencies have in evaluating the merits of, approving, and/or regulating various aspects of the proposed Project. It also lists agencies having jurisdiction over other aspects of the Project along with the statutes that give them that authority.

- **Appendix E** is a compilation of technical or other support materials that were used during development of the environmental analysis.

- **Appendix F** will be added in the final EIS. It will contain a compilation of the substantive comments that are received on the draft EIS, as well as the Agencies' responses to those comments.

SUMMARY

This environmental impact statement (EIS) identifies and analyzes the probable impacts to the human environment that would result if (1) Andalex Resources, Inc. (Andalex), and the other applicants receive the necessary permits and approvals for, and subsequently develop, the Warm Springs Project (the Project), including the proposed Smoky Hollow underground coal mine, improvements to the Smoky Mountain Road System, and those associated facilities necessary to both operate the mine and deliver the produced coal to market; or, (2) the Agencies deny one or more critical permits or approvals and Andalex and the other applicants subsequently abandon the Project. This EIS also analyzes probable cumulative impacts that would result from approval or disapproval of the proposed Warm Springs Project in combination with other projects and activities proposed for the area in the reasonably foreseeable future.

Brief Description of the Proposal

Andalex Resources, Inc. (Andalex), with cooperation from the Garkane Power Association, Inc.; the Utah Power and Light Company; the Overton Power District; the U.S. West Communications Company; the Moapa Valley Telephone Company, Inc.; the Union Pacific Railroad Company; the Iron County Board of Commissioners; and a private, bulk-carrier transport company, proposes to develop the Smoky Hollow Mine and its associated facilities. In addition, the Kane County Board of Commissioners proposes to implement planned improvements to the Smoky Mountain Road System. These proposals (the proposed mine, the associated facilities, and the improvements to the Smoky Mountain Road System) are collectively being identified as the Warm Springs Project.

The Warm Springs Project would have seven elements: (1) the proposed Smoky Hollow Mine; (2) a proposed 138-kV power transmission line extending from an existing powerline southeast of Big Water to the mine; (3) a proposed microwave communication system that would serve the mine; (4) either the Warm Creek Road, an existing county-maintained road passing through a corner of the Glen Canyon National Recreation Area (NRA) requiring reconstruction and realignment, or the Benchtop Road, a new county road that would be constructed over Nipple and Tibbet Benches; (5) a proposed unit-train loadout facility adjacent to the Union Pacific Railroad right-of-way (ROW) west of Cedar City, Utah, near Iron Springs; (6) a proposed unit-train loadout facility adjacent to the Union Pacific Railroad ROW southwest of Moapa, Nevada; and (7) a proposed truck maintenance facility near either Fredonia, Arizona, or Hurricane, Utah.

The Smoky Hollow Mine would be a new underground coal mine located at the site of the inactive Missing Canyon Coal Mine, about 6 miles north of the Glen Canyon NRA, 13 miles northeast of the city of Big Water, and 15 miles north of the Arizona/Utah State line. The mine, most of the powerline, the microwave communication system, and the Warm Creek/Benchtop Road would be located in eastern Kane County, Utah. The remainder of the powerline would be located in Coconino County, Arizona. The unit-train loadout facilities would be located in Iron County, Utah, and Clark County, Nevada. The truck maintenance facility would be located in either Coconino County, Arizona, or Washington County, Utah.

The proposed Warm Springs Project, including the mine, the 138-kV power transmission line, the microwave communication facilities, the unit-train loadout facilities, the truck maintenance facility, and the Warm Creek Road, would involve 26,496 acres of private, State, and Federal lands (26,453 acres if the Benchtop Road were constructed). Project activities would disturb about 1,390 of those acres (1,347 acres if the Benchtop Road were constructed). The surface effects of underground mining (subsidence) within the Smoky Hollow life-of-mine area could appear on an additional 12,141 acres.

The proposed mine would be in operation for about 54 years from premining construction and development through bond release after final reclamation (the mine life). Andalex proposes to eventually recover 100 to 120 million tons of run-of-mine coal, using both longwall and room-and-pillar methods. The produced coal, averaging about 2.5 to 3.0 million tons per year, would be hauled by contractor-supplied trucks over county, State, and Federal roads to developing markets in the region and to the new unit-train loadout facilities near Cedar City, Utah, and Moapa, Nevada. Once loaded on the rail, produced coal would be delivered to developing markets in the Southwestern United States and in foreign countries along the western rim of the Pacific Ocean.

Purpose and Need for a Federal Decision

Andalex holds valid coal leases for 34,498.73 acres of Federal mineral estate in the Smoky Mountain area of southern Utah, including 23,799 acres contained within the proposed life-of-mine area for the Smoky Hollow Mine. The R-645 Coal Mining Rules for the State of Utah (Utah rules); the Surface Mining Control and Reclamation Act of 1977, as amended (SMCRA); the Mineral Leasing Act of 1920, as amended (MLA); and the Department of the Interior's Federal Lands Cooperative Agreement with the State of Utah require the Secretary of the Interior (the Secretary) to approve, conditionally approve, or disapprove the mining plan submitted by Andalex for the Smoky Hollow Mine. The Federal Land Policy and Management Act of 1976, as amended (FLPMA), requires the Bureau of Land Management (BLM) authorized officer(s) to approve or disapprove the right-of-way applications submitted by Andalex and the other Applicants for various other elements of the Warm Springs Project.

Range of Alternatives Considered

This EIS identifies and analyzes the probable environmental consequences of development that could result should any of the actions, or decisions, available to the Secretary and the BLM authorized officer(s) be implemented. It evaluates the full range of alternatives associated with the Applicant's proposals, including those other alternatives which were eliminated from detailed study.

The Agencies placed specific emphasis on two prospective actions that constitute the range of reasonable alternative decisions available to the Secretary and the BLM authorized officer(s) regarding the various plans of operation associated with the proposed Warm Springs Project (the Project), including the Smoky Hollow Mine, improvements to the Smoky Mountain Road System, and the various other associated facilities. They include: (1) approval of the Applicants' proposals, with conditions (the preferred alternative); and (2) disapproval of the applicants' proposals.

Comparison of Alternatives

- Under Alternative 1 (approval of the Applicants' proposals, with conditions), BLM and OSM (the Agencies) found that significant impacts could be expected to occur to certain aspects of the socioeconomic resource. Impacts that have the potential to become significant include certain aspects of the paleontological, transportation, noise, socioeconomic, and cultural resources. Certain aspects of the geology and topography resource would by irreversible. Certain aspects of the geology and topography, paleontological, soils, vegetation, wildlife, visual/aesthetic, and cultural resources could be irretrievably lost.

- Under Alternative 2 (disapproval of the applicants' proposals), the Agencies found that impacts to the resources of the area would continue at existing levels. Certain aspects of the paleontological, transportation, socioeconomic, and cultural resources have the potential to become significant. Certain aspects of the geology and topography resource would be irreversible. Certain aspects of the paleontological, vegetation, wildlife, and cultural resources could be irretrievably lost. Incremental impacts resulting from development of the various Project elements would not occur.

The Environmental Impact Statement

This EIS is not a decision document. It is the result of a comprehensive process used to document the effects of the Applicants' proposals and the reasonable alternatives. Agency decisions regarding the proposals will be released in Decision Documents prepared by the responsible Federal officials. BLM and Department of the Interior decisions will relate only to the particular Applicant's ability to comply with FLPMA, SMCRA, MLA, and the Utah Rules. Decisions by other jurisdictions to issue or not issue approvals related to the proposals may be aided by the disclosure of impacts available in this analysis. Other Federal agencies may adopt the EIS or parts thereof for their own use, subject to the provisions of the regulations for the Council on Environmental Quality. Those agencies retain the right to require further environmental information or analysis.

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INTRODUCTION

CHAPTER 1

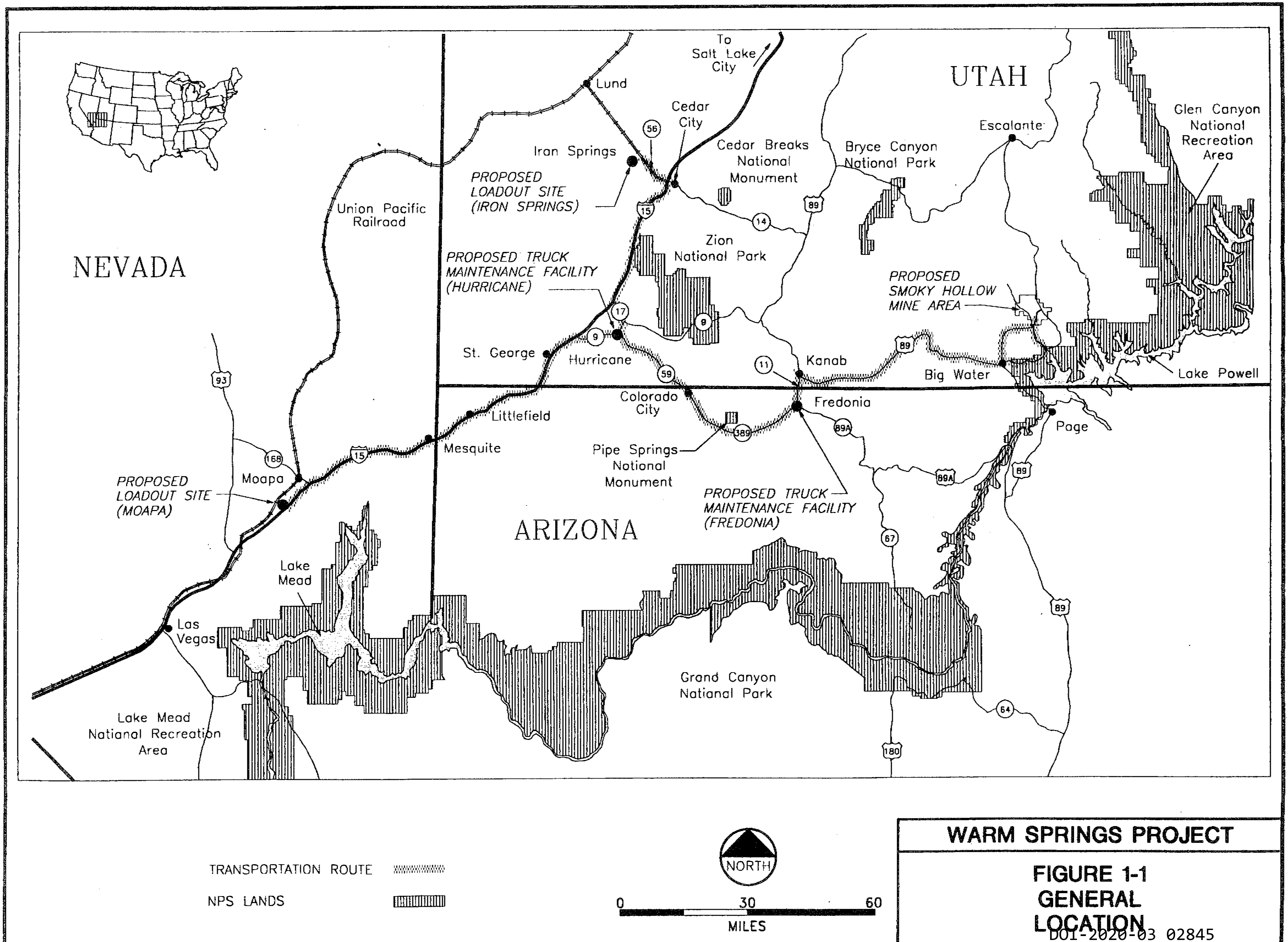
1.1 PURPOSE AND NEED FOR AN ENVIRONMENTAL IMPACT STATEMENT

Andalex Resources, Inc. (Andalex), of Price, Utah, proposes to develop a portion of the coal resources found in the Smoky Mountain area of southern Utah and has provided permit application packages (PAPs) to the Bureau of Land Management (BLM) and the Office of Surface Mining Reclamation and Enforcement (OSM). The PAPs include proposed life-of-mine mining plan and information necessary to obtain approval to conduct coal mining and reclamation operations at Andalex's proposed Smoky Hollow Mine in Kane County, Utah.

In addition, the Kane County Board of Commissioners (Kane County) of Kanab, Utah, proposes to implement planned improvements to the Smoky Mountain Road System, and several other entities propose to develop certain associated facilities that would be necessary before Andalex could operate its proposed mine or deliver the produced coal to market. They include the Garkane Power Association, Inc. (Garkane), of Richfield, Utah; the Utah Power and Light Company (UP&L) of Richfield, Utah; the Overton Power District (Overton) of Overton, Nevada; the U.S. West Communications Company (U.S. West) of Cedar City, Utah; the Moapa Valley Telephone Company, Inc. (Moapa Valley), of Overton, Nevada; the Union Pacific Railroad Company (Union Pacific) of Salt Lake City, Utah; the Iron County Board of Commissioners (Iron County) of Cedar City, Utah; and a private bulk-carrier transport company. BLM has received right-of-way (ROW) applications from Andalex, Kane County, Garkane, UP&L, Overton, U.S. West, and Moapa Valley for obtaining approval of proposed facilities that would be located on Federal lands in Kane and Iron Counties, Utah; in Coconino County, Arizona; and in Clark County, Nevada (Figures 1-1 and 1-2). The proposed Smoky Hollow Mine, together with the associated facilities necessary to both operate the mine and deliver the coal to market, and the improvements to the Smoky Mountain Road System, are collectively being identified as the Warm Springs Project (the Project).

Andalex holds valid coal leases for 34,498.73 acres of Federal mineral estate in the Smoky Mountain area of southern Utah, including 23,779 acres contained within the proposed life-of-mine area for the Smoky Hollow Mine. Andalex has submitted its PAPs pursuant to the R-645 Coal Mining Rules for the State of Utah (Utah Rules), the Surface Mining Control and Reclamation Act of 1977, as amended (SMCRA), and the Mineral Leasing Act of 1920, as amended (MLA). The Utah Rules, SMCRA, MLA, and the Department of the Interior's Federal Lands Cooperative Agreement with the State of Utah require the Secretary of the Interior to approve, conditionally approve, or disapprove the mining plan submitted by Andalex for the Smoky Hollow Mine. In addition, the various ROW applications have been submitted to BLM pursuant to the Federal Land Policy and Management Act of 1976, as amended (FLPMA). FLPMA requires the BLM Authorized Officer to approve, conditionally approve, or disapprove these ROW applications.

BLM and OSM (the Agencies) have determined that Federal approval or disapproval of the various applications associated with the proposed Warm Springs Project constitute major actions that could significantly affect the quality of the human environment, and, pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969, as amended (NEPA), that an environmental impact statement (EIS) should be prepared.



WARM SPRINGS PROJECT

FIGURE 1-1 GENERAL LOCATION

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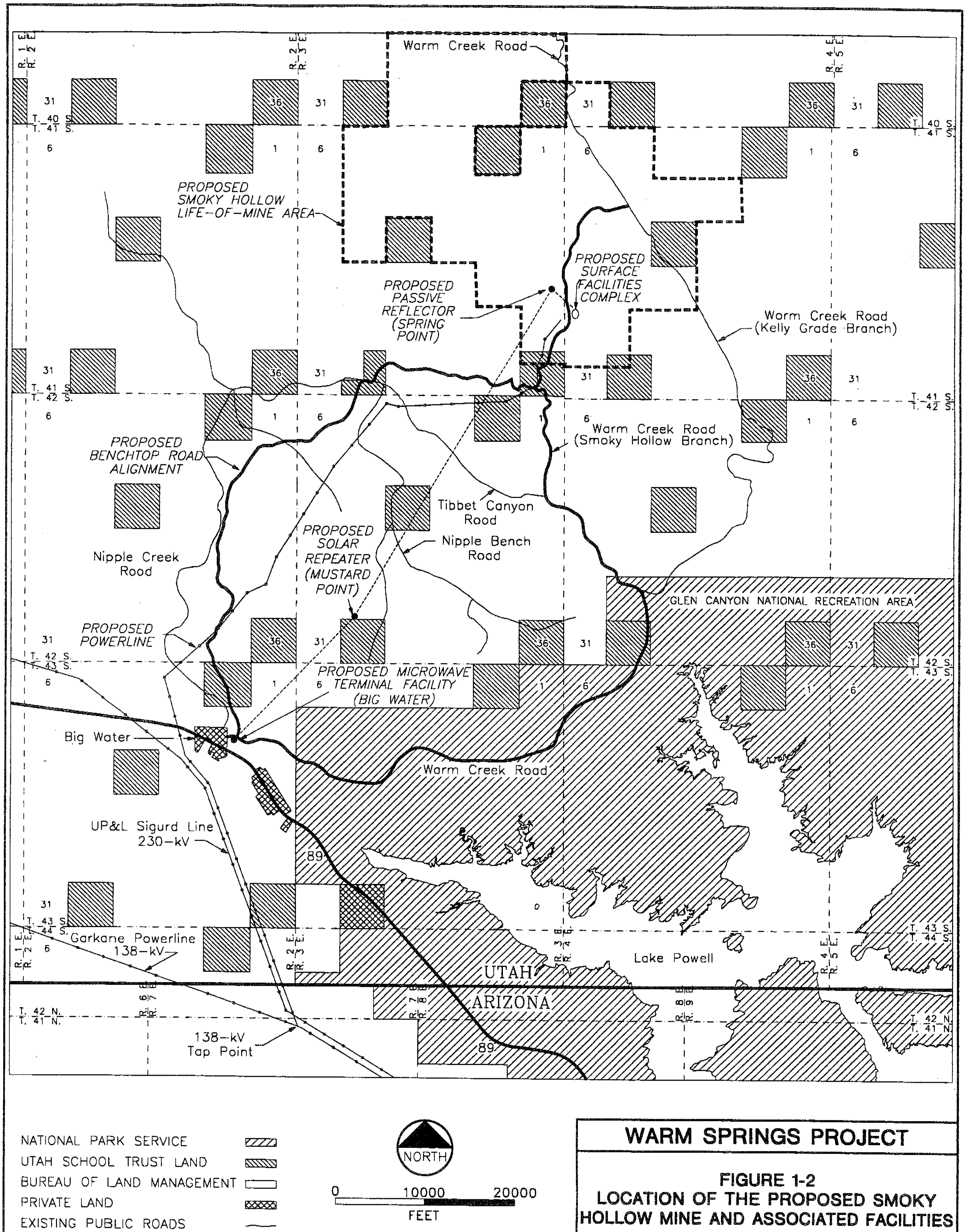

WARM SPRINGS PROJECT

FIGURE 1-2
LOCATION OF THE PROPOSED SMOKY HOLLOW MINE AND ASSOCIATED FACILITIES

DATE: MARCH 1995 ACAD FILE: FIG1-2.DWG

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1.2 THE APPLICANTS' PROPOSALS

Andalex, with cooperation from Garkane, UP&L, Overton, U.S. West, Moapa Valley, Union Pacific, Iron County, and the private bulk-carrier transport company, proposes to develop the Smoky Hollow Mine and the facilities necessary to operate the mine and deliver the coal to market. In addition, Kane County proposes to implement planned improvements to the county road system in the Smoky Mountain area. The Smoky Hollow Mine would be a new underground coal mine located at the site of the inactive Missing Canyon Coal Mine in south-central Utah. It would be about 6 miles north of the Glen Canyon National Recreation Area (NRA), 13 miles northeast of Big Water, and 15 miles north of the Arizona/Utah State Line (Figure 1-1).

The Warm Springs Project would have seven elements: (1) the proposed Smoky Hollow Mine; (2) a proposed 138-kilovolt (kV) power transmission line extending from an existing powerline southeast of Big Water to the mine; (3) a proposed microwave communication system that would serve the mine; (4) either the Warm Creek Road, an existing county-maintained road passing through a corner of the Glen Canyon NRA requiring reconstruction and realignment, or the Benchtop Road, a new county road that would be constructed over Nipple and Tibbet Benches; (5) a proposed unit-train loadout facility adjacent to the Union Pacific Railroad ROW west of Cedar City, Utah, near Iron Springs; (6) a proposed unit-train loadout facility adjacent to the Union Pacific Railroad ROW southwest of Moapa, Nevada; and (7) a proposed truck maintenance facility near either Fredonia, Arizona, or Hurricane, Utah. The mine, most of the powerline, the microwave communication system, and the Warm Creek/Benchtop Road would be located in eastern Kane County, Utah. The remainder of the powerline would be located in Coconino County, Arizona. The coal unit-train loadout facilities would be located in Iron County, Utah, and Clark County, Nevada. The truck maintenance facility would be located in either Coconino County, Arizona, or Washington County, Utah.

The proposed mine would be in operation for about 54 years, from premining construction and development through bond release after final reclamation (the mine life). Andalex proposes to eventually recover 100 to 120 million tons of run-of-mine (ROM) coal, using both longwall and room-and-pillar methods. The produced coal, averaging about 2.5 to 3.0 million tons per year, would be hauled by contractor-supplied trucks over county, State, and Federal roads to developing markets in the region and to the new unit-train loadout facilities near Cedar City, Utah, and Moapa, Nevada (Figure 1-1). Once loaded on the rail, produced coal would be delivered to developing markets in the Southwestern United States and in foreign countries along the western rim of the Pacific Ocean (the Pacific Rim).

The proposed mining operation would convert the inactive Missing Canyon Coal Mine into a full-scale underground mining facility. The life-of-mine area for the proposed mine would involve a total of 24,659 acres of Federal and State lands, 96 percent of which overlie Federal coal estate (Figure 1-2). About 52 acres of the life-of-mine area would be disturbed by a surface facilities complex to service the mining operation. Another 79 acres of the life-of-mine area would be disturbed by a microwave reflector site, a topsoil borrow area, water monitoring wells, exploratory drillholes, and associated temporary access roads. The surface effects of underground mining (subsidence) could eventually affect 12,141 acres within the life-of-mine area.

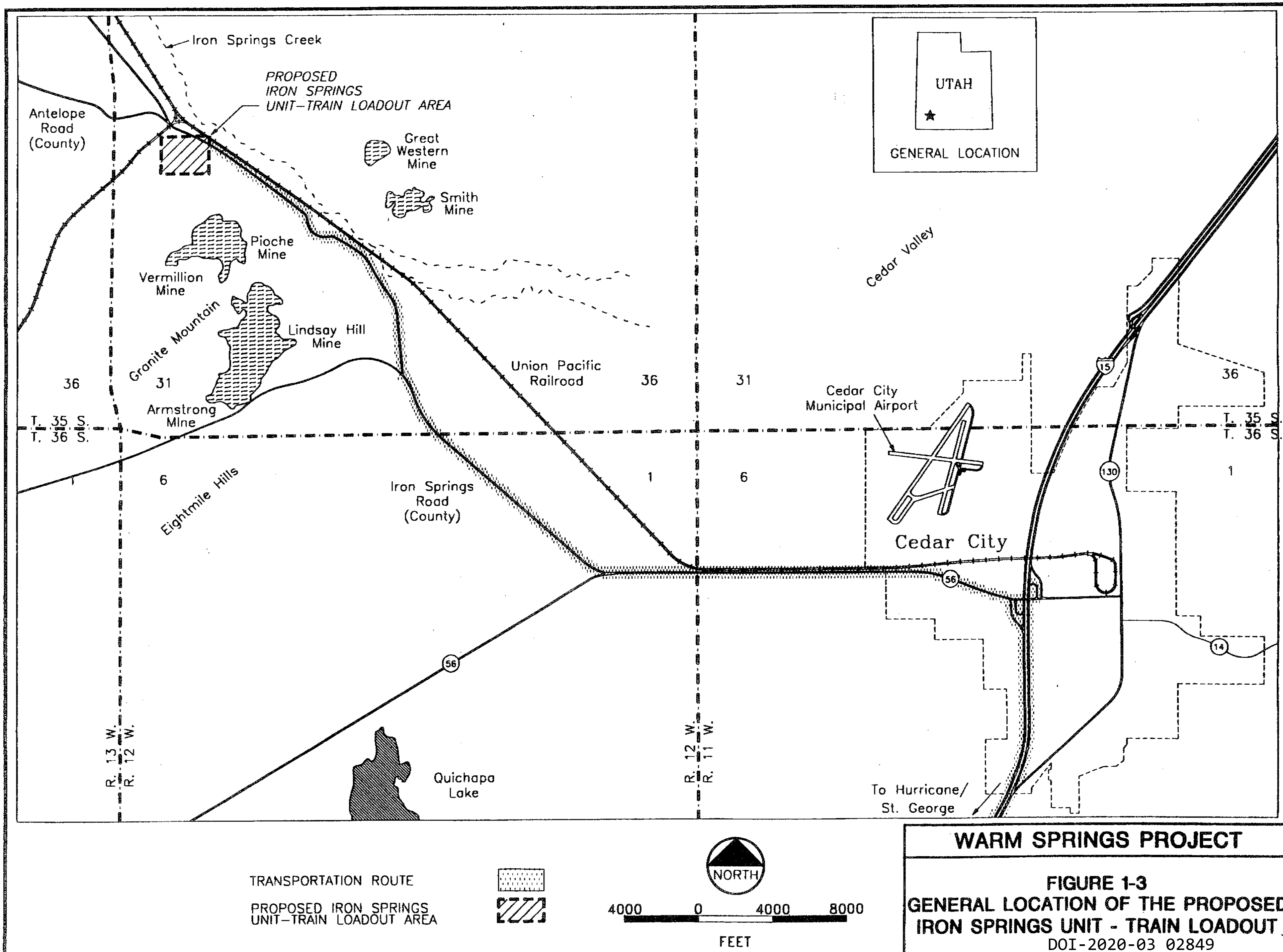
Additional facilities proposed for the general area of the mine (the Smoky Mountain area) include about 21.7 miles of 138-kV power transmission line, two additional microwave communication structures, and up to 24.7 miles of road (either the Warm Creek Road or the Benchtop Road) (Figure 1-2). These activities would disturb about 885 acres of private, State, and Federal lands (about 842 acres would be disturbed if the Benchtop Road were to be constructed rather than reconstructing and realigning the Warm Creek Road).

Additional facilities outside the Smoky Mountain area would include the 124-acre unit-train loadout facility on Federal lands near Cedar City, Utah (Figure 1-3); the 638-acre unit-train loadout facility on Federal lands near Moapa, Nevada (Figure 1-4); and the 20-acre truck maintenance facility on private lands near either Fredonia, Arizona (Figure 1-5), or Hurricane, Utah (Figure 1-6). These activities would disturb about 303 acres of private and Federal lands.

The proposed Warm Springs Project, including the mine, the 138-kV power transmission line, the microwave communication facilities, the unit-train loadout facilities, the truck maintenance facility, and the Warm Creek Road, would involve about 26,496 acres of private, State, and Federal lands (26,453 acres if the Benchtop Road were constructed). Project activities would disturb 1,374 of those acres (1,331 acres if the Benchtop Road were constructed).

All the lands disturbed by Project-related activities that are not proposed for permanent facilities would be revegetated. No revegetation activities are proposed for the active travel surface of the Warm Creek/Benchtop Road or in the area of the truck maintenance facility, since these facilities would remain in place after the end of the Project. Environmental monitoring would be conducted regularly at all proposed Project locations to further define predisturbance baseline environmental conditions and to detect mining-operation-related changes.

Table 1-1 provides life-of-mine acreages for the proposed mine, the proposed improvements to the Smoky Mountain Road System, and the various other associated facilities. It compares the total acreage requirement for each component with that part that would be disturbed by Project activities. New disturbance acreages have been separated from those acreages that have already been disturbed by previous activities. Table 1-2 identifies the time requirement for each of the phases of the proposed 54-year operation of the mine. A total of 677 people could eventually be employed by Project-related activities in some capacity. About 227 of these jobs would be temporary, associated with various construction activities (Table 1-3). (Specific details of the proposed Warm Springs Project are included in Appendix A. Specific details of the inactive Missing Canyon Coal Mine are included in Appendix B. Underground coal mining is discussed in Appendix C.)



WARM SPRINGS PROJECT

FIGURE 1-3
GENERAL LOCATION OF THE PROPOSED IRON SPRINGS UNIT - TRAIN LOADOUT

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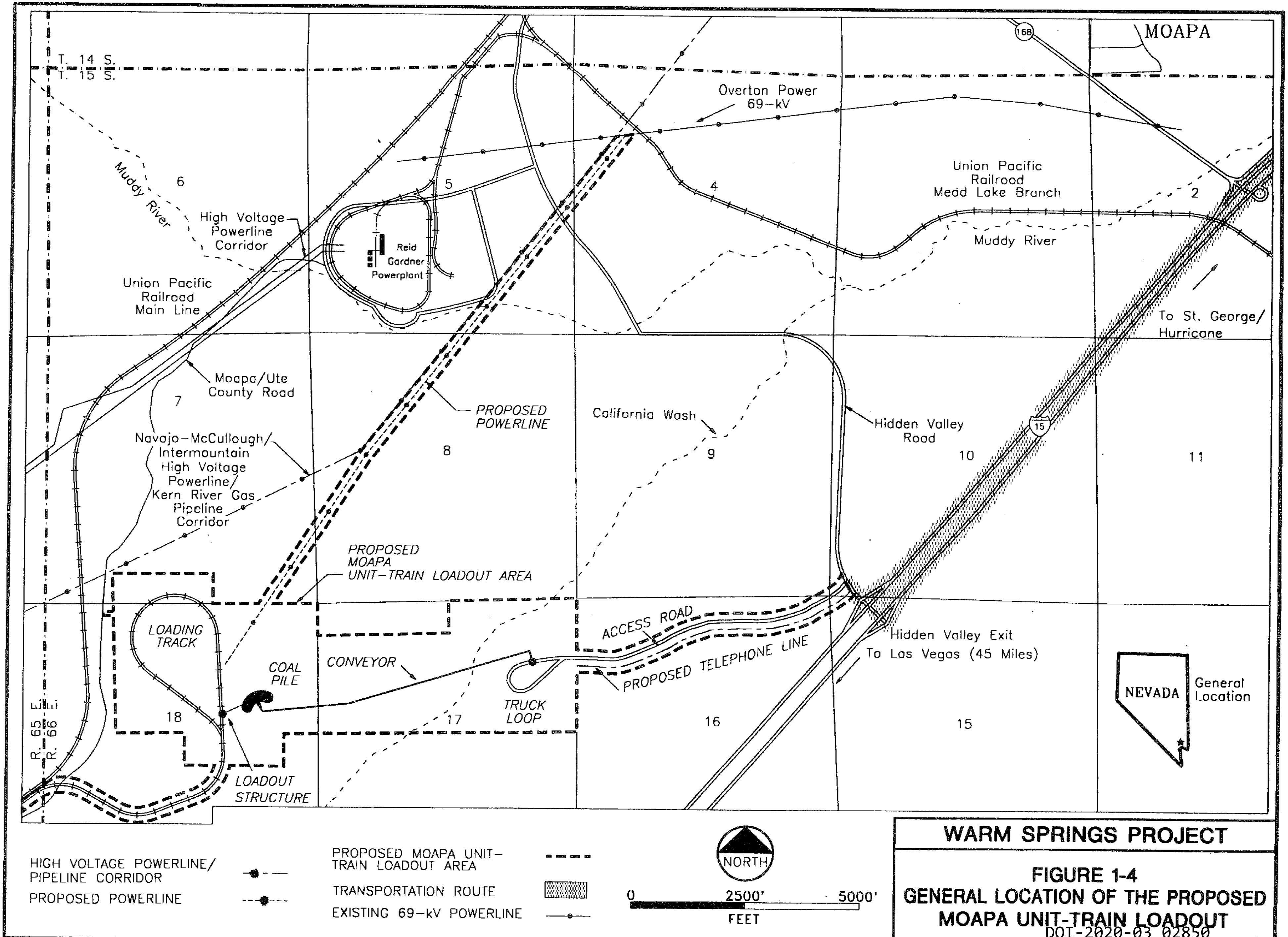

WARM SPRINGS PROJECT

FIGURE 1-4
GENERAL LOCATION OF THE PROPOSED MOAPA UNIT-TRAIN LOADOUT

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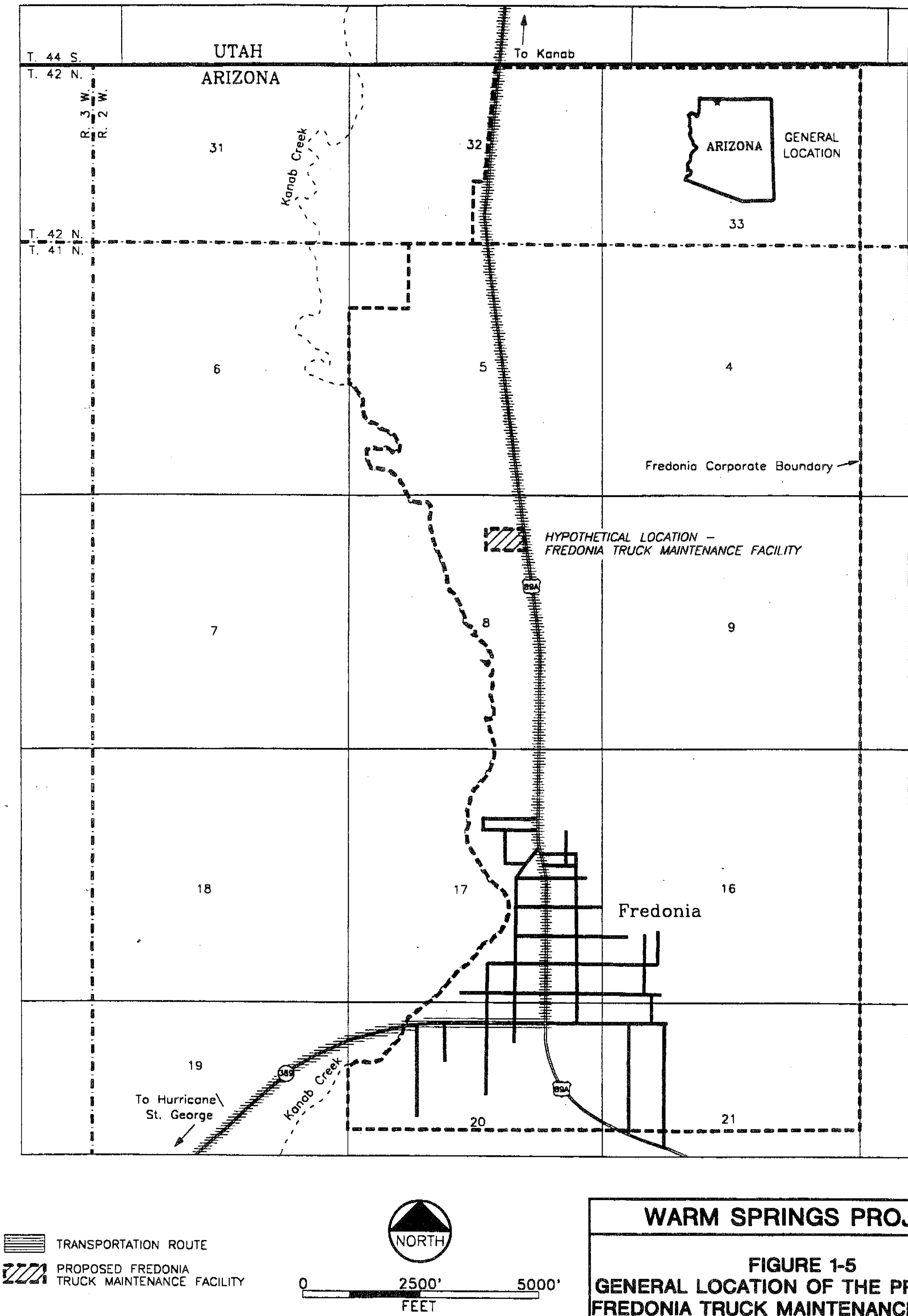

WARM SPRINGS PROJECT

FIGURE 1-5
GENERAL LOCATION OF THE PROPOSED FREDONIA TRUCK MAINTENANCE FACILITY

DATE: MARCH, 1995 ACAD FILE: FIG1-5.DWG

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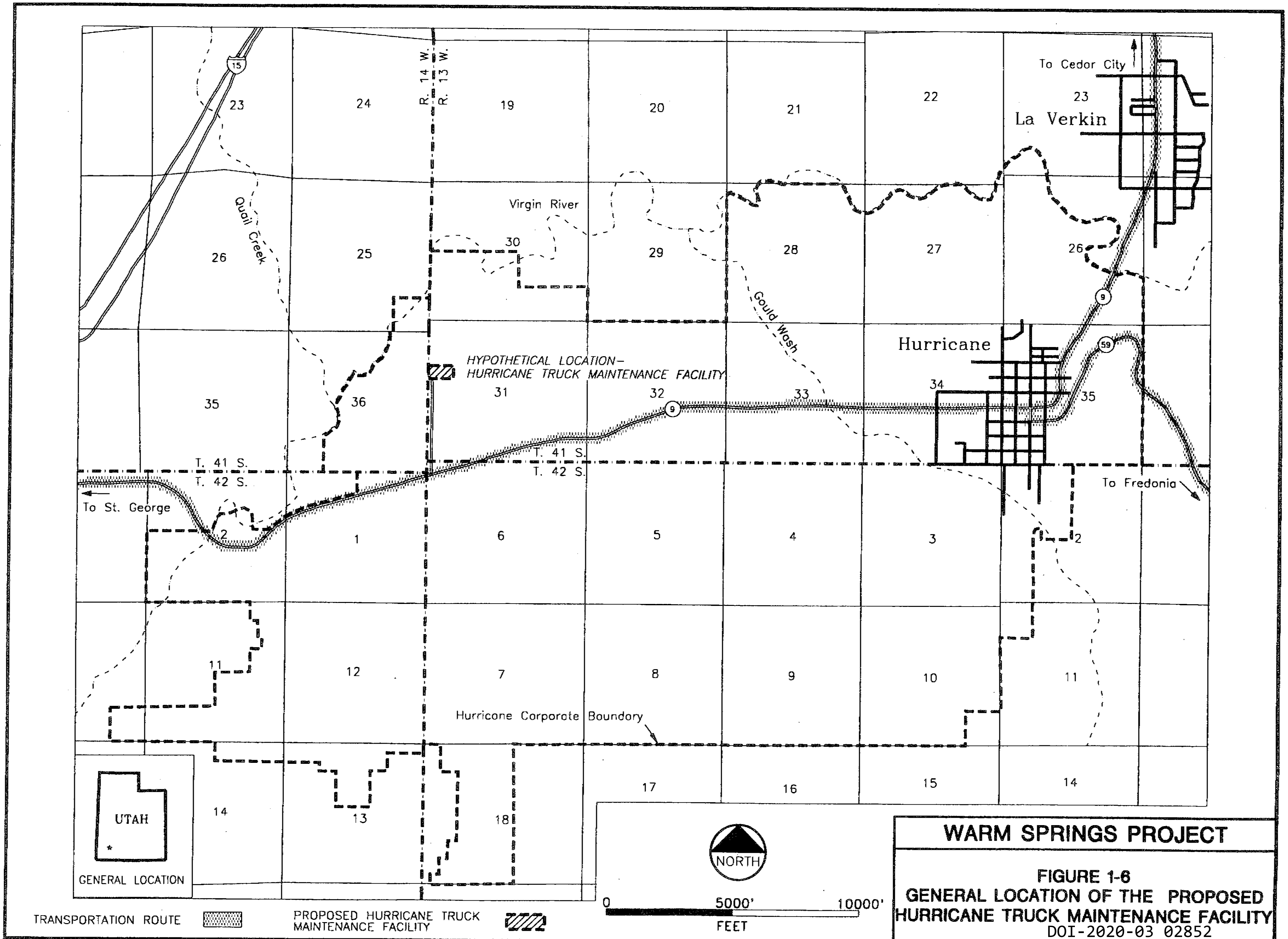

WARM SPRINGS PROJECT

FIGURE 1-6
GENERAL LOCATION OF THE PROPOSED HURRICANE TRUCK MAINTENANCE FACILITY

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DATE: MARCH 1995 ACAD FILE: FIG1-6.DWG

Table 1-1 — Acreage Data for the Proposed Warm Springs Project

	Total Acreage	Disturbed Surface Acreage			Surface/Mineral Ownership		
		Total	New	Existing	Private	State	Federal
Smoky Hollow Mine	24,659	202	183	19	0	880	23,779
138-kV Power Transmission Line	242	75	69	6	0	31	211
Microwave Communication System	5	2	2	t	t	0	5
Smoky Mountain Road System (Warm Creek)	808	808	744	64	3	87	718
Iron Springs (Cedar City) Unit-Train Loadout	124	85	80	5	3	0	121
Moapa Unit-Train Loadout	638	198	192	6	7	0	631
Truck Maintenance Facility (Fredonia/Hurricane)	20	20	20	0	20	0	0
Project Total No. 1[1]	26,496	1,390	1,290	100	33	998	25,465
Smoky Mountain Road System (Benchtop)	765	765	742	23	3	162	600
Project Total No. 2[1]	26,453	1,347	1,288	59	33	1,073	25,347

[1] Total values for Project No. 1 are the sum of the six common elements (Smoky Hollow Mine, 138-kV power transmission line, microwave communication system, Iron Springs unit-train loadout, Moapa unit-train loadout, and truck maintenance facility) plus the Warm Creek Road; total values for Project No. 2 are the sum of the six common elements plus the Benchtop Road.

t = Trace (actual acreage is less than 0.5 acre).

Table 1-2 — Schedule Data for the Proposed Warm Springs Project

Activity	Time Requirement
Facility construction and development with limited mining and truck haul	1 to 2 years
Full-scale mining and truck haul	40 years
Reclamation	2 years
Bond release (minimum time period for total release)	10 years
Total Time	53 to 54 years

Table 1-3 — Employment Data for the Proposed Warm Springs Project

	Total Employment	Mining Related			Construction Related
		Total	Admin	Other	
Smoky Hollow Mine	200	150	40	110	50
138-kV Power Transmission Line	16	n/a	n/a	n/a	16
Microwave Communication System	2	n/a	n/a	n/a	2
Smoky Mountain Road System[1]	40	n/a	n/a	n/a	40
Iron Springs (Cedar City) Unit-Train Loadout	77	20	4	16	57
Moapa Unit-Train Loadout	77	20	4	16	57
Truck Maintenance Facility (Fredonia/Hurricane)[1]	265	260	30	230	5
Project Total	677	450	78	372	227

[1] Employment numbers would remain the same, regardless of which choice were to be finally implemented for this element.

n/a = Not applicable: routine maintenance and operation of this element during the life of the Project would be conducted by regular employees of the responsible company.

1.3 ROLES OF FEDERAL AND STATE AGENCIES IN PROJECT APPROVAL

A number of agencies would be involved in issuing permits or other approvals before certain construction and operation activities associated with the Project would be allowed to begin. The primary Federal and State authorizing actions would include:

- A State Permit to Conduct Coal Mining Operations from the Utah Department of Natural Resources, Division of Oil, Gas, and Mining (Utah DOGM) prior to beginning any coal mining operations within the proposed Smoky Hollow life-of-mine area.

- A Federal Mining Plan Approval from the Assistant Secretary of the Interior for Land and Minerals Management (through OSM) prior to beginning coal mining operations on lands containing leased Federal coal reserves at the proposed Smoky Hollow Mine.

- Federal ROWs from BLM prior to constructing the proposed 138-kV power transmission line and ancillary access roads, or conducting other temporary construction activities outside the formal power transmission line ROW, on BLM-administered Federal lands.

- State ROWs from the Utah School and Institutional Trust Land Administration (Utah TLA) prior to constructing the proposed 138-kV power transmission line and associated access roads, or conducting other temporary construction activities outside the formal transmission line ROW, on Utah State School Trust (Utah Trust) lands.

- Federal ROWs from BLM prior to constructing the proposed Spring Point reflector station; the proposed Mustard Point repeater station and associated access road; or the proposed Big Water terminal linkage facility, associated access road, telephone line, and 12.5-kV power distribution line; or prior to conducting other temporary construction activities outside the formal communication ROWs, on BLM-administered Federal lands.

- Federal ROWs from BLM prior to either reconstructing and realigning the existing Warm Creek Road; constructing the proposed Benchtop Road; or conducting other temporary construction activities outside the formal road ROW, on BLM-administered Federal lands.

- State ROWs from Utah TLA prior to either reconstructing and realigning the existing Warm Creek Road; constructing the proposed Benchtop Road; or conducting other temporary construction activities outside the formal road ROW, on Utah Trust lands.

- Federal ROWs from BLM prior to constructing the proposed Iron Springs (Cedar City) unit-train loadout facility, relocating the existing 12.5-kV power distribution line, extending the existing 34.5-kV power distribution line, or constructing the proposed telephone line, on BLM-administered Federal lands.

- Federal ROWs from BLM prior to constructing the proposed Moapa unit-train loadout facility, the proposed 69-kV power transmission line, or the proposed telephone line, on BLM-administered Federal lands.

In addition, several Federal and State authorizing actions are not necessary to begin construction and operation activities at the mine but would be required in the future before the life-of-mine area could be fully developed. They would include:

- A Federal Logical Mining Unit Approval from BLM prior to the expiration of 14 leases covering Federal coal reserves at the proposed Smoky Hollow Mine.

- Successive, 5-year revisions of the Utah Permit to Conduct Coal Mining Operations from Utah DOGM prior to extending active coal mining operations throughout the remainder of the life-of-mine area.

- Successive modifications of the Federal Mining Plan Approval from the Assistant Secretary of the Interior for Land and Mineral Management (through OSM) prior to extending coal mining operations on lands containing leased Federal coal reserves throughout the remainder of the life-of-mine area.

The uncertain nature of several legal and regulatory challenges at the Federal and State levels suggests that additional Federal or State authorizing actions may be required before certain Project activities would be allowed to begin. These challenges are associated with Federal Revised Statute 2477 regarding ROWs for existing county-maintained roadways, State permitting of roads where the majority of use is coal-haul related, and valid existing rights as they pertain to the use of roads. No formal decisions have been made regarding the need for those authorizations, and no formal applications with regard to these possible authorizations have been received from any of the Project proponents. If necessary, these additional authorizations could include:

- A Federal ROW from the National Park Service (NPS) prior to reconstructing and realigning the existing Warm Creek Road on NPS-administered Federal lands.

- A revision to the Utah Permit to Conduct Coal Mining Operations from Utah DOGM prior to utilizing either the Warm Creek Road or the Benchtop Road for extensive coal hauling activities.

Detailed discussions of the roles these and a number of other Federal and State agencies play in Project approval are included in Appendix D.

Copies of Andalex's PAPs can be reviewed by the public at the following locations: the Denver, Colorado (1999 Broadway, Suite 3410), and the Albuquerque, New Mexico (505 Marquette NW, Suite 1200), offices of OSM; the Salt Lake City, Utah (355 West Temple, 3 Triad Center, Suite 350), offices of Utah DOGM; and the Salt Lake City, Utah (324 South State, Suite 301), and Kanab, Utah (318 North 100 East), offices of BLM.

Copies of the PAPs are also located at the NPS offices in Page, Arizona (Glen Canyon NRA, 691 Scenic View Drive); and the Salt Lake City, Utah, offices of the U.S. Fish and Wildlife Service (2078 Administration

Building, 1745 West 1700 South), the Utah Department of Environmental Quality (288 North 1460 West), the Utah Division of Wildlife Resources (1596 West North Temple), the Utah Division of Water Rights (1636 West North Temple), and the Utah Division of State History (300 Rio Grande).

Copies of the Federal ROW applications can be reviewed by the public at the following BLM offices: Cedar City, Utah (176 East DL Sargent Drive and 365 South Main Street); Kanab, Utah; St. George, Utah (225 North Bluff Street); and Las Vegas, Nevada (4765 Vegas Drive).

Copies of the State ROW applications can be reviewed by the public at the Salt Lake City (355 West Temple, 3 Triad Center, Suite 400) and Cedar City (585 North Main Street) offices of Utah TLA.

1.4 THE ENVIRONMENTAL IMPACT STATEMENT

As required by the President's Council on Environmental Quality (CEQ) and NEPA directives, this EIS identifies and analyzes the probable impacts to the quality of the human environment, should Andalex and the other applicants receive all necessary permits and approvals and subsequently construct and operate the Project. The EIS provides decisionmakers with information upon which to base a final decision that is fully informed and that considers all factors relevant to the proposal. Preparation of the EIS helps ensure that the proposed operations are well planned, that the major environmental impacts of the proposed actions and their reasonable alternatives are analyzed, and that concerns of agencies, organizations, and citizens are considered (CEQ 1978, 40 CFR §1500-1508).

This EIS has been prepared as a joint effort between BLM and OSM (the Agencies). They are jointly responsible for management of the EIS process, including facilitating public involvement and preparing the EIS. BLM is the responsible administrative lead agency (CEQ, 1978, 40 CFR §1501.5). NPS and Utah DOGM, as other agencies possessing special expertise or jurisdiction by law, are formal cooperating agencies in the preparation of the EIS. As such, they are responsible for participating in the EIS scoping process and providing specific comments on those aspects of the impact analysis within their expertise and/or under their jurisdiction (CEQ 1978, 40 CFR §1501.6).

The Applicants' proposals, including the reasonable alternatives, have been evaluated through an interdisciplinary analysis and review by representatives from the lead and cooperating Agencies. Interdisciplinary participation has also been provided by private consultants working under the direction of BLM and OSM (CEQ 1978, 40 CFR §1502.6).

This EIS is not a decision document. As previously mentioned, it is the result of a comprehensive process used to document the effects of the Applicants' proposals and the reasonable alternatives. Agency decisions regarding the proposals will be released in Decision Documents prepared by the responsible Federal officials. BLM and Department of the Interior decisions will relate only to the particular Applicant's ability to comply with FLPMA, SMCRA, MLA, and the Utah Rules. Decisions by other jurisdictions to issue or not issue approvals related to the proposals may be aided by the disclosure of impacts available in this analysis. Other Federal agencies may adopt the EIS or parts thereof for their own use, subject to the provisions of the CEQ regulations (CEQ 1978, 40 CFR §1506.3). Those agencies retain the right to require further environmental information or analysis.

1.5 SCOPE OF THE EIS ANALYSIS

CEQ regulations define the scope of an EIS as "the range of actions, alternatives, and impacts to be considered." Agencies are initially directed to "tier" from program, policy, or planning documents/EISs "of broad scope to those of narrower scope, to eliminate repetitive discussions," and to help the Agencies "focus on the issues which are ripe for decision and exclude from consideration issues already decided or not yet ripe" (CEQ 1978, 40 CFR §1500-1508):

- Environmental issues associated with leasing and subsequent development of Federal coal in the United States have been evaluated by the U.S. Department of the Interior (USDOI) in the final EIS on the Proposed Federal Coal Leasing Program (USDOI 1975), the final EIS on the Federal Coal Management Program (USDOI 1979b), and the final EIS on the Federal Coal Management Program Supplement (USDOI 1985).

- Environmental issues associated with leasing and subsequent development of Federal coal in southern Utah have been evaluated by USDOI in the final EIS on Development of Coal Resources in Southern Utah (USDOI 1979c), and by BLM in the final EIS on the Uinta-Southwestern Utah Coal Region (BLM 1981) and the final EIS on the Uinta-Southwestern Utah Coal Region - Round 2 (BLM 1983a).

- Environmental issues associated with preliminary coal leasing (e.g., application of the unsuitability criteria) and other land use (e.g., ROW) decisions for BLM-administered Federal lands in the Project area were evaluated by BLM in a variety of planning and environmental documents. The Escalante—Paria—Zion Management Framework Plan (BLM 1980) evaluated those issues in the southern part of the Kanab Resource Area. The Cedar—Beaver—Garfield—Antimony Resource Management Plan final EIS (BLM 1984) evaluated those issues in the eastern part of the Beaver River Resource Area in Utah. The final EIS on the Arizona Strip District Resource Management Plan (BLM 1992a) evaluated those issues in the eastern part of the Arizona Strip Resource Area in Arizona. The Clark County Management Framework Plan (BLM 1983b) evaluated those issues in the eastern part of the State Line Resource Area in Nevada.

- Environmental issues associated with land use decisions for NPS-administered Federal lands in the Glen Canyon NRA were evaluated by NPS in the final EIS on the Glen Canyon NRA General Management Plan (NPS 1979).

- Environmental issues associated with the development of coal resources in the Smoky Mountain area were evaluated by BLM in the final EIS on the Kaiparowits Project (BLM 1976) and by USDOI in the final EIS on Development of Coal Resources in Southern Utah (USDOI 1979c). These documents evaluate development activities associated with the coal resources contained in a 47,768-acre composite of Federal and State lands in the Smoky Mountain area that was originally controlled by The

Resources Company and was eventually transferred to Andalex. Site-specific and cumulative analyses cover the impacts of coal mining and related development of up to five coal mines. These mines would have disturbed as much as 1,814 acres, eventually removed 420 million tons of coal, and produced at rates of up to 12 million tons per year. The Smoky Hollow Mine, including the entire coal removal/life-of-mine area identified in the current proposal, was specifically included in these analyses.

The Agencies prepared this EIS to specifically analyze the probable site-specific and cumulative impacts to the human environment from the proposed Warm Springs Project, including underground coal mining and the associated activities, as follows:

- Site-specific analyses address the direct and indirect impacts that would result from proposed development, operation, and reclamation activities associated with the Project, both on and off the specific areas targeted for disturbance, over the proposed 54-year life of the Smoky Hollow Mine.

- The cumulative segments of the analyses address the collective impacts that would result from developing the proposed Project in conjunction with other past, present, and reasonably foreseeable future actions in the southern Utah, northern Arizona, and southeastern Nevada area.

In order to perform these analyses, certain assumptions were made about Federal and State actions. A complete list of these assumptions is included in Chapter 4. These assumptions are for these analyses only and are not intended to be the final projection of future activities that may or may not materialize in the area over the mine's proposed 54-year life. (Specific details of the proposed Project, including the Smoky Hollow Mine, improvements to the Smoky Mountain Road System, and those other activities associated with the production and delivery of coal, are included in Appendix A. Specific details of projects considered in the cumulative analyses are included in Appendix B.)

1.6 ISSUES RELATING TO THE PROPOSED ACTION

Numerous impact topics regarding the proposed Project were identified by the public during the scoping activities for this EIS. (Chapter 5 contains a complete discussion of the public participation process.) These topics were evaluated during the impact analysis phase of the EIS process to the extent that they were relevant and would have significant impact. In addition, the Agencies supplemented the public's list with additional topics identified by both the EIS interdisciplinary team and Agency management. The agencies are required to assess impacts to prime or unique farmlands, floodplains, and areas of critical environmental concern (ACEC); none occurs within the proposed project area. This elimination of nonrelevant issues follows the Council on Environmental Quality (CEQ) policy as stated in 40 CFR §1500.4 (CEQ 1978). The impact topics analyzed by the Agencies in Chapter 4 of the EIS include:

- Geologic and topography: Impacts to the mineral resources and the topography in the Smoky Mountain area.

- Paleontology: Impacts to paleontological resources in the Smoky Mountain, Iron Springs, and Moapa areas.

- Hydrology: Impacts to water quality and quantity in the Smoky Mountain, Iron Springs, and Moapa areas.

- Soils: Impacts to soils and soil productivity in the Smoky Mountain area.

- Vegetation: Impacts to vegetative productivity and community productivity in the Project area and to the wetland/riparian Smoky Mountain evening primrose and Higgins Biscuitroot communities in the Smoky Mountain area.

- Wildlife: Impacts to mule deer movement in the Project area; to wildlife habitat/productivity, Mexican spotted owls, ferruginous hawks, golden eagles, peregrine falcons, and other raptors in the Smoky Mountain area; and to desert tortoises in the Moapa, Nevada, and Hurricane, Utah, areas.

- Transportation: Impacts to open road/intersection traffic flow, highway infrastructure, and public safety in the Project area and to the structural integrity/stability of county roads in the Smoky Mountain area.

- Noise: Impacts from noise generated in the Smoky Mountain, Iron Springs, and Moapa areas and along roads in the Project area.

- Socioeconomics: Impacts to employment, personal income, business activity, local, State, and Federal Government fiscal resources, housing availability, public safety agencies, public schools, water and sewer systems, residential property values, and the regional quality of life.

- Air quality: Impacts to air quality in the Smoky Mountain, Iron Springs, and Moapa areas and along roads in the Project area.

- Visual resources/aesthetics: Impacts to aesthetics in the Smoky Mountain, Iron Springs, Moapa, Hurricane, and Fredonia areas, along the Warm Creek Road, along the route for the Benchtop Road, and along the route for the 138-kV power transmission line.

- Recreation: Impacts to dispersed recreation opportunities in the Smoky Mountain area and to recreation use and management of the Glen Canyon NRA.

- Wilderness: Impacts to wilderness characteristics and the potential wilderness designation of Wilderness Study Areas in the Smoky Mountain area.

- Cultural resources: Impacts to both known and unknown prehistoric sites and to Native American cultural and religious concerns in the Project area.

1.7 PUBLIC ISSUES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

Several additional impact topics were identified by the public during scoping activities for this EIS but are not being addressed for a variety of reasons. CEQ is very specific when it directs Federal agencies to reduce excessive paperwork by "using the scoping process, not only to identify significant environmental issues deserving of study, but also to deemphasize insignificant issues, narrowing the scope of the environmental impact statement process accordingly" (CEQ 1978, 40 CFR §1500.4(g)). (A list of these topics, along with the Agencies' rationale for dismissing them from further analyses as environmental issues not deserving of study, is included in Chapter 5, Section 5.3, Public Issues Considered but Eliminated from Detailed Analysis).

ALTERNATIVES

CHAPTER 2

2.1 DESCRIPTION OF THE ALTERNATIVES ANALYZED

This environmental impact statement (EIS) evaluates two prospective actions that constitute the range of reasonable alternative decisions available to the Bureau of Land Management and the Office of Surface Mining Reclamation and Enforcement (the Agencies) regarding the various plans of operation associated with the proposed Warm Springs Project (the Project), including the Smoky Hollow Mine and associated ancillary facilities.

2.1.1 Alternative 1: Approval of the Applicants' Proposals, With Conditions (the Preferred Alternative)

Under Alternative 1, the Agencies would approve the Applicants' plans of operation for the proposed Project (summarized in Appendix A), subject to conditions identified by the Agencies. These conditions (listed below) are necessary to bring the proposals into compliance with the minimum requirements of the R-645 Coal Mining Rules for the State of Utah (Utah Rules); the Surface Mining Control and Reclamation Act of 1977, as amended (SMCRA); the Mineral Leasing Act of 1920, as amended (MLA); the Department of the Interior's Federal Lands Cooperative Agreement with the State of Utah; the Federal Land Policy and Management Act of 1976, as amended (FLPMA); and all other applicable State and Federal laws, such as the Endangered Species Act of 1973; the National Historic Preservation Act of 1966, as amended; the Archaeological and Historic Preservation Act of 1974; the Archaeological Resources Protection Act of 1979; the American Indian Religious Freedom Act of 1978; the Native American Graves Protection and Repatriation Act of 1990; the Clean Air Act of 1955, as amended; and the Federal Water Pollution Control Act of 1977, as amended (i.e., the Clean Water Act). (See Appendix D for a discussion of the role that Federal and State agencies have in Project approval.)

For the Project, the Agencies' conditions of approval would include, but not be limited to, the following:

- <u>Condition No. 1.</u> — The coal mine operator shall submit a detailed evaluation of the Smoky Hollow life-of-mine area to the Authorized Officer, identifying all areas that have a high probability for future surface disturbances due to mining-related subsidence. This evaluation shall be submitted at least 2 years prior to disturbance. In coordination with the Utah State Historic Preservation Officer (SHPO) and others, the Authorized Officer will identify additional paleontological and cultural resource inventory, evaluation, and mitigation measures that may be required.

- <u>Condition No. 2.</u> — The operator/grantee shall mitigate anticipated development and development-related impacts to paleontological resources of significant scientific interest and/or prehistoric or historic resources, or Native American traditional cultural properties found to be eligible for nomination to the National Register of Historic Places. The operator shall submit a mitigation/data recovery plan to the Authorized Officer at least 2 years prior to disturbance. An approved mitigation/data recovery plan must be successfully completed prior to disturbing the development site(s).

- Condition No. 3. — If, during development, operation, and/or reclamation activities, previously undiscovered paleontological, prehistoric, or historic resources, or traditional cultural properties of significant scientific interest are discovered, the operator/grantee shall ensure that the resources are not further disturbed and shall notify the Authorized Officer of their nature and location. The operator/grantee shall take all such necessary actions as are required by the Authorized Officer to protect the resource, in coordination with the responsible SHPO. If required, an approved mitigation/data recovery plan must be successfully completed prior to reinitiating development, operation, and/or reclamation activities at the site(s).

- Condition No. 4. — The operator/grantee shall conduct intensive field inventories in that part of John Henry Canyon (i.e., north-facing slopes) that could be affected by the construction of the proposed Benchtop Road for the presence or absence of the Smoky Mountain evening primrose and those Tropic Shale areas that could be affected by the proposed reconstruction of the Warm Creek Road for the presence or absence of the Higgins biscuitroot. A report of findings must be prepared and submitted to the appropriate Federal and State agencies no more than 2 years prior to initiation of disturbance activity. Additional inventory, evaluation, and mitigation measures, if necessary, would be coordinated with the agencies involved.

- Condition No. 5 — The operator/grantee shall comply with all terms and conditions of the biological opinion from the U.S. Fish and Wildlife Service necessary for the continued existence of the Mojave population of the desert tortoise during all development, operation, and/or reclamation activities at the proposed unit-train loadout facility near Moapa, Nevada. Intensive inventories for the presence of desert tortoises or eggs in or around the unit-train loadout facility would be conducted, and a report of findings must be prepared and submitted to the appropriate Federal and State agencies no more than 1 year prior to initiation of disturbance activities. Additional inventory, evaluation, and mitigation measures, if necessary, would be coordinated with the agencies involved.

- Condition No. 6 — The bulk carrier transport company will be responsible for compliance with either Section 7 or Section 10 of the Endangered Species Act of 1973, as amended, and with provisions of the Washington County Habitat Conservation Plan for the threatened desert tortoise if: (1) it is determined that the proposed truck maintenance facility should be located in or around Hurricane, Utah, and (2) desert tortoise habitat is determined to be present in the area.

- Condition No. 7 — The operator/grantee shall conduct intensive field inventories in (1) that part of Wesses Canyon that could experience the surface effects of proposed underground mining (subsidence) at the Smoky Hollow Mine for the presence or absence of the Mexican spotted owl; (2) that part of John Henry Canyon that could be affected by the construction of the proposed Benchtop Road for the presence or absence of the Mexican spotted owl; (3) those areas in and around Lake Powell that could be affected by the proposed reconstruction of the Warm Creek Road for the presence or absence of the peregrine falcon; and (4) those areas in and around Iron Springs that could be affected by activities associated with the proposed Iron Springs unit-train loadout for the presence or absence of the ferruginous hawk. A report of finding must be prepared and submitted to the appropriate Federal and State agencies no more than 1 year prior to initiation of disturbance activity.

Additional inventory, evaluation, and mitigation measures, if necessary, would be coordinated with the agencies involved.

2.1.2 Alternative 2: Disapproval of the Applicants' Proposals

Under this alternative, the Agencies would disapprove the Applicants' plans of operation for the proposed Project (summarized in Appendix A) because (1) they did not meet the requirements of all applicable Federal and State laws, or (2) they would incur, or had the potential to incur, unacceptable impacts on the human environment.

2.2 OTHER ALTERNATIVES CONSIDERED

Several additional alternatives were identified by both the public and the Agencies during scoping activities for this EIS but are not being fully analyzed for a variety of reasons. The President's Council on Environmental Quality (CEQ) is very specific when it directs Federal agencies to reduce excessive paperwork by using scoping activities to narrow the scope of the environmental impact statement process (CEQ 1978, 40 CFR §1500.4(g)). It also points out that the range of alternatives discussed in an EIS includes all reasonable alternatives, as well as those other alternatives which are eliminated from detailed study. "Reasonable alternatives include those that are *practical* or *feasible* from the technical and economic standpoint and using common sense, rather than simply *desirable* from the standpoint of the applicant" (46 FR 18026-18027). The following alternatives were considered by the Agencies during the preparation of this EIS but were eliminated from further, detailed analysis.

2.2.1 Alternatives to the Proposed Location for Project Components

- Alternate locations for the Smoky Hollow Mine and its surface facilities complex within the 36,419 acres of Federal and State coal reserves currently under lease to Andalex in the Smoky Mountain area were evaluated. In particular, the Agencies reviewed those locations proposed by The Resources Company in the mid-1970s in conjunction with the proposed Kaiparowits Power Project. Environmental issues associated with the development of coal resources from these proposed facilities were addressed by BLM and USDOI in earlier environmental documents (Section 1.5, Scope of the EIS Analysis). The Agencies also reviewed several locations on the upper benches of Spring Point and Smoky Mountain and in the drainages along John Henry, Wesses, Smoky Hollow, and Squaw Canyons for placement of the proposed surface facilities complex for the Smoky Hollow Mine. These locations were initially considered because of their proximity to this proposed life-of-mine area but were eliminated from further consideration by the Agencies as a result of (1) their nearness to, and visibility from, the Wahweap and Burning Hills Wilderness Study Areas; (2) the amount of excess waste rock that would be generated during rock slope development; and (3) the additional access road and powerline infrastructure that would be required to develop and eventually operate a facility at those particular sites.

- Several alternatives to the Applicants' proposed alignment for the Benchtop Road were evaluated by the Agencies. One alignment, proposed by Utah DOT in the 1970s for access to Nipple Bench as part of the Kaiparowits Power Project, would have left U.S. Hwy. 89 northwest of Big Water, crossed Wahweap Creek north of the Wahweap Warm Water Fish Hatchery, traversed the Entrada Cliffs, and followed the existing Nipple Creek Road up Nipple Creek Canyon to the base of Nipple Butte. Environmental issues associated with the development of this access road were addressed by BLM in earlier environmental documents (Section 1.5, Scope of the EIS Analysis). The Agencies considered other routes that would have used the existing Head of Creeks Road along the edge of the Wahweap and Burning Hills Wilderness Study Areas to connect Nipple Creek Road with the existing Smoky Hollow Road, or followed Mustard Canyon to the top of Nipple Bench. In addition, routing adjustments were evaluated that would have placed the road in the vicinity of both Nipple and Tibbet Springs, had the road descend into John Henry Canyon near the head of the canyon or had the road parallel the streambed from the top of Smoky Hollow Canyon.

  These alternatives were determined not to be reasonable for a variety of reasons: (1) the potential for increased impacts to areas with cultural and wetland values; (2) the nearness to, and visibility from, the Wahweap and Burning Hills Wilderness Study Areas; (3) the increased visibility of certain stretches from U.S. Hwy. 89, Big Water, or the Glen Canyon NRA; or (4) increases in engineering complexity and cost of construction. In addition, many of these alternatives would have involved a longer roadway, thereby increasing the amount of construction and the subsequent amount of surface disturbance.

- Several possible alignments for the proposed 138-kV power transmission line from its tap point to the proposed mine were evaluated. They included several possible routes proposed as part of the Kaiparowits Power Project, as well as (1) branching off from the Garkane line on the flank of Flat Top Mountain, southwest of Big Water, and following a direct route to Nipple Bench; (2) branching off of the UP&L line west of Big Water and crossing Wahweap Creek near the Wahweap Warm Water Fish Hatchery; and (3) using the proposed alignment as far as Big Water, but placing the line adjacent to either the existing Warm Creek Road through the Glen Canyon NRA or the proposed Benchtop Road over Nipple Bench. In addition, routing adjustments were evaluated that would have either placed the tap point along U.S. Hwy. 89 or placed the powerline in the immediate vicinity of the Wahweap Warm Water Fish Hatchery or in areas containing cultural resources.

  These alternative alignments were eliminated from further consideration because of Agency concerns with cultural resources, and the visibility of the alignments, or parts of the alignments, from U.S. Hwy. 89, the Glen Canyon NRA, and the Wahweap Wilderness Study Area. The lack of available access for powerline construction and the increase in engineering complexity and construction costs involved were also considered. Environmental issues associated with powerline right-of-way development in the Smoky Mountain area were addressed by BLM in earlier environmental documents (Section 1.5, Scope of the EIS Analysis).

- Several alternative locations for the proposed unit-train loadout facility near Moapa were evaluated. Two sites along the Union Pacific railline (north of Moapa and east of the powerplant, and along Weiser Wash, east of Moapa) were eliminated because of local industrial siting concerns. A third site, along the Union Pacific railline in The Narrows segment of the Muddy River Canyon, was eliminated because of the difficulty in designing a facility that could take advantage of the limited road access but which would lie outside of the Muddy River floodplain.

- The Agencies evaluated alternate locations for the unit-train loadout facility in the Iron Springs area, including several parcels of private and private/public land north of the Iron Springs Road along Iron Springs Wash, and a disturbed part of an abandoned iron mining site adjacent to the Iron Springs Road. Concerns about floodplains, wetlands, and alluvial valley floors eliminated the first group of locations from further consideration, and legal concerns associated with possible hazardous material issues eliminated the other.

- The Agencies initially evaluated an additional (i.e., third) unit-train loadout facility that could have been located near either Williams or Flagstaff, Arizona. This loadout, along the main railline for the Santa Fe Railroad, would have provided access to those additional coal markets served by that rail system. The possibility of a third loadout in Arizona was eliminated from further consideration when it became obvious that truck and highway load limits in the State of Arizona would have required the operator to haul smaller, nonstandard loads of coal. As a result, the proponent withdrew the right-of-way applications for those sites.

- Several hypothetical locations for the truck maintenance facility were examined by the Agencies. These included several other private land parcels in Hurricane and Fredonia, as well as locations along the proposed truck route in or near Big Water, Kanab, Hildale/Colorado City, Cedar City, and Moapa. The truck maintenance facility locations identified in the EIS are hypothetical for the purposes of the impact analysis. The actual location and number of facilities would be selected by the specific contractor chosen to provide truck haul and maintenance services. Alternate locations were eliminated because they were located in areas already receiving social or economic impact from the Project, or were not conveniently accessed from both truck routes.

2.2.2 Alternatives to the Proposed Method and Route of Coal Haulage

- Several alternate methods for the transportation of the produced coal to prospective markets were evaluated. Coal transport by airplane, conveyor belt, boat, or private haul road were eliminated as being obviously unfeasible. Possible development of either a railroad or a slurry pipeline for coal haulage (to the south, through the Navajo Indian Reservation connecting with the existing Santa Fe railline near Flagstaff, Arizona, or to the west, connecting with the existing Union Pacific railline near Cedar City, Utah) was determined to be unreasonable owing to Agency concern over wilderness, environmental, water, and Native American issues, as well as the engineering, cost, and maintenance problems associated with these alternatives.

- The use of either a conveyor or a rail system to transport coal from the mine to a truck loadout facility near Big Water was evaluated because of the potential to eliminate the need for either the reconstruction of the Warm Creek Road or the construction of the Benchtop Road. Several factors made these options unreasonable, including Kane County's desire to improve vehicular access in the

Smoky Mountain area; the continuing need for workers and equipment to gain access to the Smoky Hollow minesite; the need for another new loadout facility; the complexity of the engineering that would be required; the amount and cost of construction material; and the lack of any reasonable reduction in the predicted level of surface disturbance or other environmental impact from that of the proposal.

- Several alternate highway routes were suggested for use by trucks hauling coal between Big Water and the Iron Springs and Moapa unit-train loadouts. The Agencies evaluated alternate routes that would have utilized existing roadways: following State Street in Hurricane, rather than making two 90-degree turns along Utah Route 59; avoiding La Verkin by routing all traffic to Interstate-15 along Utah Route 9; or, avoiding west Hurricane by routing all traffic through La Verkin along Utah Route 9/17. The Agencies also evaluated alternate routes that would have required new highway construction on the part of the proponent, Utah DOT, Iron County, Washington County, or Kane County: a new private haul road bypassing Kanab to the south; a new private haul road bypassing Hurricane to the south; several possible realignments of Utah Route 59 east and south of Hurricane (extend the Hurricane grade around town, follow Gould Wash, follow the Utah/Arizona State line from the Hildale Industrial Park, or pass through Warner Valley); reconstruction of the Old Sheep Road to bypass Hurricane Hill and access either Utah Route 9 or Utah Route 17 to the north of Hurricane; and/or, a new Iron County road leaving Interstate-15 at the Hamilton Fort interchange and passing west of Cedar City. The Agencies eliminated these routing options, both existing and new construction, from further consideration because of (1) the presence of an adequate, federally funded public highway system and (2) the lack of planning, funding, or identified need on the part of the government entities involved that would be essential for expansion of the public highway system.

2.2.3 Alternatives to the Proposed Method for Providing Power or Telephone Services for the Smoky Hollow Mine

- The Agencies evaluated the possibility of generating power onsite for use in the underground mining operations in order to eliminate the need for construction of a new 138-kV power transmission line. The option of using either solar panels or diesel engines to supply the permanent power needs at the Smoky Hollow Mine were eliminated because of the tremendous size of both the facility and the various support operations that would be required to provide a continuous supply of 12,500-volt power and assure safe underground operations. The potential for impacts to air quality, visual, aesthetic, cultural, and wildlife resources made these alternatives unreasonable. Environmental issues associated with the use of diesel power at the Smoky Hollow minesite were addressed by BLM in earlier environmental documents (Section 1.5, Scope of the EIS Analysis).

- The Agencies also evaluated the possibility of burying the 138-kV power transmission line to avoid the visual impacts of an aboveground installation but eliminated this option from further consideration. Although possible, this approach to powerline installation would be contrary to established industry practices for such a large power transmission line. In addition, the small gains from a reduction in visibility would not offset the higher levels of disturbance that would be necessary, along with the associated impacts to sensitive resources in the area. This would be particularly true in Nipple, Tibbits, and John Henry Canyons, where extensive sections of the line would need to be placed in solid rock.

- A recommendation to install a wire-based telephone communication system within the 138-kV power transmission line corridor to eliminate the need for the Spring Point reflector and the Mustard Point repeater facilities was reviewed by the Agencies. Installing the system aboveground, on the same poles used for the powerline, would be contrary to established industry practices for such a large power transmission line, primarily due to interference and power transmissivity problems. A buried communication line, within the powerline right-of-way or any other possible corridor, would introduce the same problems with increased levels of disturbance and the associated impacts to sensitive resources that were discussed above concerning the possible burying of the powerline. The Agencies determined that the possible advantages did not outweigh the negative aspects of the alternative.

- Construction of the powerline and the microwave communication facilities using helicopters was suggested to reduce the amount of surface disturbance necessary to gain reasonable road access. The Agencies determined that the extensive road network already present in and around the areas proposed for the powerline and microwave rights-of-way made this alternative unnecessary. Past reclamation success in the area suggests that these areas could be successfully reclaimed to be substantially unnoticeable.

2.2.4 Other Alternatives

- The no action alternative, or the refusal on the part of the Agencies to act on the applications that have been submitted, was evaluated and determined not to be reasonable, considering the various applications associated with the Project. The Applicants have fulfilled the requirements of applicable laws and filed the necessary application packages with the Agencies. Therefore, a decision (action) by the Agencies on whether or not to approve the various applications is required by law.

  However, for the Agencies, the impacts to the human environment of implementing the no action alternative would be essentially the same as those of disapproving the Applicants' proposals (Alternative 2). Thus, for the purpose of this EIS, these alternatives are considered equivalent, and the no action alternative is not analyzed further.

- The alternative to approve the proposed mining plan for the Smoky Hollow Mine without additional conditions was evaluated and determined to be inappropriate. The Utah Rules, SMCRA, and the Department of the Interior's Federal Lands Cooperative Agreement with the State of Utah require the Secretary of the Interior to approve, conditionally approve, or disapprove the mining plan submitted by Andalex for the Smoky Hollow Mine (Section 1.1, Purpose and Need for an Environmental Impact Statement). However, if additional conditions are necessary for the mining plan to be acceptable under the applicable regulations, approving it without those conditions would not be a reasonable alternative.

- Alternatives that would have analyzed various combinations of approval or disapproval of Project elements were evaluated and determined to be unnecessary. The Agencies anticipate that the decision to approve or disapprove either the mining plan or any one of the various rights-of-way that make up the Warm Springs Project would be made by the specific Authorized Officer for that particular action, based on the merits of the specific proposal. The full range of impacts associated with the Project (maximum and minimum) are encompassed within the approval/disapproval scenarios contained in the current analysis. Selective disapproval of certain "key" elements, such as the mining plan, would of course eliminate the need for most of the other elements, a situation in which the resulting impacts would be similar, if not identical, to Alternative 2: Disapproval of the Applicants' Proposals. These alternatives are not analyzed further.

- Several alternatives to the development of the coal resources at the Smoky Hollow Mine have been suggested. They would essentially provide energy at some other location or through some means other than coal mining, thereby eliminating the need to develop these specific coal resources. Many of these issues were addressed by the Department of the Interior and the Bureau of Land Management in earlier environmental documents (Section 1.5, Scope of the EIS Analysis). These issues are inappropriate in the present analysis because Andalex holds valid leases for coal resources in the Smoky Mountain area, including those within the proposed Smoky Hollow life-of-mine area, and has the legal right to develop those resources, subject to full compliance with all applicable Federal and State laws. Therefore, these alternatives are not analyzed further.

- An alternative that would have evaluated development of all or, at least, a larger portion of the 200-400 million tons of Federal and State coal contained in the 36,419 acres currently under lease to Andalex in the Smoky Mountain area was eliminated from further analysis by the Agencies. As required by Federal law, Andalex has provided the Agencies with a resource recovery plan that would mine all 17 of their leases (the entire leasehold) over a 100- to 150-year period, based on currently available coal quality and geologic data. The Agencies anticipate that Andalex will eventually establish a Logical Mining Unit (LMU) in the Smoky Mountain area that would combine their minable coal reserves into a single administrative unit. The life-of-mine area described in Appendix A of this EIS (Section A.2.1, Smoky Hollow Mine) is one scenario of an LMU at the Smoky Hollow Mine, but other possible scenarios do exist. An LMU would allow mining activities at the Smoky Hollow Mine to represent due diligence for that area during a sustained coal removal period of 40 years. At the time the LMU is formed, the Agencies also expect Andalex to relinquish any excess lease acreages to the Federal Government that would not be part of the LMU and that could not be mined prior to expiration of the leases involved. Additional coal quality and geologic data must be obtained before the final LMU boundaries can be established by Andalex in cooperation with BLM. That activity will not be required for several years (i.e., prior to the end of the 10-year lease term).

  The Agencies also anticipate that Andalex probably would eventually require modifications to its Federal coal leases, logical mining unit, mining plan, or permit to mine coal at some point during the life of the mine. Actual conditions encountered during underground mining operations routinely force changes in the overall mining program to ensure that both maximum economic recovery and environmental protection occurs. Federal regulations recognize this problem and allow for such modifications as new leases, emergency bypass leases, incidental boundary changes, etc., to meet the needs of the coal operator. As with the LMU, additional coal quality and geologic data must be obtained before final boundaries for these various modifications can be established or are even determined to be necessary. That activity may not occur for as many as 30 to 40 years (i.e., when the underground workings reach the outer limits of the current mining plan).

For the purposes of this analysis, the Agencies chose to limit the period for coal removal at the proposed mine to 40 years. Evaluating any large development proposal in the coal industry for periods longer than 40 years is difficult, if not impossible, because of changes in coal marketing, mining technology, and energy production and consumption trends. A variety of economic review parameters (the rate-of-return analysis, present value determinations, etc.) and the limited design life of the equipment necessary to operate the various facilities are all factors in these evaluations. The Agencies are aware that coal mining activity at the Smoky Hollow Mine would probably extend beyond 40 years, so long as the coal reserves continue to be available and the coal market continues to be strong. Limiting the coal removal period to 40 years for the purpose of this analysis follows standard industry planning practices, aligns the mining proposal with the maximum allowable limit for an LMU once it is established, and allows the Agencies to evaluate the impacts of project development, coal removal and transport, mine closure, and bond release within a reasonable time period.

The Agencies have reviewed the resource recovery and protection plan submitted by Andalex as part of their permit application package and are satisfied that maximum economic recovery of the Federal coal resource would take place under the current proposal. Proposed coal removal activities at the Smoky Hollow Mine would not isolate or bypass any Federal reserves, preventing them from being recovered in the future. The Agencies are also fully aware that future expansions of mining activity for LMUs, new leases, or other routine modifications beyond the current proposal, if and when they occur, would require additional approvals from a variety of Federal and State agencies along with the environmental, technical, and economic evaluations that must accompany those decisions. Environmental issues associated with the development of coal resources contained within a 47,768-acre composite of Federal and State lands in the Smoky Mountain area were addressed by BLM and USDOI in earlier environmental documents (Section 1.5, Scope of the EIS Analysis).

- Alternatives that would evaluate the impacts from unplanned or premature closure of the Smoky Hollow Mine were evaluated. The Agencies determined that those impacts, primarily social and economic, would be essentially the same whether mine closure occurred in year 10 or at any other time during the 41- or 42-year life of the proposed operation. The Agencies chose to limit the coal removal period at the proposed mine to 40 years, specifically for the purpose of analyzing the impacts of mine closure within a reasonable time period. The social and economic impacts of mine closure are analyzed in Chapter 4 (Section 4.2.9, Socioeconomics).

- An alternative that would have evaluated coal development at the Smoky Hollow Mine at a higher production rate, possibly as high as 8 million tons per year, was eliminated from further analysis by the Agencies. Andalex and other companies control sufficient coal reserves in the Smoky Mountain area to support higher levels of production, either from this mine or from other new mines. However, neither Andalex nor any other coal company has given any indication that additional development activities are likely to be requested in this area within a reasonably foreseeable time period. The uncertain long-range market for coal and the limitations associated with the existing transportation infrastructure would prevent the development of these reserves at a rate substantially higher than that currently proposed.

Production from the Smoky Hollow Mine is proposed to average about 2.5 to 3.0 million tons per year, with actual production rates expected to fluctuate between 2.0 and 3.0 million tons per year in response to mining conditions, unavailability of equipment, marketing, and/or worker productivity. The Agencies are aware that any substantial increase in annual production at the Smoky Hollow Mine over an extended period would require a proportionate increase in the number of employees, the amount of equipment required, the number of trucks needed to deliver the coal to unit-train loadouts, and the extent of impacts to the environment. Depending on the increase, it could require the addition of one or more longwall mining systems at a cost of over $20 million for each longwall and additional mine, road, and power facilities to meet the additional access, ventilation, and coal storage needs. Future expansions of the mining activity beyond the current proposal, should they occur, would require approvals from a variety of Federal and State agencies, along with the environmental, technical, and economic evaluations that must accompany those decisions. Environmental issues associated with the development up to 12 million tons of the coal resource per year at five separate coal mines in the Smoky Mountain area were addressed by BLM and USDOI in earlier environmental documents (Section 1.5, Scope of the EIS Analysis).

- Alternatives that would require the use of room-and-pillar mining methods throughout the Smoky Hollow Mine, rather than the proposed combination of room-and-pillar and longwall methods, were determined to be unreasonable due to the increased costs and decreased levels of coal recovery that would result. Environmental impacts associated with room-and-pillar methods were determined to be comparable to those associated with longwall methods over the long term. (See Appendix C for a discussion of the methods and equipment associated with the underground mining of coal.)

- An alternative that would require the use of coal silos at the truck and train loadout facilities, rather than allowing open coal piles, was determined to be unreasonable due to increased cost and visual resource concerns and the very limited improvement in erosion and air quality that could result. About 100,000 tons of crushed coal could be stored in the primary stockpile at the loadout at any one time (Appendix A). With an average capacity of 10,000 tons of coal per silo, each loadout would need at least 10 silos to maintain their design storage capability.

- Alternatives that would require partial-day or daytime-only coal hauling operations, rather than permitting the 24-hour-a-day operations currently proposed, were eliminated from further consideration. The increased number of trucks per hour required to deliver 2.5 to 3.0 million tons of coal during a restricted time period would cause a proportionate increase in Agency concern for the noise, safety, and traffic congestion issues already present along the haul route. The Applicant's proposal involves the use of the existing, federally funded public highway system; a system that does not place restrictions on the time of day or, with the proper permits in place, the type of traffic allowed.

- An alternative that would require Kane County to completely reclaim the Warm Creek/Benchtop Road after operations cease at the Smoky Hollow Mine was eliminated from further consideration because it is contrary to Kane County's stated intentions for the road. Specifically, Kane County intends to "provide and maintain public road access into the Smoky Mountain area in fulfillment of its responsibilities to provide safe and convenient accommodation of traffic associated with the management and responsible utilization of public land resources within the county to benefit the interests of Kane County," (excerpt from the Resolution of the County Commission of Kane County, Utah; November 16, 1993). Kane County's need for the proposed road would extend far beyond the end of any mining-related activity at the Smoky Hollow Mine.

2.3 COMPARISON OF ALTERNATIVES

Table 4-17 provides a complete listing, by discipline, of all impact comparisons from the Chapter 4 analysis. Table 2-1 provides a selected listing of those comparisons that include the more important impacts. Summaries of the comparisons follow:

- Alternative 1 (approval of the Applicants' proposals, with conditions): If the Agencies choose this alternative, significant impacts could be expected to occur to certain aspects of the socioeconomic resource. Impacts that have the potential to become significant include certain aspects of the paleontological, transportation, noise, socioeconomic, and cultural resources. Certain aspects of the geology and topography, paleontological, soils, vegetation, wildlife, visual/aesthetic, and cultural resources could be irretrievably lost.

- Alternative 2 (disapproval of the Applicants' proposals): If the Agencies choose this alternative, impacts to the resources of the area would continue at existing levels. Certain aspects of the paleontological transportation, socioeconomic, and cultural resources have the potential to become significant. Certain aspects of the geology and topography resource would be irreversible. Certain aspects of the paleontological, vegetation, wildlife, and cultural resources could be irretrievably lost. Incremental impacts resulting from development of the various Project elements would not occur.

Table 2-1 — Summary of Selected Impacts by Alternative for the Warm Springs Project

Impact Topic	Alternative 1	Alternative 2
GEOLOGY AND TOPOGRAPHY		
Impacts to topography in and around the Smoky Mountain area.	Minor to moderate over the short term, negligible to minor over the long term. Impacts on topography would be irreversible.	Negligible. Irreversible.
Impacts to mineral resources in and around the Smoky Mountain area.	Minor over the short term, negligible to minor over the long term. Coal removal would be an irretrievable commitment of the resource.	Negligible to minor.
Impacts to topography along the Warm Creek/Benchtop Road.	Minor to moderate over both the short and long terms.	Negligible to minor.
PALEONTOLOGY		
Impacts to paleontological resources in the Smoky Mountain area.	Minor over the short term, negligible over the long term. Potential to become significant. Loss of paleontological resources would be irretrievable.	Negligible. Potential to become significant. Loss of paleontological resources would be irretrievable.
Impacts to paleontological resources in the Iron Springs and Moapa areas.	Negligible over the short and long terms. Potential to become significant. Loss of paleontological resources would be irretrievable.	Negligible. Potential to become significant. Loss of paleontological resources would be irretrievable.
SOILS		
Impacts to soil productivity in the Warm Springs Project area.	Minor to moderate over the short term, minor over the long term. Losses of soil productivity and development would be irretrievable.	Negligible. Losses of soil productivity and development would be irretrievable.
Impacts to soils in the Smoky Mountain area.	Negligible to minor over the short term, negligible over the long term.	Negligible.
Impacts to cryptogamic soils in the Smoky Mountain area.	Minor over both the short and long terms.	Negligible.

Table 2-1 — Summary of Selected Impacts by Alternative for the Warm Springs Project — (Continued)

Impact Topic	Alternative 1	Alternative 2
VEGETATION		
Impacts to vegetative productivity and community stability in the Warm Springs Project area.	Minor over the short term, negligible to minor over the long term. Loss of vegetative productivity would be irretrievable.	Negligible. Loss of vegetative productivity would be irretrievable.
Impacts to wetland and riparian communities in the Smoky Mountain area.	Negligible to minor over the short term, negligible over the long term. Temporary loss of riparian productivity would be irretrievable.	Negligible. Loss of riparian productivity would be irretrievable.
Impacts to the Smoky Mountain evening primrose and Higgins biscuitroot.	Negligible to minor over both the short and long terms.	Negligible.
WILDLIFE		
Impacts to mule deer movement during migrational periods along Interstate-15 and U.S. Hwy. 89.	Negligible to minor over both the short and long terms. Highway deer mortalities would be irretrievable.	Negligible to minor. Deer mortality would be irretrievable.
Impacts to wildlife habitat and productivity in the Smoky Mountain area.	Minor over the short term, negligible over the long term. Temporary habitat and productivity losses would be irretrievable.	Negligible. Habitat loss would be irretrievable.
Impacts to wildlife in the Smoky Mountain area from increased human presence.	Minor to moderate over the short term, minor over the long term. Mortality and reduced productivity would be irretrievable.	Negligible to minor. Wildlife mortality would be irretrievable.
Impacts to the ferruginous hawk, golden eagle, peregrine falcon, and other raptors in the Warm Springs Project area.	Minor over both the short and long terms. Mortalities would be irretrievable.	Negligible. Mortalities would be irretrievable.
Impacts to the Mexican spotted owl in the Smoky Mountain area.	None to minor over both the short and long terms.	None to negligible.
Impacts to the desert tortoise in the Moapa and Hurricane areas.	Minor over the short term, negligible to minor over the long term. Tortoise mortality would be irretrievable.	Negligible to minor. Tortoise mortality would be irretrievable.

Table 2-1 — Summary of Selected Impacts by Alternative for the Warm Springs Project — (Continued)

Impact Topic	Alternative 1	Alternative 2
TRANSPORTATION		
Impacts to open road traffic flow in the Warm Springs Project area.	Minor to moderate over both the short and long terms. Potentially significant along U.S. Hwy. 89, Utah Route 59, Utah Route 17, I-15.	Negligible to moderate. Potentially significant along I-15 and Utah Route 9.
Impacts to traffic flow at intersections in the Warm Springs Project area.	Minor to moderate over both the short and long terms. Potentially significant at intersections of U.S. Hwy. 89A and Arizona Route 389; Utah Route 59 and Utah Route 9; Utah Route 9 and I-15; Utah Route 9 and Utah Route 17; and I-15 and Utah Route 56.	Minor to moderate. Potentially significant at intersections of U.S. Hwy. 89A and Arizona Route 389; Utah Route 59 and Utah Route 9; Utah Route 9 and I-15; Utah Route 9 and Utah Route 17; and I-15 and Utah Route 56.
Impacts to highway infrastructure in the Warm Springs Project area.	Minor to moderate over both the short and long terms. Potentially significant along Utah Routes 17, 56, 59, and Hidden Valley Road.	Minor to moderate. Potentially significant along Utah Routes 17, 56, 59, and Hidden Valley Road.
Impacts to public safety along highways in the Warm Springs Project area.	Moderate to major over both the short and long terms. Potentially significant along I-15, Utah Route 9, Utah Route 59, and U.S. Hwy. 89.	Moderate to major. Potentially significant along I-15, Utah Route 9, Utah Route 59 and U.S. Hwy. 89.
Impacts to structural integrity and stability of county roads in the Smoky Mountain area.	Minor over the short term, negligible over the long term.	Negligible.
NOISE		
Impacts from noise generated along the roads in the Warm Springs Project area.	Minor to moderate over both the short term, minor over the long term.	Minor.
Impacts from noise generated in the Iron Springs and Moapa areas.	Negligible over both the short and long terms.	Negligible.
Impacts from noise generated in the Smoky Mountain area.	Minor over both the short and long terms. Potentially significant along the Warm Creek/Benchtop Road.	Negligible.
SOCIOECONOMICS		
Impacts to employment, population, personal income, and business activity in the Warm Springs Project area.	Moderate to major over both the short and long terms. Potentially significant in Big Water and Kanab, Utah; and Fredonia, Arizona.	Moderate to major.

Table 2-1 — Summary of Selected Impacts by Alternative for the Warm Springs Project — (Continued)

Impact Topic	Alternative 1	Alternative 2
SOCIOECONOMICS (Con.)		
Impacts to local government fiscal resources in the Warm Springs Project area.	Moderate to major over the short term, moderate over the long term. Significant in Kanab, Big Water, and Kane County. Potentially significant in Fredonia, La Verkin, Toquerville, and Hurricane.	Moderate. Potentially significant in Kane County, Kanab, Big Water, and Fredonia or Hurricane.
Impacts to State and Federal fiscal resources.	Minor to moderate over the short term, minor over the long term. Significant in Utah.	Negligible to minor. Potentially significant in Utah.
Impacts to housing availability in the Warm Springs Project area.	Moderate over both the short and long terms. Potentially significant in Page and Toquerville.	Minor to moderate.
Impacts to public safety agencies in the Warm Springs Project area.	Moderate over both the short and long terms.	Minor to moderate.
Impacts to public schools in the Warm Springs Project area.	Major over the short term, minor over the long term. Significant in Kane County. Potentially significant in Washington County.	Minor to moderate. Potentially significant in Kane County and in Utah.
Impacts to water and sewer systems in the Warm Springs Project area.	Minor to moderate over both the short and long terms. Potentially significant in Page and Toquerville.	Minor. Potentially significant in Page and Toquerville.
Impacts to regional quality of life from population growth in the Warm Springs Project area.	Moderate to major over both the short and long terms. Potentially significant in Fredonia, Big Water, and Kanab.	Moderate.
Impacts to regional quality of life from traffic growth in the Warm Springs Project area.	Moderate to major over the short term, moderate over the long term. Significant in Hurricane, La Verkin, and Toquerville.	Minor to moderate. Potentially significant in Hurricane, La Verkin, and Toquerville.
Impacts to residential property values from population and traffic growth in the Warm Springs Project area.	Minor to moderate over both the short and long terms. Potentially significant in Page, Hurricane, and Toquerville.	Minor. Potentially significant in Hurricane and Toquerville.
Impacts to socioeconomic conditions.	Minor to moderate over both the short and long terms. Potentially significant in Kane County and Kanab, Utah, and Fredonia, Arizona.	Negligible to minor.

Table 2-1 — Summary of Selected Impacts by Alternative for the Warm Springs Project — (Continued)

Impact Topic	Alternative 1	Alternative 2
VISUAL RESOURCES/AESTHETICS		
Impacts to visual resources/aesthetics in the Smoky Mountain area.	Minor to moderate over the short term, minor over the long term.	Minor.
Impacts to visual resources/aesthetics in the Smoky Mountain area along the Warm Creek Road.	Minor and permanent. Irretrievable commitment of visual resource.	Minor.
Impacts to visual resources/aesthetics in the Smoky Mountain area along the route of the Benchtop Road.	Moderate and permanent. Irretrievable commitment of visual resource.	Negligible.
Impacts to visual resources/aesthetics in the Smoky Mountain area along the route of the 138-kV power transmission line.	Minor to moderate over the short term, negligible over the long term.	Negligible.
Impacts to visual resources/aesthetics in the Iron Springs, Moapa, and Hurricane/Fredonia areas.	Negligible over both the short and long terms.	Negligible.
CULTURAL RESOURCES		
Impacts to prehistoric and historic resources in the Warm Springs Project area.	Minor and permanent. Loss of NRHP-eligible prehistoric or historic sites would be irretrievable.	Negligible and permanent. Potentially significant if an NRHP-eligible site is damaged/destroyed. Loss of a prehistoric/historic site would be irretrievable.
Impacts to undiscovered prehistoric and historic resources in the Warm Springs Project area.	Minor and permanent. Potentially significant if undiscovered sites are destroyed. Loss is irretrievable.	Negligible and permanent. Potentially significant if an NRHP-eligible site is damaged/destroyed. Loss of a prehistoric/historic site would be irretrievable.
Impacts to Native American cultural and religious concerns in the Warm Springs Project area.	Minor and permanent. Potentially significant if unidentified Native American cultural/religious sites are destroyed. Loss of Native American cultural/religious site would be irretrievable.	Negligible and permanent. Potentially significant if a Native American cultural/religious site is damaged/destroyed. Loss of a Native American religious/cultural site would be irretrievable.
Indirect (secondary) impacts to prehistoric and historic resources in the Warm Springs Project area due to increased levels of activity.	Minor and permanent. Potentially significant if NRHP-eligible sites are disturbed. Loss of a prehistoric/historic site would be irretrievable.	Negligible and permanent. Potentially significant if an NRHP-eligible site is damaged/destroyed. Loss of a prehistoric/historic site would be irretrievable.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

CHAPTER 3

3.1 GEOLOGY AND TOPOGRAPHY

3.1.1 Introduction

The southern Utah, northern Arizona, and southeastern Nevada area is located in the Colorado Plateaus and the Basin and Range physiographic provinces (Fenneman 1931). The Colorado Plateaus province includes southwestern Colorado, the southeast half of Utah, most of northern Arizona, and northwestern New Mexico and is characterized by generally flat or gently dipping geologic strata that have been sculpted by erosion to form mesas and plateaus, which are capped by rocks more resistant to erosion (Figure 3-1).

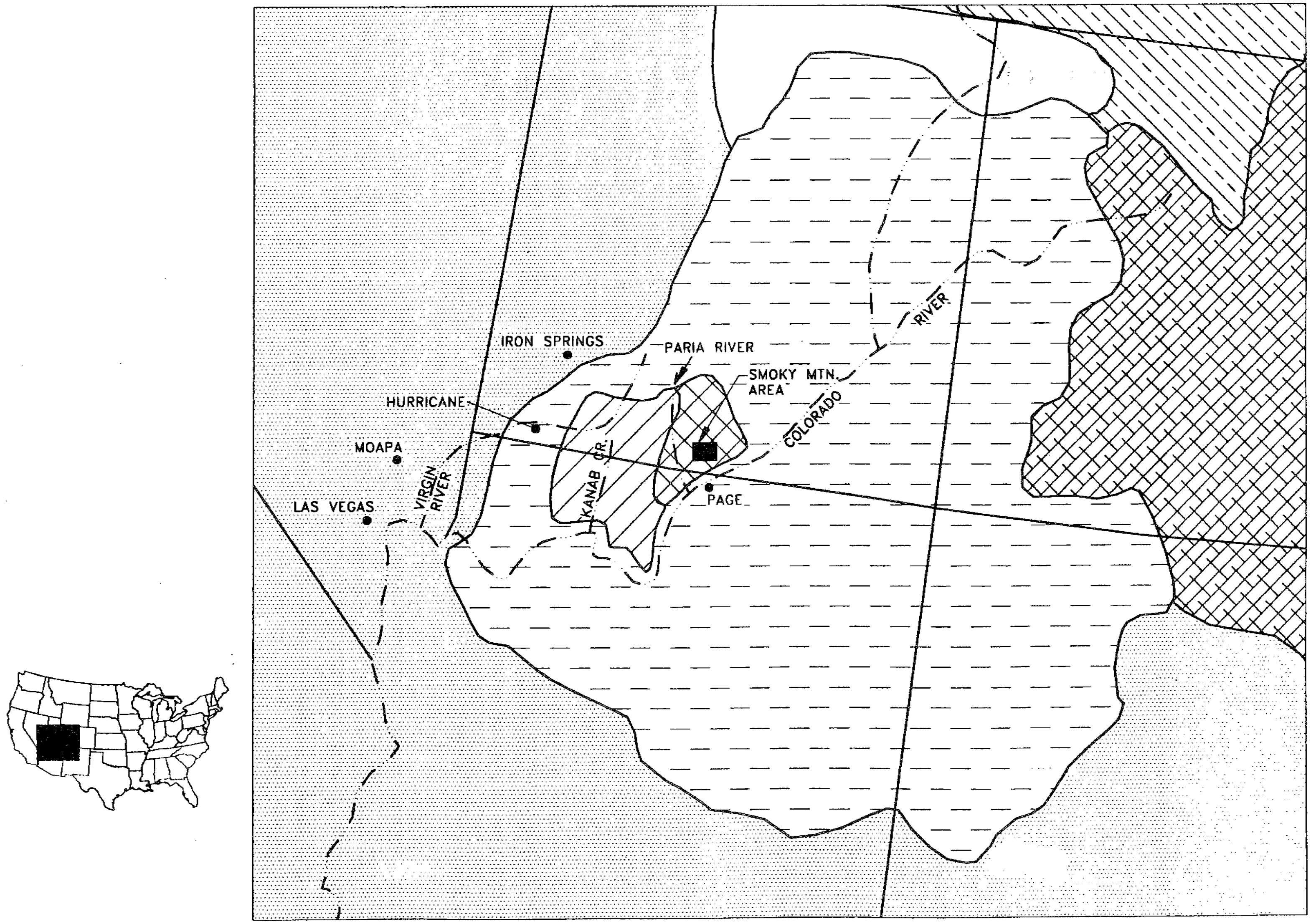
The geological structure of the Colorado Plateaus is typified by large monoclines that are commonly found along the boundaries between large areas of uplifted and downwarped strata (Sargent and Hansen 1976). The Cockscomb, located 15 miles west of Big Water in south-central Utah, is an example of a monoclinal fold. The large areas of uplift and downwarp form the basis of further subdivision of the Colorado Plateaus province. Differences in altitude and character of the underlying strata have heavily influenced the formation of the resulting topography. There are also smaller scale anticlines and synclines located within broad areas of uplifted or downwarped strata.

Most of the Colorado Plateaus province is drained by tributaries of the Colorado River, which is the major source of surface water in the region (Harris 1976). Drainages in the region have cut canyons into the plateaus and have created the topography that typifies the Colorado Plateaus province. Elevations in the province range from 5,000 to 11,000 feet above mean sea level.

The Basin and Range province borders the Colorado Plateaus province on the west, south, and east and stretches from southern Oregon to Texas and continues into Mexico (Fenneman 1931). The area is typified by narrow mountain ranges separated by valleys or basins. The geology of the area is extremely complex, and much of it is hidden beneath alluvial fill in the valleys. The mountain ranges in this province were generally formed by uplifting. They are typically rugged and steep sided and are skirted by alluvial fans, which grade into valley fill deposits in the basins (Harris 1976). The basins typically have no exterior drainage (Longwell et al. 1965); however, parts of eastern Clark County, Nevada, which lie in a basin area, are drained by tributaries that flow into the Colorado River.

Two geologic subdivisions of the Colorado Plateaus province are identified in the southern Utah area: the Kaiparowits Plateau and the Grand Staircase subdivisions. The Kaiparowits Plateau is an area of downwarped strata and is essentially a large syncline or geologic basin (Sargent and Hansen 1976). The Grand Staircase is an area of south- to north-ascending plateaus that form a series of east- to west-trending massive cliffs (Stokes 1977).

The Kaiparowits Plateau subdivision, like the Grand Staircase, consists of successive south- to north-ascending plateaus or bench sets and is bounded on the west by the Cockscomb, on the east by the Straight Cliffs and Fiftymile Bench, on the south by Glen Canyon and Paria Canyon, and on the north by the Aquarius Plateau. The bench sets that characterize the Kaiparowits Plateau subdivision include, in



LEGEND

- MIDDLE ROCKY MOUNTAINS PROVINCE
- KAIPAROWITS PLATEAU SUBDIVISION
- GRAND STAIRCASE SUBDIVISION
- COLORADO PLATEAUS PROVINCE
- BASIN AND RANGE PROVINCE
- SOUTHERN ROCKY MOUNTAINS PROVINCE
- WYOMING BASIN PROVINCE

NORTH

0 80 160
MILES

SOURCE: FENNEMAN 1931; STOKES 1977

WARM SPRINGS PROJECT

FIGURE 3-1
REGIONAL PHYSIOGRAPHIC PROVINCES

DOI 2026-03-02883

ascending order: the Escalante Bench, Sit Down Bench, Nipple Bench, Fourmile Bench, and the Upper Valley Bench (Sargent and Hansen 1980). The benches reflect the underlying character of geologic strata that crop out in the area. The topography of the area is characterized by relatively flat bench tops that are capped with resistant geologic units. The benches are deeply incised by generally north- to south-trending drainages and canyons and dominate the character of the Kaiparowits Plateau, where the topography, mineral resources, water, climate, vegetation, and wildlife are dependent on the geologic units that comprise a particular bench, its altitude, and its location (Figure 3-2).

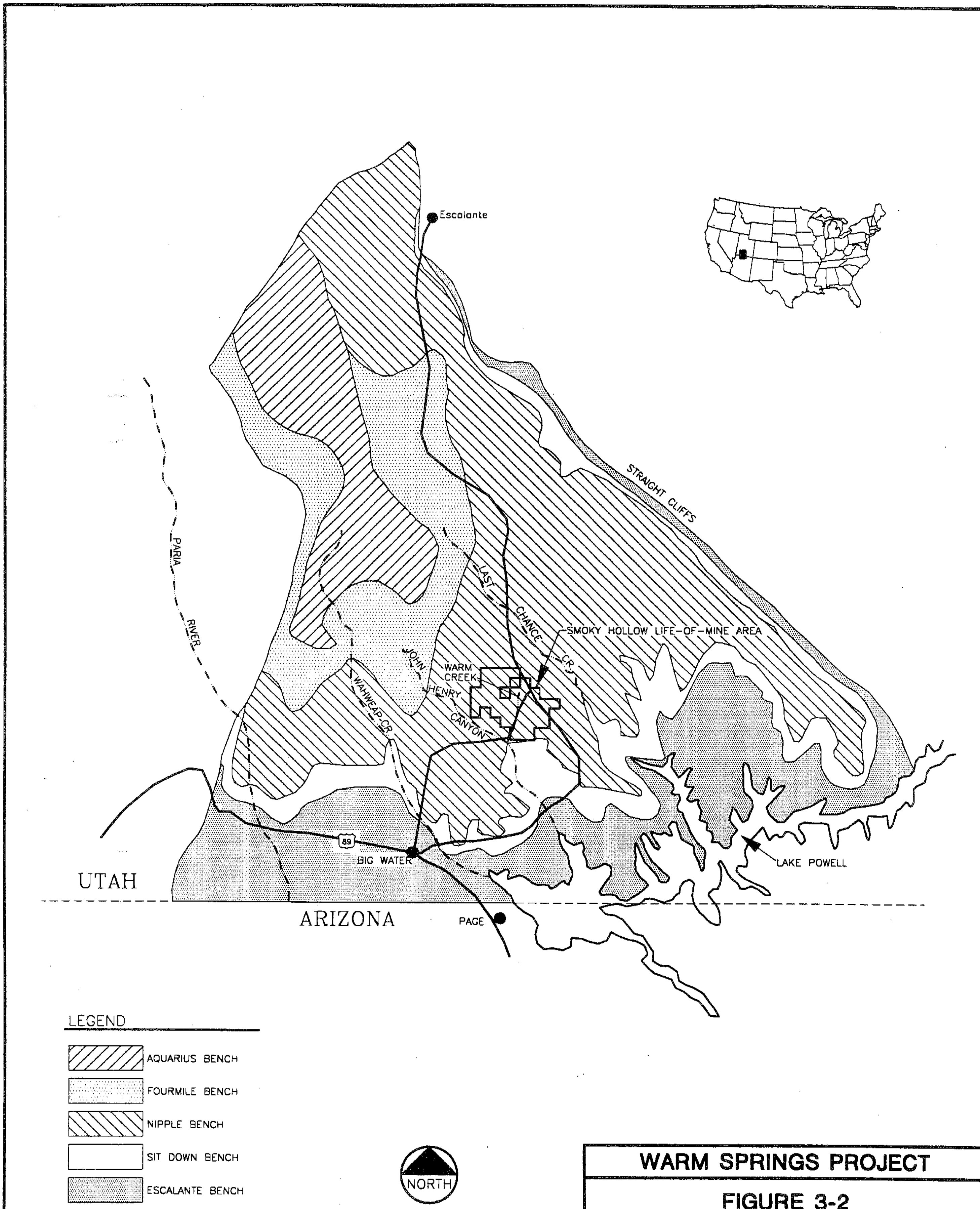
Three fault regions, Four Corners, Grand Canyon, and Utah-Nevada, are present in the area (Howard et al. 1978). The Four Corners fault region, which comprises most of the Colorado Plateau, has been a fairly tectonically stable region, with the last major fault activity believed to have occurred in the northeastern part of the region in western Colorado and eastern Utah. Within the last 10,000 years (Recent to Holocene), no movement has been detected on these faults, but uplift may be ongoing in the northeastern part of the region (Howard et al. 1978). The Grand Canyon fault region, which is also located within the Colorado Plateaus, is characterized by large, steep faults that have been active at infrequent intervals throughout geologic time. There is no evidence of Recent or Holocene movement on these faults. The Utah-Nevada fault region, located within the Basin and Range physiographic province, had frequent faulting in the late Cenozoic (2 million years before present), and the faults are generally strike-slip faults associated with uplifted blocks of mountain ranges (Howard et al. 1978). No Recent or Holocene faults have been identified near the Utah-Nevada fault region. Magnitudes of earthquakes in the area are generally less than 5.0 (National Geophysical Data Center 1993). The largest seismic events in the area range from 5.0 to 5.4 in magnitude.

3.1.1.1 Smoky Mountain Area

The Smoky Mountain area includes the southern part of the Kaiparowits Plateau, from Escalante Bench on the south to Nipple Bench on the north, and is bounded generally to the west by Wahweap Creek and on the east by Rees Canyon (Figure 3-2). The Smoky Mountain area is generally located on Escalante Bench, Sit Down Bench, and Nipple Bench. Geologic formations within the Smoky Mountain area range in age from the Middle Jurassic to the Upper Cretaceous (Figure 3-3). These formations form the distinctive bench sets that characterize the area. Table 3-1 summarizes the descriptions of the formations exposed in the Smoky Mountain area.

The geologic structure of the area is characterized by a series of generally northwest trending anticlines and synclines (Doelling and Graham 1972). From west to east lie the Wahweap Syncline, Nipple Bench Anticline, Warm Creek Syncline, and Smoky Mountain Anticline (Figure 3-4). The proposed life-of-mine area lies generally on the southwestern flank of the Smoky Mountain Anticline. Except in the extreme northeastern part of the proposed life-of-mine area, the strata of the Straight Cliffs Formation gently dip to the southwest into the Warm Creek Syncline.

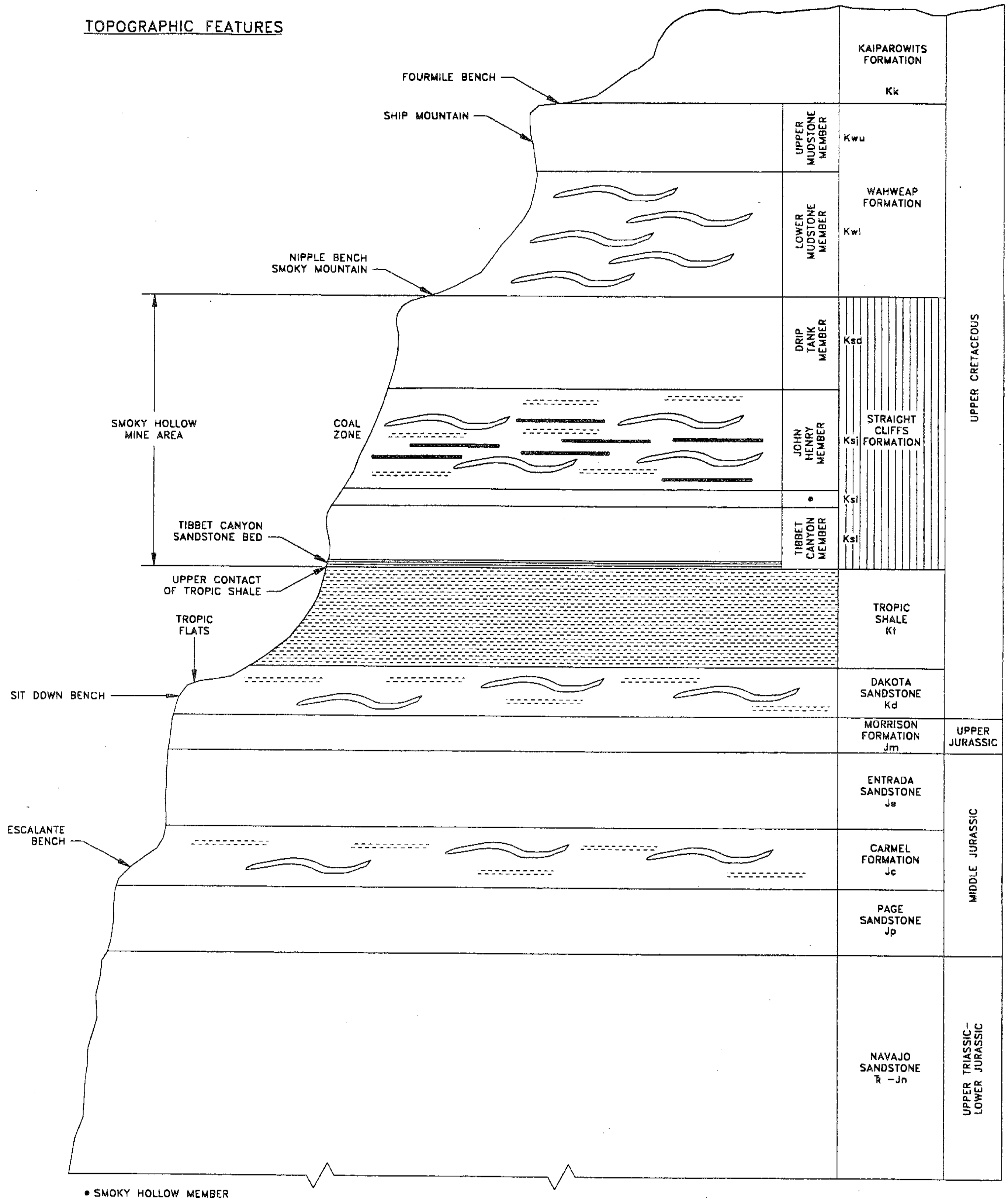
No debris flow hazards or mapped landslide areas have been identified in the Smoky Mountain area. There are, however, infrequent boulder fall zones located along the base of cliffs in the area (Fuller et al. 1981).



WARM SPRINGS PROJECT

FIGURE 3-2
KAIPAROWITS PLATEAU GEOGRAPHIC BENCHES AND MAJOR DRAINAGES

DATE: MARCH 1995 ACAD FILE: FIG3-2.DWG



SOURCE: MODIFIED FROM KAISER ENGINEERS GEOLOGIC REPORT 1976; SARGENT AND HANSEN 1980

WARM SPRINGS PROJECT

FIGURE 3-3
GENERALIZED STRATIGRAPHY OF THE SMOKY MOUNTAIN AREA

DATE: MARCH 1995 ACAD FILE: STRAT.DWG

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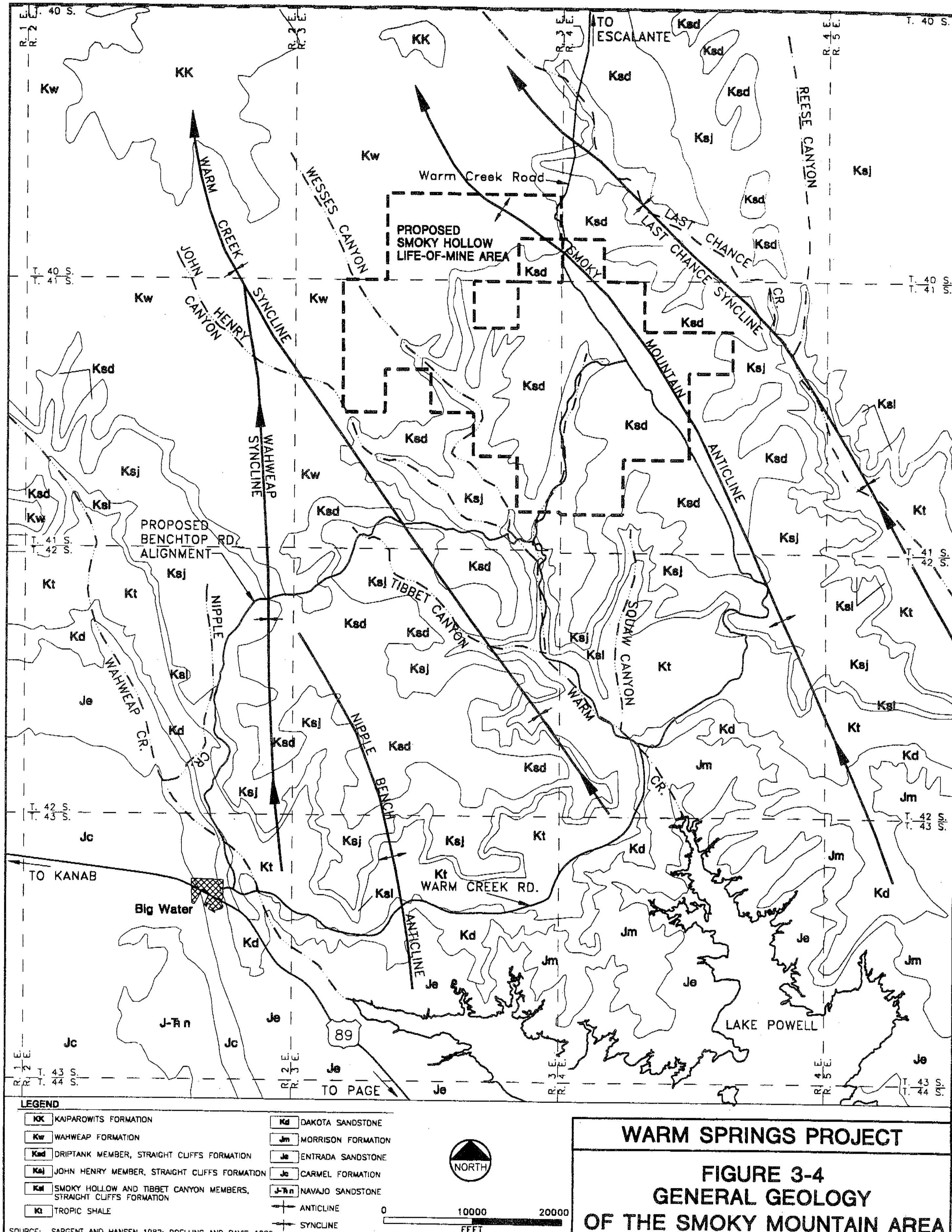
Table 3-1 — Geologic Unit Descriptions for the Smoky Mountain Area

Formation	Age	Description
Wahweap	Upper Cretaceous.	Sandstone and mudstone; 900-1,500 ft. thick.
Straight Cliffs	Upper Cretaceous.	Sandstone, mudstone, carbonaceous shale, and coal; 1,000-1,700 ft. thick.
Tropic Shale	Upper Cretaceous.	Calcareous shale; minor sandstone, siltstone, and limestone; 600-900 ft. thick.
Dakota Sandstone	Upper Cretaceous.	Sandstone, mudstone, shale, and conglomerate; 0-350 ft. thick.
Morrison	Upper Jurassic.	Sandstone, conglomeratic sandstone, mudstone; 0-800 ft. thick.
Entrada Sandstone	Middle Jurassic.	Eolian and marine sandstone and siltstone; 400-1,000 ft. thick.
Carmel	Middle Jurassic.	Limey siltstone, sandstone, limestone, and minor gypsum; 100-900 ft. thick.
Page Sandstone	Middle Jurassic.	Eolian sandstone, 0-250 ft. thick.
Navajo Sandstone	Triassic-Jurassic.	Eolian sandstone, 900-1,800 ft. thick.

Source: Sargent 1984.



WARM SPRINGS PROJECT

FIGURE 3-4
GENERAL GEOLOGY
OF THE SMOKY MOUNTAIN AREA

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3.1.1.2 Iron Springs Area

The Iron Springs area is located in a transition area of the Basin and Range and Colorado Plateaus physiographic provinces (Stokes 1977) and lies about 5,400 feet above mean sea level (Appendix A, Table A-3) in a saddle (referred to as the Iron Springs Gap) between Three Peaks Mountain to the north and Granite Mountain to the south. Surficial geologic deposits in the area consist mainly of unconsolidated alluvial fan and pediment deposits that are Holocene and Pleistocene in age (Mackin and Rowley 1976; Mackin et al. 1976). Surficial deposits in the extreme northeastern part of the proposed Iron Springs unit-train loadout site consist of unconsolidated alluvium from Iron Springs Creek, which lies north of the proposed loadout and drains to the northwest. Bedrock at the site is the Cretaceous Iron Springs Formation, which is roughly geologically equivalent to the Cretaceous formations in the Smoky Mountain area (Hintze 1973). Isolated outcrops of the Iron Springs Formation occur within the area (Mackin and Rowley 1976; Mackin et al. 1976). The Iron Springs Formation is primarily composed of medium- to coarse-grained sandstone with interbedded shale and minor amounts of limestone and coal. No landslide hazards have been identified in the area.

3.1.1.3 Moapa Area

The Moapa area is located in the Basin and Range physiographic province and is situated in a north- to south-trending valley between the Arrow Canyon Range to the west and the North Muddy Mountains to the east (Longwell et al. 1965). Elevation of the proposed Moapa unit-train loadout site is about 1,700 feet above mean sea level (Appendix A, Table A-3). Surficial geologic deposits in the area consist of poorly sorted colluvium composed of cobbles and boulders in a silt matrix that seldom is thicker than 15 to 20 feet (Weide 1982). The colluvium is commonly cemented with calcium carbonate. Bedrock at the site consists of the late Tertiary Muddy Creek Formation. The Muddy Creek Formation is composed of fine-grained sandstone, siltstone, and clay. No landslide hazards have been identified in the area.

3.1.1.4 Fredonia and Hurricane Areas

The Fredonia and Hurricane areas are both located in the Colorado Plateaus physiographic province. Bedrock around Fredonia is the Chinle Formation, composed of sandy shales and fine-grained sandstone. Surface material consists of alluvium or windblown deposits. Bedrock in the Hurricane area is Quaternary in age and is volcanic in origin (Cook 1960). No landslide hazards have been identified in these areas.

3.1.2 Mineral Resources

3.1.2.1 Coal

The Smoky Mountain area is located in the Kaiparowits coal field which is generally defined on the east, south, and west by outcrops of the Cretaceous Dakota Sandstone (Doelling and Graham 1972) and on the north by overlapping Tertiary rocks. The majority of the coal resources in the Kaiparowits coal field are found in the Upper Cretaceous Straight Cliffs and Dakota Sandstone Formations, with minor amounts potentially occurring in the Tropic Shale. The John Henry Member of the Straight Cliffs Formation has two major coal zones: the Rees coal zone and the Christensen coal zone (Doelling and Graham 1972). In the Smoky Mountain area, most of the coal resources are found in numerous coal seams in the Christensen coal zone. Coal reserves in the Kaiparowits coal field could be as much as 15 billion tons, of which 4 billion tons may be minable (Doelling and Graham 1972).

Coal mining in the Kaiparowits coal field has been conducted since the late 1800s. The mining activity has been sporadic. Up until the 1960s, total production of all mines and prospects in the area produced only about 25,000 tons of coal (Doelling and Graham 1972). Mining in the Smoky Mountain vicinity took place at the Spencer No. 1 and No. 2 Mines. These mines, operated in 1913, were located 4 miles southwest of the proposed life-of-mine area and produced very little coal (115 tons reported). In the 1970s, about 12,000 tons of coal were mined from a test mine (the Missing Canyon Coal Mine; Appendix B) located at the proposed site of the Smoky Hollow Mine surface facilities complex. The total acreage under current Federal coal leases in the Kaiparowits coal field is about 75,375 acres. Andalex Resources, Inc. (Andalex), is the largest Federal leaseholder in the southern part of the coal field with about 34,499 acres under lease, of which 23,779 acres are included in the proposed Smoky Hollow Mine area. Other leaseholders in this part of the coal field include 5M Corporation, Inc. (about 22,720 acres) and S. H. West (about 960 acres). Utah Power and Light Company holds about 18,475 acres of Federal leases in the northern part of the coal field. Andalex is the only current leaseholder that has submitted a permit application package for coal development in the entire coal field.

The Andalex leasehold in the Smoky Mountain area contains an estimated 200-400 million tons of recoverable coal. Major seams in the area include the Red seam, the Brown seam, the Purple seam, the Blue seam, and the Green seam. All of these seams are located within a 100-foot to 150-foot band of the Christensen coal zone, separated vertically as well as horizontally by areas of thin coal, high amounts of interbedded shale (partings), or no coal deposition. Seams range from 5 feet to 25 feet in thickness, but average about 8 to 10 feet thick. The Brown seam is located about 25 feet below the Red seam, the Purple and Blue seams are located about 60 feet above the Red seam, and the Green seam is located about 80 feet below the Blue seam, or about 20 feet below the Red seam (Andalex Resources Inc. 1994a, 1995).

In-place coal resources within the proposed Smoky Hollow life-of-mine area are estimated to be 405.7 million tons; actual recoverable reserves are estimated to be 100 to 120 million tons from the Red, Brown, Purple, Blue, and Green seams (Andalex Resources, Inc. 1994a, 1995). The overburden in the proposed life-of-mine area ranges from 0 feet at the outcrop of the Red coal seam in Smoky Hollow and Wesses Canyon up to 820 feet under Smoky Mountain and 1,790 feet under Ship Mountain Point. The average overburden depth over the life-of-mine area is 650 feet.

Coal in the Kaiparowits Basin has an average ash content of 8.96 percent; an average sulfur content of 0.87 percent; a fixed carbon level of 47.25 percent; a moisture content of 11.33 percent; an average volatile matter level of 43.63 percent; and a heat content of 11,999 British thermal units per pound (Btu/lb)(Doelling and Graham 1972). The rank of the coal ranges from subbituminous C to high-volatile A bituminous. Coal rank is based on measurements of the aforementioned properties and is indicative of the degree of physical and chemical alteration of the original organic constituents within a particular coal seam (Schmidt 1979). The coal in the life-of-mine area has properties generally consistent with the area; however, it has a lower average sulfur content of 0.45 percent, a heat content of 11,907 Btu/lb, and its rank is high-volatile C bituminous.

The thickness of the coal seams and the low sulfur content make the coals in the proposed life-of-mine area attractive for mining. Smoky Mountain area coal is amenable to the efficiencies of longwall mining because of consistent thicknesses. (See Appendix C for a discussion of longwall mining.) The low sulfur content of the coal is advantageous, as it creates a relatively low polluting powerplant fuel, which could allow some end-use burners of the coal in some States to burn it without using sulfur dioxide scrubbers and still meet the Clean Air Act (CAA) standards. Burners could also mix higher sulfur coal with this type of low sulfur coal to help reduce their overall sulfur emissions.

Coal in the Smoky Mountain area and the rock above and below the coal have low acid-forming potential, partly as a result of the low sulfur content of the coal, but also because of the presence of calcium carbonate in amounts that neutralize acid (Andalex Resources, Inc. 1994a). In coal in other regions, sulfur, usually occurring as iron sulfides, is commonly found in minerals in the coal (Caruccio et al. 1988). These iron sulfide minerals can become oxidized in the presence of oxygen and water to form iron-rich acidic mine drainages. The iron sulfide content of coal in the Smoky Mountain area is low (Andalex Resources, Inc. 1994a).

3.1.2.2 Oil and Natural Gas

There is a moderate to high potential for oil and natural gas in the Kaiparowits Basin because of the favorable habitat for oil in the Paleozoic and Mesozoic strata that are present. Oil may be present in stratigraphic and structural traps, especially in the Paleozoic rocks. The Kaiparowits Basin contains many of the equivalent Paleozoic formations that are prolific oil and gas producers in the Paradox Basin, located in southeastern Utah and southwestern Colorado. Although the Kaiparowits Basin has a favorable potential for oil and gas, the basin has only one producing oil field. The lack of discovered reserves is not necessarily indicative of the potential for petroleum resources; rather, it is probably the result of minimal exploratory drilling. The Kaiparowits Basin is sparsely drilled compared to other Rocky Mountain basins with a well density of one well per 72 square miles, including producing and wildcat, exploratory, and test wells (Lyons and Montgomery 1985).

The only established oil production area in the Kaiparowits Basin is the Upper Valley field, which lies in Garfield County about 25 miles north of the Smoky Mountain area. The field was discovered in 1964 and produces from Permian Kaibab Limestone and the Timpoweap Member of the Triassic Moenkopi Formation (Peterson 1973). The field has produced, as of August 1994, over 24 million barrels of oil; 23 wells are still productive (Utah DOGM 1994). The field is a structural trap with a strong hydrodynamic water drive (Sharp 1976). Similar trapping potential in Paleozoic rocks may exist in other structures in the area, but exploratory drilling spurred by the discovery of the Upper Valley field did not result in identification of additional fields. Several structures in the basin have not yet been tested. Oil was also found in deeper zones in the Upper Valley field in the Mississippian Redwall Formation and the Permian Coconino and Cedar Mesa Formations, but in uneconomical amounts (Peterson 1973).

Another potential resource associated with hydrocarbon resources is carbon dioxide. Carbon dioxide has been found in wells on the Escalante Anticline, about 10 miles east of the Upper Valley field (Lyons and Montgomery 1985). The Escalante Anticline may contain as much as 4 trillion cubic feet of carbon dioxide. The anticline is located outside the Kaiparowits Basin; however, the basin may have potential for important carbon dioxide resources. The gas associated with oil production at the Upper Valley field is mainly carbon dioxide (Lyons and Montgomery 1985).

Several oil and gas tests have been drilled in the Smoky Mountain area; however, none has resulted in economic production. Three oil and gas wildcat tests were drilled along the axis of the Rees Canyon Anticline northeast of Big Water. The deepest well had a total depth (TD) of 10,045 feet (formation at TD not reported), but no economic shows of petroleum were reported, and all three wells were plugged and abandoned. The last of the Rees Canyon wells was drilled in 1968. Another nearby oil and gas test well was drilled in 1969 and was located about 10 miles to the northwest of the Smoky Mountain area. The well was drilled to a TD of 9,336 feet and penetrated the Cedar Mesa Formation. No shows of oil and gas were reported, and the test was plugged and abandoned. No oil and gas tests have been drilled within the Andalex Smoky Mountain leasehold.

There are active oil and gas leases in the Smoky Mountain area that occur in generally two areas. There are current leases in the Rees Canyon area, where the wildcat wells were drilled (southwestern part of T. 39 S., R. 5 E.; the eastern part of T. 39 S., R. 3 E.; and the northwestern part of T. 40 S., R. 5 E.). These leases total about 16,000 acres. The other area of current oil and gas leases occurs west and south of the proposed surface facilities complex (western part of T. 41 S., R. 4 E., the northern part of T. 42 S., R. 4 E., and scattered areas in T. 41. S., R. 3 E., and T. 42 S., R. 3 E.). These leases cover about 20,500 acres. Oil and gas leased lands make up about 10 percent of the Federal lands within a 20 township area (T. 39 S. to T. 43 S. and from R. 2 E. to R. 5 E.). Much of the area is unleased because of its inclusion in Wilderness Study Areas (Section 3.13, Wilderness). These lands are not available for new oil and gas leasing at this time.

3.1.2.3 Other Mineral Resources

There are a few uranium occurrences in the Kaiparowits Basin (Doelling and Tooker 1983). These are located 15 miles northeast of the Smoky Mountain area in the vicinity of Croton Canyon. Occurrences of uranium in the area are low grade and small (Sargent and Hansen 1976).

No important metallic mineral resources in the Kaiparowits Basin have been identified; however, there are nearby deposits of copper, gold, and iron (Sargent and Hansen 1976). Minor copper deposits are found in association with uranium deposits in the Triassic Chinle Formation. Gold has been found disseminated in the Chinle and Moenkopi Formations near Lees Ferry on the Colorado River and near the old Paria townsite along the Paria River. The gold was mined between 1910 and 1913 by hydraulic mining (Sargent and Hansen 1976). Most of the iron ore mined in Utah came from the Iron Springs district, located in the vicinity of the proposed Iron Springs unit-train loadout. Iron ore has been mined in the Iron Springs area from 1852 to the present, and the ore occurs in veins associated with igneous intrusive bodies.

Sand and gravel resources are located throughout southern Utah. Active gravel workings are located along Wahweap Creek north and east of Big Water (Appendix B, Section B.2.6, Gravel Operations). The gravel deposits of Wahweap Creek supplied millions of tons of aggregate for the construction of the Glen Canyon Dam in the early 1960s and continue to supply material for a variety of road and building projects (Martin 1989).

3.2 PALEONTOLOGY

Paleontological resources are the physical remains, impressions, or traces of plants or animals from past geologic ages. They can include actual remains, casts, molds, and trace fossils, such as burrows or tracks. Fossils can be found almost anywhere, but they are the most obvious in and on rock outcrops, in underground mines where subsurface deposits are exposed, and in any other exposed environment that favored the preservation of plant or animal remains. The presence of fossils is controlled by geologic formations and is not site-specific. Fossils might occur anywhere within a given formation at localities sometimes hundreds of miles apart. Where fossils have been recovered from a given geologic formation in a particular area, they could also occur elsewhere. Paleontological resources are important mainly for their potential to provide scientific dating information, information on the evolutionary history of plants and animals, and information on paleoenvironments and paleoclimates. Vertebrate fossils are considered to be the most important; however, rare occurrences of invertebrates, plants, and other fossils can also provide valuable information.

3.2.1 Fossil-Bearing Formations

Within the southern Utah, northern Arizona, and southeastern Nevada area, there are fossiliferous geologic formations throughout the geologic column. Selected formations of interest include the Morrison, Dakota Sandstone, Tropic Shale, Straight Cliffs, Wahweap, Iron Springs, and Muddy Creek Formations.

The Jurassic-age Morrison Formation, well known for its dinosaur fossils, is a widespread unit that is found from northeastern Arizona to Montana and from central Utah to Kansas and Nebraska (Peterson 1972). Dinosaur bones have been found in the Morrison Formation in widespread localities throughout the region where the unit is defined. Invertebrate fossils have also been found in the Morrison and include snails, clams, and ostracods (Peterson 1972).

The Dakota Sandstone Formation is the lowest Cretaceous-age unit in the southern Utah area. The formation may be either Lower Cretaceous or Upper Cretaceous in age and is similar to other so-called Dakota Sandstones throughout the Colorado Plateaus but is not necessarily time-equivalent to these other sandstones (McGookey et al. 1972). Fossils found in the Dakota Sandstone include petrified wood logs up to 4 feet in diameter (Gregory and Moore 1931), coalified plants, mollusk fossils (including *Exogyra*, a type of fossil mollusk resembling an oyster), worm burrows, shark teeth (Lawrence 1965), turtle, and unidentified bone fossils (Doelling et al. 1989), ray and fish fossils, including the oldest identified fossil of a lungfish in North America (Kirkland 1987), and crocodile, dinosaur, and rare mammal fossils (Cifelli 1987; Eaton 1987, 1993a).

The Tropic Shale Formation is an Upper Cretaceous-age unit that occurs in southern Utah. The Tropic Shale was deposited under marine conditions and is correlative to the Mancos Shale Formation in northern Arizona, western Colorado, and central Utah (Peterson and Waldrop 1965). The Tropic Shale Formation contains numerous shallow marine invertebrate fossils, particularly ammonites, which are extinct cephalopods related to the modern-day nautilus. Ammonites are especially important in making fossil age determinations (Peterson and Waldrop 1965; Peterson 1969b). Other fossils found in the Tropic Shale include mollusks, crabs, fish, and marine reptiles (Doelling et al. 1989), such as mosasaurs (Tilton 1991).

The Straight Cliffs Formation is limited to the southern Utah area. The formation was deposited during the Upper Cretaceous Period in the Colorado Plateaus area. The Straight Cliffs Formation contains numerous fossils, including mollusks, such as snails, oysters, and ammonites; shrimp burrows; nonmarine plants, such as tree logs, leaves, and coalified plant debris; shark teeth (Doelling and Graham 1972; Gregory and Moore 1931); and primitive mammals (Eaton and Cifelli 1988), including one of the potentially oldest marsupial fossils identified (Cifelli 1987; Cifelli and Eaton 1987).

The Wahweap Formation is mainly limited to the southern Utah area and consists of nonmarine deposits (Peterson and Waldrop 1965). The Wahweap Formation has a great abundance and diversity of unique fossils, including fossilized wood, leaf and other plant matter, mollusks, fish, turtle, crocodile, mammals, and dinosaurs, including a known discovery of a tyrannosaurid (Zeller 1973). Because of extensive interbedding, it is not always possible to separate the upper Wahweap Formation from the overlying, commonly more fossiliferous formations (Eaton 1993a).

The Iron Springs Formation is also Upper Cretaceous in age and is probably time-correlative to the Straight Cliffs, Tropic Shale, and Dakota Sandstone Formations (Elder and Kirkland 1993). The Iron Springs Formation is found mainly in southwestern Utah. The stratigraphic relationship of the Iron Springs Formation to the other Upper Cretaceous units in south-central Utah is uncertain. Mammal, dinosaur, crocodile, turtle, and fish fossils have been found. These discoveries have earned the Iron Springs Formation a high paleontological sensitivity rating. In some areas, alluvium overlying the Iron Springs Formation also has a potential for important vertebrate fossils.

The Muddy Creek Formation, although extensive enough to merit formation status, is confined to areas near Lake Mead and some of the larger valleys in northeastern Clark County, Nevada, and southern Lincoln County, Nevada (Longwell et al. 1965). The Muddy Creek Formation has similar characteristics to other late Tertiary formations farther north in Lincoln County, Nevada, and to the south in Arizona. The formation was probably deposited in a closed basin before the Colorado River formed its present course. The Muddy Creek Formation has yielded a variety of fossils including mammals, birds, reptiles, and plants (Reynolds and Scott 1992).

3.2.2 Fossils in the Smoky Mountain Area

The Smoky Mountain area is underlain by the Morrison, Dakota Sandstone, Tropic Shale, Straight Cliffs, and the Wahweap Formations. (See Figure 3-4 for locations of fossiliferous formations within the Smoky Mountain area.)

Morrison Formation exposures occur south and east of the existing Warm Creek Road as it winds around the base of Nipple Bench. The Morrison Formation is thin in this area and pinches out between Big Water and Warm Creek. No important fossils have been located in the Morrison Formation in this vicinity (Madsen 1994c, f).

The Dakota Sandstone Formation is exposed at the base of Nipple Bench and is crossed by the Warm Creek Road as it winds around the base of Nipple Bench between Big Water and Warm Creek. It is also exposed along the Wahweap Creek drainage. The Dakota Sandstone is considered to be an important sensitive fossil-bearing unit. Fossil pelecypods (bivalve mollusks), considered to be of important sensitivity, have been found in the Dakota Sandstone in the Smoky Mountain area (Madsen 1994b, d).

The Tropic Shale Formation lies immediately above the Dakota Sandstone and is exposed along the base of Nipple Bench between Big Water and Warm Creek and in the Warm Creek drainage. The Tropic Shale is considered to be an important sensitive fossil-bearing formation, but no paleontological resources have been identified in the formation in this area (Madsen 1994c).

Important fossils have also been previously located in the Straight Cliffs Formation (Madsen 1994a). The Straight Cliffs Formation forms the slopes and top of Nipple Bench and underlies most of the Smoky Mountain area. Fossilized wood fragments and logs have been located in the Drip Tank Member of the Straight Cliffs Formation (Madsen 1994a). These fossilized wood fragments are common in the Drip Tank Member but are not considered to be paleontologically important (Madsen 1994b).

The Wahweap Formation lies at the top of Nipple Bench in the north-northwestern part of the Smoky Mountain area. Fossilized vertebrate bone fragments, possibly turtle, crocodile, or dinosaur bone, have been found in the Wahweap Formation in this area (Madsen 1994d).

Invertebrate fossil localities have been identified near the confluence of Warm Creek and Squaw Creek (Madsen 1994c). These localities occur in the Dakota Sandstone and reportedly do not contain important fossils (Madsen 1994f). Other fossil localities have been identified in the Tibbet Canyon Member of the Straight Cliffs Formation and in the Tropic Shale near the Warm Creek Road in Smoky Hollow. These localities also reportedly do not contain important fossils (Madsen 1994f).

3.2.3 Fossils in the Iron Springs Area

The Iron Springs area is underlain by the Iron Springs Formation; since much of the formation is covered by alluvium and alluvial fan deposits, outcrops of the Iron Springs formation occur only sporadically. Fragments of petrified wood and small fragments of unidentified fossilized bone have been found in the area (Madsen 1994e). These bone fragments are not considered to be paleontologically important because they were found scattered on the surface and could not be related to any particular strata (Madsen 1994f). No fossils have been identified in the alluvium in this area.

3.2.4 Fossils in the Moapa Area

The Moapa area is underlain by the Muddy Creek Formation. The Muddy Creek Formation is exposed in drainages and along California Wash. Much of the formation is covered by colluvium. Four fossil localities have been identified within the boundaries of the proposed Moapa unit-train loadout (Reynolds and Scott 1992). The fossils found in the Muddy Creek Formation include fossilized rodent bone fragments and fossilized bird tracks, petrified wood fragments, root casts, and fossilized cactus spines. These fossils are typical of the Muddy Creek Formation.

3.3 HYDROLOGY

3.3.1 Introduction

Southern Utah, northern Arizona, and southeastern Nevada are generally located in and drained by the Colorado River drainage basin. Exceptions include the Cedar City and Iron Springs areas, which are drained by the Escalante Valley and Parowan Valley basins. The Escalante Valley and Parowan Valley basins are typical closed drainage basins of the Basin and Range province.

The Colorado River is the major surface-water feature in the region. Other year-round sources of surface water are Kanab Creek and the Paria and Virgin Rivers. These streams begin in the High Plateaus region of southern Utah and flow generally southward, eventually discharging their flows into the Colorado River (Figure 3-1). Kanab Creek lies west of Fredonia, Arizona. The Paria River is crossed by U.S. Hwy. 89 about 15 miles west of Big Water, Utah. The Virgin River lies north and west of Hurricane, Utah, and then parallels Interstate-15 through the Virgin River Canyon. Much of the base flow in these streams comes from seeps and springs (Sandberg and Sultz 1985; Blanchard 1986; Cordova 1981); flows are augmented from snowmelt runoff in the spring and early summer. The region is generally dominated by ephemeral (intermittent) streams, carrying flows only during precipitation events or during periods of snowmelt runoff.

The water quality in the Colorado Plateaus (Colorado River drainage) area varies with elevation, streamflow, and the bedrock over which streams flow (Price et al. 1987). One measure of water quality is the concentration of total dissolved solids (TDS), which is measured in milligrams per liter or parts per million (mg/L or ppm). Higher TDS levels indicate poorer water quality. In this area, the total amount of solid material dissolved in water varies from less than 300 to over 3,000 ppm (Price et al. 1987). A general characteristic of the area is that the water quality, as measured by TDS, declines as the streams flow from higher plateau areas to lower elevation areas. TDS values markedly increase where streams flow over certain geologic formations, such as the Tropic Shale and Carmel Formations (Price et al. 1987). Also, concentrations of TDS are lower during periods of increased flow, such as during runoff from snowmelt. The TDS concentration in the Paria River can vary from less than 500 ppm to over 2,000 ppm over its entire length. The TDS concentrations in the main tributaries of the Virgin River are less than 500 ppm in the higher plateau areas. TDS concentrations in the main stem of the Virgin River can be as much as 2,000 ppm. TDS concentrations in Kanab Creek, below Kanab, Utah, are generally greater than 1,000 ppm.

The concentration of TDS measured in the Colorado River near Lees Ferry, Arizona, ranges from 462 to 602 ppm (Smith et al. 1994).

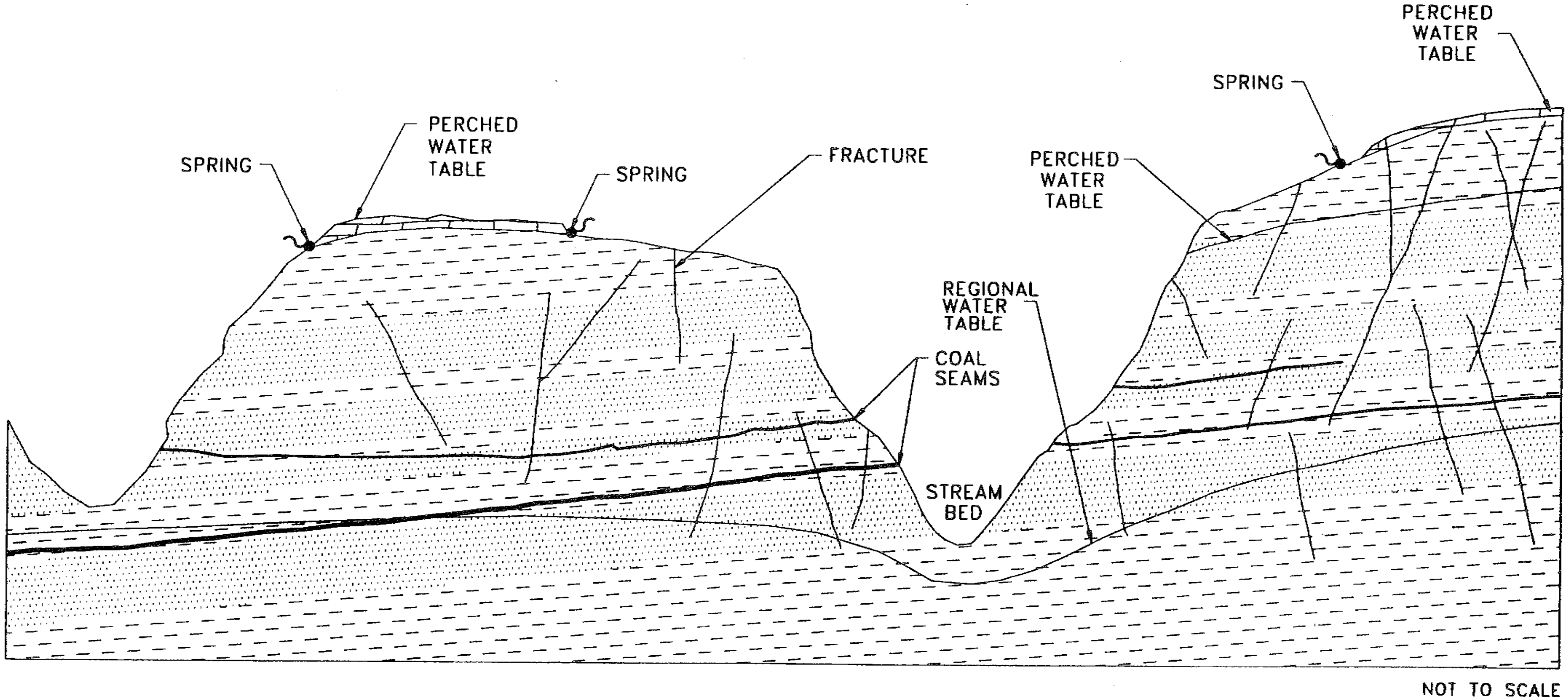
Another measure of water quality is the amount of total suspended solids (TSS), which is also measured in ppm. In the Colorado Plateaus, measurements of TSS can be highly variable, and periods of high flow correspond to higher levels of TSS (Price et al. 1987). Generally, TSS is lower in well-vegetated, higher elevation areas than in areas of sparse vegetation and exposures of easily erodible shale and siltstone. TSS in the Paria River has been measured as much as 100,000 ppm and as low as 1 ppm.

Most of the groundwater resources in the Colorado Plateaus province are primarily found in consolidated sedimentary rocks ranging from Palezoic to Cenozoic in age (Taylor et al. 1986). Other groundwater resources of lesser importance are found in unconsolidated alluvial deposits associated with rivers and streams. Most porous geologic strata contain groundwater within intergranular pore spaces, fractures, and voids (Price et al. 1987). The presence of groundwater is dependent on precipitation, rock permeability, and topography. Geologic strata below the ground surface that yield water in large amounts are called aquifers. (See Chapter 8, Definitions, Abbreviations, and Acronyms, for definitions of groundwater terms.)

The regional water table (the top of the saturated zone at depth) may occur at depths of up to 1,000 feet below the surface in the Colorado Plateaus area (Price et al. 1987). Groundwater that occurs in aquifers at some depth below the ground surface (below the regional water table) is referred to as confined groundwater. Other aquifers that occur at relatively shallow depths and above the regional water table are termed "perched aquifers." Perched groundwater commonly occurs in the plateau areas and is the source of seeps and springs that discharge along canyon walls (Price et al. 1987). In addition to the deeper confined aquifers and perched aquifers, there are aquifers associated with alluvial deposits. In the alluvial aquifers, groundwater is under unconfined conditions and, in the higher altitude areas, is located above the regional water table (Figure 3-5). The aquifers are recharged by precipitation that infiltrates through the ground or they are recharged by water from surface flows. The amount of aquifer recharge that occurs is dependent on the amount of precipitation and on the permeability of the strata through which the water infiltrates.

3.3.2 Smoky Mountain Area

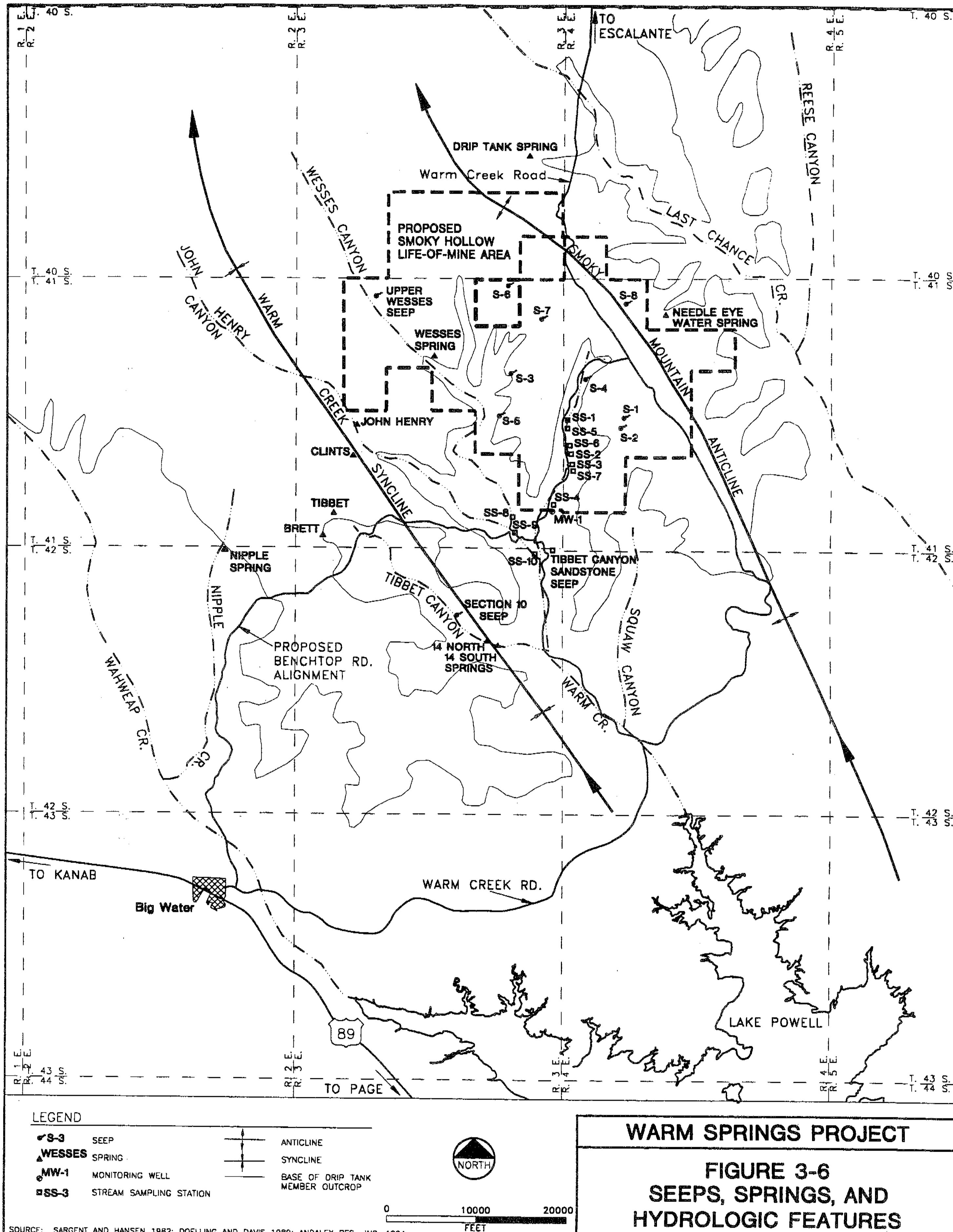
The major drainages in the Smoky Mountain area, from west to east, include Wahweap Creek, Warm Creek, and Last Chance Creek (Figure 3-6). These drainages trend north to south, and their flows drain directly into the Colorado River (Lake Powell) to the south. Other important surface drainages in the Smoky Mountain area consist of deeply incised, north- to south-trending canyons (Figure 3-4). The drainages, from west to east, include Nipple Creek, Tibbet Canyon, John Henry Canyon, Wesses Canyon, Smoky Hollow Canyon, and Squaw Canyon. Nipple Creek Canyon, located on the west side of the Smoky Mountain area, drains into Wahweap Creek, a perennial stream north of Big Water, Utah. Tibbet Canyon, John Henry Canyon, Wesses Canyon, Smoky Hollow Canyon, and Squaw Canyon are tributaries of Warm Creek. On the east side of the Smoky Mountain area is Last Chance Creek. Tributaries of Last Chance Creek drain the east side of Smoky Mountain; a north-south drainage divide separates the Warm Creek drainage from the Last Chance Creek drainage.



SOURCE: Price et al. 1987

WARM SPRINGS PROJECT

FIGURE 3-5
DIAGRAMMATIC DEPICTION OF HYDROGEOLOGICAL RELATIONSHIPS



WARM SPRINGS PROJECT

FIGURE 3-6
SEEPS, SPRINGS, AND HYDROLOGIC FEATURES

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The streams in these canyons are intermittent; flow is present only after major precipitation events or during periods of melting snow (Plantz 1985). Most of the time, the streams are dry. The average annual precipitation in the area is about 8 inches (Price et al. 1987). Springs in the area do not contribute enough flow to maintain a base streamflow throughout the year (Plantz 1985).

Surface water on the southern Kaiparowits Plateau is naturally high in TDS and shows the same general trends in TDS concentration with respect to elevation and bedrock as in the Paria River and Virgin River basins, although the overall water quality on the plateau is somewhat lower than in the Paria and Virgin Rivers. In general, surface water quality in the area is variable but does not appear to vary with stream discharge or time (Plantz 1985). TDS concentrations in Wahweap Creek, Warm Creek, and Last Chance Creek range from less than 1,000 ppm in the higher elevations to greater than 2,000 ppm in the lower canyons, where the drainages cross areas of Tropic Shale and Carmel Formation outcrops.

Water quality baseline measurements in the Smoky Hollow/Warm Creek area indicate that TDS concentrations are widely variable (Andalex Resources, Inc. 1994c). TDS concentrations in surface water have considerable range and in many cases exceed the U.S. Environmental Protection Agency (EPA) recommended TDS concentration limit of 500 ppm for drinking water. Average TDS measurements range from 446 ppm to 2,265 ppm. State of Utah drinking water standards allow up to 2,000 ppm TDS for human consumption, so long as it is demonstrated that no other, better source is available. EPA-recommended concentration limits for TDS range from 3,000 to 7,000 ppm for livestock use, depending upon the type of animal. (A summary of representative TDS concentrations for the area is presented in Table 3-2. Figure 3-6 identifies sample locations in the area.)
Surface water quality, measured by TSS concentrations in surface flows in the vicinity, is also widely variable, but maximum concentrations are consistent with TSS maximum concentrations for other drainage basins of the High Plateaus of Utah (Price et al. 1987). (Representative TSS measurements are also presented in Table 3-2.)

There is no flow in the Smoky Hollow and Warm Creek drainages except during brief precipitation events. The highest flows recorded occurred at a sampling station in Smoky Hollow Canyon about 1 mile south of the proposed surface facilities complex. The maximum discharge recorded was 124.6 cubic feet per second (cfs) (Andalex Resources, Inc. 1994d).

Groundwater in the Smoky Mountain area is generally found in deep, confined aquifers or in shallow, perched aquifers above the regional water table. Although groundwater is present in the alluvium of Wahweap Creek, no groundwater has been found in the alluvium of the Smoky Hollow and Warm Creek drainages (Andalex Resources, Inc. 1994d). In the Smoky Mountain area, the depth to the regional water table (the zone of saturation) is commonly 500 to 1,000 feet or more below the surface, especially in the benchtop areas. Depth to the regional water table underneath canyons and drainages ranges from 200 to 500 feet below the surface (Price 1977a).

Groundwater in the Cretaceous rocks of the southern Kaiparowits Plateau generally occurs in sandstone lenses surrounded by low-permeability rocks, such as mudstones and shales (Price 1977a). These

Table 3-2 — Surface Water Quality Measurements for the Smoky Mountain Area

Sample Site	Period Sampled	TSS (ppm)		TDS (ppm)		pH	
		Range	Average	Range	Average	Range	Average
SS-1	8/16/89 - 11/1/92	294 - 75,380	30,587	[1]282 - 6,502	446	7.3 - 7.5	7.5
SS-2	5/15/92 - 11/1/92	8,260 - 148,000	65,665	[1]200 - 1,400	[1]550	7.5 - 7.8	7.65
SS-3	8/16/89 - 9/7/92	3,970 - >90,000	46,985	[1]332 - 594	463	7.3 - 7.5	7.4
SS-4	7/27/90 - 9/1/93	80,100 - 180,000	130,050	[1]640 - 660	[1]650	7.1 - 7.3	7.2
SS-5	5/30/92 - 9/20/92	11,500 - 65,000	31,433	[1]290 - 808	465	7.1 - 7.6	7.4
SS-6	8/15/92	9,750		[1]1,240		7.7	
SS-7	No Samples	No Samples					
SS-8	7/11/92 - 4/13/93	10 - 206,000	36,614	[1]326 - 6,840	[1]1,953	7.3 - 8.3	8.1
SS-9	7/11/92 - 9/1/93	33 - 50,800	16,874	[1]410 - 11,500	[1]3,562	7.5 - 8.3	7.9
SS-10	3/6/93 - 9/1/93	454 - 283,000	141,727	[1]1,170 - 2,760	[1]2,265	7.5 - 8.3	7.9

Source: Andalex Resources, Inc. 1994d.
TSS = Total suspended solids.
TDS = Total dissolved solids.
[1]Exceeds Safe Drinking Water Act (SDW) recommended standard of 500 mg/L for TDS.

sandstones contain perched groundwater and are isolated from the regional water table that lies much deeper. Because the aquifers in the sandstone are limited in extent, are surrounded by rocks of lesser water-holding capabilities, and have a low rate of recharge, water yields from these sandstone aquifers would be expected to be small (Price 1977a). The sandstones also have low transmissibility (Andalex Resources, Inc. 1994d). Perched groundwater is the source of seeps and springs associated with canyon outcrops. The quality of the perched groundwater in the area, based on TDS concentration, ranges from less than 300 ppm to more than 2,600 ppm (Price 1977a) (Table 3-3).

The major aquifer in the area is the Navajo Sandstone. The Navajo is a medium- to fine-grained sandstone that, where exposed, has been eroded to form prominent cliffs and domes (Sargent and Hansen 1982). In the vicinity of Lake Powell, the Navajo Sandstone ranges from 950 to 1,800 feet in thickness. The top of the Navajo Sandstone could be as much as 2,000 feet below the base of the Straight Cliffs Formation. It is a confined aquifer and lies below the regional water table. The proposed Smoky Hollow Mine is located in an area where the Navajo Aquifer is completely saturated (Blanchard 1986). This area of complete saturation within the Navajo generally coincides with the boundary of the Kaiparowits Plateau. The amount of recoverable water in the Navajo in this area is estimated to be 140 million acre-feet (Blanchard 1986), and annual discharge from wells in the Navajo in the Kaiparowits Plateau area has been estimated at 1,500 to 1,700 acre-feet (Blanchard 1986; Andalex Resources, Inc. 1994d). Wells that produce water from the Navajo at the southern edge of the Kaiparowits Plateau range from 1,000 to 1,600 gallons per minute (gpm) (Price 1977a). The TDS concentration in water from the Navajo Sandstone in wells near Big Water, Utah, ranges from 500 to 1,000 ppm. These wells are as much as 778 feet deep, with the top of the Navajo at about 300 feet (Blanchard 1986). One well has a discharge rate of 20 gpm. Other wells on the south side of Wahweap Bay (Lake Powell) have discharges of as much as 1,200 gpm.

The Drip Tank Member of the Straight Cliffs Formation is the primary source of springs and seeps in the Smoky Mountain vicinity. The Drip Tank Member is the uppermost member of the Straight Cliffs Formation and overlies the John Henry Member in which the coal seams are located. The Drip Tank Member in this area is limited in water resources because it is discontinuous, eroded, and cut by numerous drainages (Andalex Resources, Inc. 1994d). Each plateau area (John Henry Bench, Spring Point Bench, and Smoky Mountain) is an isolated hydrogeologic unit as far as the Drip Tank is concerned because the intervening canyons and drainages preclude the flow of water through the Drip Tank from one plateau to another.

No perennial flowing water is present in the area, but damp or wet zones are encountered at various depths between the surface and the top of the primary coal formation. Generally, there is less evidence of groundwater in areas along the Smoky Mountain Anticline (Figure 3-4). More evidence of water is found in areas to the west, especially along the axis of the Warm Creek Syncline. It is likely that water preferentially accumulates in the structural low formed by the syncline (Andalex Resources, Inc. 1994d). Perched groundwater in the area is limited and has little potential to produce water in appreciable quantities. No correlation has been found between zones of moisture located above the coal.

Twenty-one springs and seeps have been identified in the general vicinity of the proposed Smoky Hollow life-of-mine area (Andalex Resources, Inc. 1994d). The locations of these springs and seeps, fed by perched groundwater in the Straight Cliffs Formation, are plotted in Figure 3-6, and their descriptions and uses are

Table 3-3 — Groundwater Quality Measurements for the Smoky Mountain Area

Sample Site	Period Sampled	TSS (ppm)		TDS (ppm)		pH	
		Range	Average	Range	Average	Range	Average
Seep 2 (S-2)	9/30/90 - 12/4/92	3 - 52	30.50	1,320 - 1,705	1,418.78	6.4 - 8.7	7.38
Seep 4 (S-4)	2/9/91 - 12/4/92	≤1.0 - 4.0	2.5	158 - 208	178.29	6.8 - 8.8	7.9
Clints Spring	2/28/92 - 10/19/94	NA	NA	514 - 906	650	7.4 - 7.8	7.5
Drip Tank Spring	2/28/92 - 10/19/94	NA	NA	805 - 1,160	1,018	7.1 - 7.7	7.38
John Henry Spring	2/28/92 - 10/19/94	NA	NA	662 - 2,660	1,722	7.7 - 8.0	7.8
Needle Eye Water	10/28/93 - 10/19/94	NA	NA	516 - 556	533	7.1 - 7.5	7.3
Tibbet Canyon Sandstone Seep	12/27/89 - 12/4/92	2 - 190	73	820 - 936	886.4	7.5 - 8.9	8.39
Wesses Spring	6/24/94 - 10/19/94	NA	NA	644 - 1,080	875	7.5 - 8.0	7.3
Monitoring Well 1	9/30/90 - 7/15/93	18	18	707 - 1,350	1,235.48	7.5 - 10.9	9.1

Source: Andalex Resources, Inc. 1994a, c.
NA: Not analyzed.

listed in Table 3-4. Springs have been differentiated from seeps on the basis of measured waterflows and documented use, with seeps showing either no measurable flow or slight drips. Springs and seeps in the Smoky Mountain area are very dependent on fluctuations in precipitation; prolonged periods of little or no precipitation can cause flows to fluctuate drastically and/or dry up.

Seeps S-1 through S-8, all fed by the Drip Tank Member, are located within the life-of-mine area but have little or no measurable flow (Table 3-4). Most of these seeps, identified on the basis of observed moisture staining on rocks, salt precipitates, anomalous vegetation, or associated pooled water, are located either on the west side of Spring Point Bench or on the west side of Smoky Mountain. Seep S-8 is located at the head of a drainage on the east flank of Smoky Mountain.

Brett, Clints, Drip Tank, John Henry, Needle Eye Water, Nipple, Tibbet, and Wesses Springs are fed by perched groundwater in the Drip Tank Member. Brett, Clints, John Henry, Nipple, and Tibbet Springs are located southwest of the proposed life-of-mine area and are hydrologically separate from the Drip Tank strata that overlie the proposed mining area because of intervening canyons or drainages.

Drip Tank Spring is located more than a mile north of the proposed mining area, and Needle Eye Water Spring less than a quarter of a 0.25 mile east of the mining area. Both the Drip Tank and Needle Eye Water Springs are fed from Drip Tank strata that cap much of Smoky Mountain. Drip Tank Spring may not have hydrological continuity with the Drip Tank beds that overlie proposed mining areas because of its distance from those areas and its location on the east flank of the Smoky Mountain Anticline. Drip Tank Spring was observed to have slight flow (Table 3-4). However, Needle Eye Water Spring, while also located on the east flank of the Smoky Mountain Anticline, may be fed by strata that overlie proposed mining areas, as it is directly downgradient from and very close to those areas. Little or no flow has been observed from Needle Eye Water Spring (Table 3-4). Wesses Spring is located within the life-of-mine area and is fed by beds that directly overlie proposed mining areas.

Upper Wesses Seep is located above the proposed mining area about 1 mile northwest of Wesses Spring. This seep is fed by the Wahweap Formation, which overlies the northwestern part of the mining area. Slight flow (less than 1 gallon per minute) was observed at the seep (Table 3-4).

The John Henry Member of the Straight Cliffs Formation has only one identified spring or seep. The Section 10 Spring is located in Tibbet Canyon, about 3 miles southwest of the proposed life-of-mine area. The spring may be more properly classified as a seep, as no measurable flow has been observed from the spring. Pooled water is occasionally present (Andalex Resources, Inc. 1994d).

Two springs are present in the Tibbet Canyon Sandstone Member of the Straight Cliffs Formation (Andalex Resources, Inc. 1994d). These springs, 14 South and 14 North Springs, are located in Tibbet Canyon, about 3 miles south of the proposed life-of-mine area. The flow, less than 1 gpm, is supplied from a sandstone within the Tibbet Canyon Sandstone Member. A seep from the Tibbet Canyon Sandstone is present along Warm Creek, 1.5 miles south of the proposed life-of-mine area. The sandstone that feeds the 14 North and 14 South Springs and the Tibbet Canyon Sandstone Seep lies a few hundred feet below the coal seams in the John Henry Member.

Table 3-4 — Seeps and Springs in the Smoky Mountain Area

Spring/Seep	Location	Approximate Flow	Geologic Unit	Observed Use
Seep 1 (S-1)	NE¼NW¼ sec. 20, T. 41 S., R. 4 .E	No Flow 9/90	Drip Tank	None.
Seep 2 (S-2)	SW¼NW¼ sec. 20, T. 41 S., R. 4 E.	No Flow[1] 9/90	Drip Tank	Wildlife.
Seep 3 (S-3)	NE¼NE¼ sec. 14, T. 41 S., R. 3 E.	No Flow 9/90	Drip Tank	None.
Seep 4 (S-4)	W½NE¼ sec. 18, T. 41 S., R. 4 E.	No Flow 9/90	Drip Tank	None.
Seep 5 (S-5)	NW¼NE¼ sec. 23, T. 41 S., R. 3 E.	No Flow 9/90	Drip Tank	None.
Seep 6 (S-6)	NE¼NE¼ sec. 2, T. 4 1 S., R. 3 E.	No Flow[1] 11/94	Drip Tank	Wildlife.
Seep 7 (S-7)	SE¼SW¼ sec. 1, T. 41 S., R. 3 E.	<1 gpm 11/94	Drip Tank	None.
Seep 8 (S-8)	SW¼NE¼ sec. 5, T. 41 S., R. 4 E.	No Flow 11/94	Drip Tank	Wildlife.
Brett Spring	NW¼SW¼ sec. 32, T. 41 S., R. 3 E.	0.25 gpm 5/93	Drip Tank	Stock.
Clints Spring	SW¼SW¼ sec. 20, T. 41 S., R. 3 E.	3 gpm 5/93	Drip Tank	Stock.
Drip Tank Spring	SE¼NE¼ sec. 24, T. 40 S., R. 4 E.	1.5 gpm[2] 6/93	Drip Tank	Stock, wildlife.
John Henry Spring	NW¼NW¼ sec. 20, T. 41 S., R. 3 E.	5.5 gpm 5/93	Drip Tank	Stock.
Needle Eye Water Spring	NW¼SW¼ sec. 4, T. 41. S, R. 4 E.	No Flow 2/92	Drip Tank	Stock.
Nipple Spring	NW¼NE¼ sec. 2 T. 42 S., R. 2 E.	N/A	Drip Tank	Stock, wildlife.
Upper Wesses Seep	NW¼SE¼ sec. 5 T. 41 S., R. 3 E.	< 1 gpm 11/94	Wahweap	Wildlife.
Tibbet Canyon Sandstone Seep	SE¼NW¼ sec. 1, T. 42 S., R. 3 E.	Drip 2/92	Tibbet Canyon	None.
Tibbet Spring	SW¼NW¼ sec. 32, T. 41 S., R. 3 E.	0.23 gpm 5/93	Drip Tank	Stock.
Wesses Spring	SE¼NW¼ sec. 9, T. 41 S., R. 3 E.	7.5 gpm 6/93	Drip Tank	Stock, wildlife.

Table 3-4 — Seeps and Springs in the Smoky Mountain Area (Continued)

Spring/Seep	Location	Approximate Flow	Geologic Unit	Observed Use
Section 10 Seep	SE¼NW¼ sec. 10, T. 42 S., R. 3 E.	No Flow 2/92	John Henry	None.
14 South Spring	NE¼NW¼ sec. 14, T. 42 S., R. 3 E.	3 gpm 2/92	Tibbet Canyon	Stock, wildlife.
14 North Spring	NW¼NW¼ sec. 14, T. 42 S., R. 3 E.	<1 gpm 2/92	Tibbet Canyon	Stock, wildlife.

Source: Anadalex Resources, Inc. 1994d.
[1]Small pool of water with no apparent flow.
[2]Gallons per minute (gpm).

Water quality measurements in the seeps in this area show wide variability over time. TDS concentrations in Seep 2 average 1,419 ppm, and TDS concentrations in Seep 4 average 178 ppm. TDS concentrations in the five springs that issue from various places in the Drip Tank Member, located west of the proposed life-of-mine area, average 740 ppm (Andalex Resources, Inc. 1994d). A monitoring well (MW-1) installed in the Tibbet Canyon Sandstone, about 1 mile south of the proposed surface facilities complex, showed average TDS concentrations of 946 ppm (Andalex Resources, Inc. 1994d). The 14 North and 14 South Springs showed TDS concentrations of 1,179 and 2,668 ppm, respectively. The Tibbet Canyon Sandstone Seep had TDS concentrations that averaged 946 ppm (Andalex Resources, Inc. 1994d).

There are no permitted water supply wells in the vicinity of the proposed life-of-mine area (Andalex Resources, Inc. 1994d). The seeps from the Drip Tank Member within the proposed life-of-mine area do not produce enough flow to provide reliable sources of water for wildlife or livestock. The springs from the Drip Tank Member, located west of the proposed life-of-mine area, have enough flow to be used as sources of water for livestock or wildlife (Andalex Resources, Inc. 1994d). Strata with perched groundwater above the coal seams do not have the productivity and continuity to be usable aquifers. The Tibbet Canyon Sandstone has poor productivity and, therefore, may not be a suitable aquifer. The Navajo Sandstone is the only unit in the proposed life-of-mine area with the potential to produce large amounts of water. The nearest wells in the Navajo Sandstone are located west of Big Water.

3.3.3 Iron Springs Area

Iron Springs Creek, which drains most of the Iron Springs area, flows northwestward into Escalante Valley (Bedinger et al. 1984). The creek is intermittent and may be, in part, spring-fed (Thomas and Taylor 1946). Water quality in Iron Springs Creek is likely to be similar to the groundwater that feeds the creek. Water from a well about 1 mile east of the proposed unit-train loadout has a dissolved solids concentration of 2,068 ppm (Thompson and Nuter 1984).

Water has been found at 11 feet below the surface in the alluvial aquifer of Iron Springs Creek in a well located a few hundred feet north of the proposed Iron Springs unit-train loadout (Thomas and Taylor 1946). The alluvial aquifer is locally fed in part by springs found about 2 miles upstream from the proposed Iron Springs unit-train loadout (Thomas and Taylor 1946). The springs, in turn, are fed by Cretaceous rocks that crop out north of the railroad tracks. Alluvial groundwater flows to the northwest through the Iron Springs Gap and into the Escalante Valley (Bedinger et al. 1984).

3.3.4 Moapa Area

The Muddy River is the major drainage in the Moapa area, with perennial flows that have averaged 42.8 cubic feet per second (cfs) over the last 80 years (Emett et al. 1994). Much of the flow is spring-fed. The Muddy River originates in the Arrow Canyon Mountains, west of Moapa, and drains into the Colorado River at Lake Mead to the southeast of Moapa. California Wash runs south to north across the proposed Moapa unit-train loadout area and drains into Muddy Creek about 1.5 miles north of the site. Runoff is variable in the area drained by California Wash (Rush 1968). The California Wash drainage basin is estimated to contribute up to 34,000 acre-feet of water per year to Muddy Creek. However, California Wash is an ephemeral stream, flowing only during periods of precipitation. Water in Muddy Creek has a dissolved solids content ranging from 603 to 666 ppm (Emett et al. 1994). The elevated levels of sodium in the water create a high salinity hazard for use as irrigation water (Rush 1968). Drinking water in the Moapa area is primarily imported from the Muddy Springs area, about 6 miles to the northwest.

Potential aquifers are located in the alluvial deposits or valley fill which underlie the area (Rush 1968). The Muddy Creek Formation is generally a poor aquifer, and the better potential aquifers are found in the younger alluvium. In areas under and adjacent to Muddy Creek, the depth to groundwater may be 30 feet below the surface, whereas outside the Muddy Creek drainage, groundwater in valley aquifers may be as much as 400 feet deep (Bedinger et al. 1983). TDS concentrations in water from wells and seeps located in the Muddy Creek alluvial aquifer north of the proposed unit-train loadout range from 768 to 2,800 ppm; the water from the wells and seeps has a high salinity hazard (Rush 1968).

3.4 SOILS

Soil development is related to the geology, topography, climate, and natural vegetation of a specific area. In general, the soils in the southern Utah, northern Arizona, and southeastern Nevada area have formed from sedimentary rock of various ages and compositions or from unconsolidated deposits related to alluvial processes. The climate is arid, and soils form slowly and generally lack abundant organic matter. In many places soil cover is thin or nonexistent, especially in areas of bedrock exposures. Also, as is typical of soils found in arid environments, many of the soils have a layer of calcium carbonate, or caliche. The thickness of the caliche varies, but its presence can limit the amount of soil available for salvage in a given area.

Soils suitable for use in reclamation generally are restricted to soils lying above caliche layers; that is, material lying above decomposed bedrock layers and material not characterized as having extremely gravelly, stony, or cobbly textures. High saline or alkaline levels in soils can also reduce their reclamation potential. Highly erosive soils may be limited in their ability to be reclaimed successfully. Table E-1 (Appendix E) summarizes soil suitability descriptions of soil units found in the Warm Springs Project area and indicates both the average depth of salvageable growth medium estimated for each soil association and the limiting factors that may be associated with the soil units.

3.4.1 Smoky Mountain Area Soils

Most upper soil layers in the Smoky Mountain area consist of sandy or clay loams. Soil depths range from zero in badland and rock outcrop components to 60 inches in the Nipple Bench area. Soils in the area can be shallow and stony or gravelly, with moderate to high erosion potentials.

The soil units in the proposed surface facilities complex area are generally gravelly sandy loams derived from weathered sandstone and shale (Appendix E, Table E-1). Soils are shallow with abundant rock fragments. About 14 acres of the proposed surface facilities complex area lies within an area of previously disturbed land, a result of prior mining activities conducted at the site (Appendix B, Section B.2.12, Missing Canyon

Coal Mine). Rock outcrops are also present and contain areas unsuitable for use in reclamation (Appendix E, Table E-1).

Small areas of "cryptogamic soils" may occur throughout the Smoky Mountain area. Cryptogamic soils consist of areas where the ground surface is covered by a crusty layer of lichens (NPS 1976). The layer of lichens helps to stabilize soil erosion, and micro-organisms associated with the lichens can include algae or bacteria that can be important for nitrogen fixation in the soil (Richardson 1974). They have been found in small areas within the boundaries of the proposed surface facilities complex (Andalex Resources, Inc. 1994c). Cryptogamic soils generally take a long period to develop and can take years to recover if disturbed.

The soils at the top of Smoky Mountain and in the potential subsidence area of the proposed Project are mainly sandy loams that generally become very gravelly at depth, with some soils having a high wind-erosion potential (BLM no date). Rock outcrops are also present in the proposed subsidence area. The soils in the proposed topsoil borrow area at the landing strip on Smoky Mountain (Appendix A, Section A.2.1.3.2, Topsoil Borrow Area) and in much of the proposed subsidence area consist of fine sandy loam, clay loam, and gravelly loam, sandy loam, and very gravelly loam. Soil depths range from 12 to 60 inches.

The soils along the southern parts of the existing Warm Creek Road are thin, gravelly, silty or sandy loams (SCS 1984). Rock outcrops are present. The soils have severe ratings for suitability of road building. Also, some of the soils have a high salinity rating,. especially in areas underlain by Tropic Shale. Parts of the Warm Creek Road in the Warm Creek drainage cross soils derived from alluvial deposits in the Warm Creek drainage. These soils have a moderate to high water-erosion potential and a moderate wind-erosion potential, and they are subject to flooding. Five of the nine soils units along the Warm Creek Road may contain areas unsuitable for use in reclamation (Appendix E, Table E-1).

Along the proposed Benchtop Road, soils are generally gravelly to sandy loams with rock outcrops and occasional steep slopes that have moderate to high wind- and water-erosion potential (BLM no date). Six of the 10 soil units along the proposed Benchtop Road may contain areas unsuitable for use in reclamation (Appendix E, Table E-1). The proposed 138-kV power transmission line and microwave communication facilities are located on soils similar to those found along the proposed Benchtop Road (Andalex Resources, Inc. 1994c). Along the transmission line route south of Big Water, much of the ground surface consists of dune sand (Andalex Resources, Inc. 1994c). Five of the nine soil units along the proposed power transmission line may contain areas unsuitable for use in reclamation (Appendix E, Table E-1).

Agricultural activity in the Smoky Mountain area is limited. The nearest activity occurs on privately owned land along the Paria River north of U.S. Hwy. 89, about 13 miles west of Big Water, Utah. Through irrigation, the production of hay and a small amount of fruit and vegetables is made possible.

No soils of prime farmland quality have been identified in the Smoky Mountain area (Andalex Resources, Inc. 1994c). Poor soil conditions and the general lack of water make agricultural activities unfavorable (BLM 1976). Although the canyon bottoms support vegetation, they are not suitable for farming, owing to both their limited area and lack of a dependable water supply.

3.4.2 Moapa and Iron Springs Area Soils

Soils in the Moapa and Iron Springs areas range from loam to gravelly loam in texture and from 8 to 60 inches in depth. Limiting reclamation factors generally include shallow caliche layers, high alkalinity, high erosion potentials, and some potential for flash flooding (SCS 1993, no date(a)).

The soils at the proposed Iron Springs unit-train loadout are loam to gravelly loam, have medium to high alkalinity, and erode easily. Caliche is present at depths from 6 to 60 inches (Appendix E, Table E-1) (SCS 1993).

At the proposed Moapa unit-train loadout, soils range from fine sandy loam with moderate to high alkalinity at the proposed facility location to badlands, with no topsoil and very limited reclamation potential. Caliche layers are present at 14 to 19 inches. The soil in California Wash is a gravelly fine sand to cobbly coarse sand below 8 inches depth. The soil is subject to frequent flooding, has high wind-erosion potential, and is moderately to highly alkaline. The slopes of California Wash are composed of badland soils that contain no topsoil and are highly erodible (SCS no date(a)).

3.4.3 Fredonia and Hurricane Area Soils

Soils in the Fredonia and Hurricane areas range from silty clay loam to very cobbly sandy loam clay in texture and from 26 to 60 inches in depth. Limiting factors generally include the presence of a cemented hardpan layer, moderate to severe erosion hazards, and a moderate shrink-swell potential (SCS 1977, no date(b)).

Soils at the site selected for the hypothetical Hurricane truck maintenance facility are sandy, gravelly to cobbly loams with a cemented hardpan at 26 to 28 inches (Appendix E, Table E-1). Soils in this area have a moderate erosion hazard (SCS 1977).

Soil at the site selected for the hypothetical Fredonia truck maintenance facility is a silty clay loam that becomes a loamy fine sand at a depth of 43 inches. The soil has a high wind-erosion potential and a moderate shrink-swell potential (SCS no date(b)).

3.5 VEGETATION

3.5.1 Vegetation Types

Three vegetative sudivisions or "floristic sections" of the Colorado Plateaus province are identified in the southern Utah, northern Arizona, and southeastern Nevada area (Figure 3-1): the Canyon Lands section, the Utah Plateaus section, and the Dixie-Corridor section. The Canyon Lands section occurs in southwestern Colorado, southeastern Utah, and northeastern Arizona and is bounded by the San Juan Mountains to the east, the Book Cliffs to the north, the Bonneville Basin to the west, and the Grand Canyon to the south. The Canyon Lands section is characterized by a broad desert plain with deep canyons, low hills, and mountains of layered igneous and sedimentary rock (Cronquist et al. 1972). The Smoky Mountain and Fredonia areas are located in the Canyon Lands floristic section.

The Utah Plateaus section is located in central Utah and is characterized by plateaus and valleys that are north-south oriented. The Dixie-Corridor floristic section is bounded by the Grand Canyon Plateau to the south and the Utah Plateaus to the north and is characterized by low, undulating hills (Cronquist et al. 1972). The Iron Springs area is located on the western fringe of the Utah Plateaus floristic section in the eastern fringe of the Basin and Range physiographic province (Figure 3-1). The Moapa and Hurricane areas are located in the Dixie-Corridor floristic section.

Existing influences on the local distribution of vegetation types in the sections include precipitation levels, soils, topography, surface disturbance, and aspect. Percentages of cover of the vegetation types present in these floristic sections vary from about 10 percent in the western part of the Dixie-Corridor floristic section to about 30 percent in the Canyon Lands and Utah Plateaus floristic sections. The ecological condition of the grasslands, shrublands, and woodlands present in the region are generally considered fair to good.

Six broad vegetation types are present within the three floristic sections found in the region. Predominant vegetation types that occur in the Canyon Lands section include blackbrush scrub and galleta-threeawn shrubsteppe. Vegetation present in the western part of the Utah Plateaus floristic section typically includes plant species associated with sagebrush steppe and pinyon-juniper woodland (Cronquist et al. 1972). The Dixie-Corridor section supports creosotebush and desert scrub vegetation. Grassland and riparian areas are also present throughout the region. (Scientific names for plant species can be found in Appendix E, Table E-2.)

In addition to the major vegetation types, rocky and barren areas, such as those associated with Tropic Shale, also are present in the Smoky Mountain area. Typically, vegetation is absent in these areas, although in some places, several species have adapted to the steep slopes and highly alkaline soils that are present.

Desert shrub is the most common vegetation type present in the region and includes sand sagebrush, shadscale, and other desert shrub subtypes. This vegetation type commonly occurs with the grassland vegetation type to form mosaics of desert shrub-grassland areas. Desert shrub occurs on moderately well drained sites of valley floors, dry slopes, and areas that contain dry, impervious, saline soils. The dominant shrub layer generally includes shadscale, fourwing saltbush, blackbrush, rabbitbrush, sand sagebrush, and big sagebrush. The subdominant herbaceous layer generally supports a variety of forbs and grasses including bottlebrush, scarlet globemallow, aster, sand dropseed, galleta, Indian ricegrass, blue grama, and threeawn. This vegetation type is present in the Smoky Mountain, Moapa, Fredonia, and Hurricane areas.

The grassland type present in the region includes the short grass subtype, which occurs on moderately well to well-drained sites of valley floors and dry slopes. Grasslands are dominated by grasses, such as blue grama, sand dropseed, galleta, Indian ricegrass, and threeawn, and a variety of forbs, such as bottlebrush, milkvetch, aster, and phacelia. This vegetation type occurs in the Smoky Mountain area.

The sagebrush vegetation type is characterized by a dominant shrub layer of rubber rabbitbrush, sagebrush, and snakeweed, and a subdominant herbaceous layer of phlox, goosefoot, threeawn, cheatgrass, blue grama, bottlebrush squirreltail, Indian ricegrass, and sand dropseed. Scattered Utah junipers are present on shallow, rocky soils. This vegetation type occurs in the Iron Springs area.

Pinyon-juniper woodland, creosotebush scrub, and riparian areas are the least prevalent vegetation types occurring within the region. The pinyon-juniper woodland type occurs on well-drained to very well drained hills and sideslopes that typically have shallow, rocky soils. Pinyon-juniper woodland is dominated by an overstory of pinyon pine and Utah juniper and a sparse understory of shrubs and herbaceous species, including buffaloberry, bitterbrush, cliffrose, sagebrush, scarlet globemallow, milkvetch, aster, and goosefoot. Pinyon-juniper woodland only occurs in the higher elevations of the Smoky Mountain area.

The creosotebush type is characterized by a dominant shrub layer, including creosotebush, indigobush, joint-fir ephedra, white bursage, spiny hopsage, and snakeweed. The subdominant herbaceous layer consists of a variety of forbs and grasses, including bottlebrush, desert plantain, phlox, galleta, Indian ricegrass, threeawn, red brome, and fluffgrass. The creosotebush vegetation type is present in the Moapa area. California Wash, which runs through the Moapa area, supports plant species common to the creosotebush and desert shrub vegetation types, including fourwing saltbush, creosotebush, rabbitbrush, white bursage, red brome, and common filaree.

Riparian and wetland areas account for less than 1 percent of the vegetative communities in the study region and generally lack floristic diversity. These areas provide limited amounts of forage for wildlife or livestock and nesting cover for birds because both the floristic and the vegetative structural diversities tend to be low. Riparian areas are present in the Smoky Mountain and Moapa areas, along the margins of creeks and dry washes, including Warm Creek, Wahweap Creek, Muddy Creek, and within adjacent floodplains. They are characterized by dominant stands of tamarisk and a subdominant understory consisting of several weedy species, including Russian thistle, tansymustard, and common filaree. In the Smoky Mountain area, the floodplain associated with Wahweap Creek generally ranges from about 400 feet to 800 feet in width. Riparian habitat in the floodplain ranges from 200 feet to 300 feet in width. Riparian habitat in Wahweap Creek is characterized by dense stands of tamarisks or scattered and discontinuous populations of tamarisks and other weedy species. The floodplain associated with Warm Creek is about 50 feet in width, of which riparian habitat occupies about 15 feet. Wahweap Creek is a "natural stream" and one of the jurisdictional "waters of the United States" (Utah DNR 1994a, b). Warm Creek and other intermittent creeks located in the Smoky Mountain area are not. The Muddy River floodplain in the Moapa area is about 50 feet wide and supports riparian vegetation consisting mainly of tamarisk. The floodplain of California Wash is about 700 feet wide in the Moapa area and does not support riparian or wetland vegetation. Muddy River, California Wash, and several intermittent drainages present in the Moapa area are classified as "waters of the United States."

Wetlands in the Smoky Mountain area are generally associated with seeps and springs. The seeps are precipitation dependent and fluctuate annually. They range from dry to wet in direct response to seasonal moisture and temperature. There are 21 seeps and springs of interest identified in the Smoky Mountain area (Section 3.3.2, Smoky Mountain Area). Nine of the seeps and one of the springs (Wesses Spring) occur in the proposed life-of-mine area (Figure 3-6; Table 3-4; Appendix A, Table A-3); the other two seeps and the nine springs occur in the general vicinity but outside the life-of-mine area. Inside the proposed life-of-mine area, four of the seeps and the spring were observed to have pooled water. The other seeps only showed evidence of moisture, such as damp soil or rock (Figure 3-4). Although five of the seeps and the spring support wetland species, the low diversity of the species that are present limits their value as wetlands (Andalex Resources, Inc. 1994d).

The other 11 seeps and springs that occur in the general vicinity are located within a 5-mile radius outside the proposed life-of-mine area. Plant species present at these seeps and springs include cottonwood, willows, tamarisk, liverworts, and cattails. These seeps and springs are also characterized by low species and vegetative structural diversity.

The Smoky Mountain area is used primarily for cattle grazing. Various allotments exist for livestock grazing on public lands in the area. The Upper Warm Creek Allotment is utilized by one operator from November through May and has a current grazing capacity of 1,477 active animal unit months (AUMs). The Last Chance Creek Allotment, which is assigned to another operator, is located on the top of the plateau and has a current grazing capacity of 3,417 active AUMs (3,090 BLM AUMs and 327 State AUMs).

3.5.2 Threatened and Endangered Species

The Endangered Species Act of 1973, as amended, offers Federal protection to species listed by USFWS as endangered or threatened. (See Section 5.3.1, Issues Concerning Threatened or Endangered Wildlife or Plant Species Protected by the Endangered Species Act, for a complete discussion of the Agencies' efforts to comply with the Act.) An endangered species is a species considered in danger of extinction throughout all or a significant part of its range. A threatened species is any species likely to become an endangered species within the foreseeable future throughout all or a significant part of its range. Any species that the USFWS is considering for listing as endangered or threatened is termed a "candidate species." Candidate species are not protected under the Endangered Species Act. A variety of plants in the southern Utah, northern Arizona, southeastern Nevada area have been identified as threatened, endangered, or as candidate species (USFWS 1993b). Only two of these plant species, the Smoky Mountain evening primrose (*Camissonia atwoodii*) and the Higgins biscuitroot (*Cymopterus higginsii*), have been observed in the vicinity of the Warm Springs Project or have habitat in the Project vicinity (BLM and OSM 1995).

The Smoky Mountain evening primrose is a Federal candidate species. This species occurs on clay soils primarily on steeper slopes of the Tropic Shale and Carmel Formations (Table 3-1); these areas support desert shrub vegetation at 4,060 to 5,000 feet elevation (Atwood et al. 1991). Four populations have been documented to occur in eastern Kane County, north of Lake Powell. One population was located in 1993 in the naturally occurring burned coal, or "clinker," zone of the upper John Henry Member of the Straight Cliffs Formation in John Henry Canyon. Another population occurs at Smoky Mountain on the "Kelly Grade," and two populations occur in the Glen Canyon National Recreation Area. This primrose species is tall (20 to 60 inches) and has conspicuous flowers in September and October.

The Higgins biscuitroot is also a Federal candidate species. This species occurs on sandy gravelly alluvium of the Tropic Shale Formation in desert shrub communities at 5,000 feet elevation. One historic population has been documented adjacent to the existing Warm Creek Road near its intersection with the Allstrom Point Road. (NPS 1991). This species flowers in early spring.

3.6 WILDLIFE

3.6.1 Habitat Types

The wildlife communities of southern Utah, northern Arizona, and southeastern Nevada are typical of the habitats associated with the three vegetative subdivisions described in Section 3.5.1. The range of habitat types occurring in these areas supports a wide variety of wildlife resources correlated to the differences in elevation and climatic zones. The arid climate, sparse vegetation, and restricted water availability common to the region limit many wildlife populations.

Climate is the primary factor that characterizes these areas. Even with wildlife species that are adapted to the arid environment, populations fluctuate considerably because of both annual and seasonal climatic variations. Competition is high for limited resources, such as forage, cover, and available water.

The arid upland areas are typically characterized by a diversity of wildlife species rather than high population density, except in riparian habitat. Available water for wildlife consumption and riparian vegetation are the limiting factors. Therefore, riparian habitats, particularly those with a multistory canopy, tend to support a greater diversity and population density of wildlife species than any other habitat type occurring within the region.

Surface water resources in the proposed life-of-mine area include nine naturally occurring seeps and one spring (Wesses Spring) (Figure 3-6; Table 3-4; Appendix A, Table A-3); and Section 3.3.2, Smoky Mountain Area). Four of these seeps and the spring contained pooled, surface water for wildlife consumption. The remaining seeps are mostly defined by moist soils and some low, riparian vegetation. The seeps fluctuate annually from wet to dry, depending upon seasonal precipitation and temperatures. Signs of wildlife use of the area's seeps were limited; however, wildlife trails to and around several seeps and the spring were found (Andalex Resources, Inc. 1994c). Two additional seeps and nine springs have been recorded within a 5-mile radius of the proposed life-of-mine area. Only four of the springs in this area have exhibited any signs of wildlife use (Andalex Resources, Inc. 1994c).

3.6.2 Important Nongame Species

The arid environment found within southern Utah, northern Arizona, and southeastern Nevada supports a number of nongame species, which provide a substantial prey base for the region. Certain habitats (e.g., riparian) support a greater number of these species. Many of the nongame species, particularly small mammals, are widely distributed and occupy a variety of habitat types.

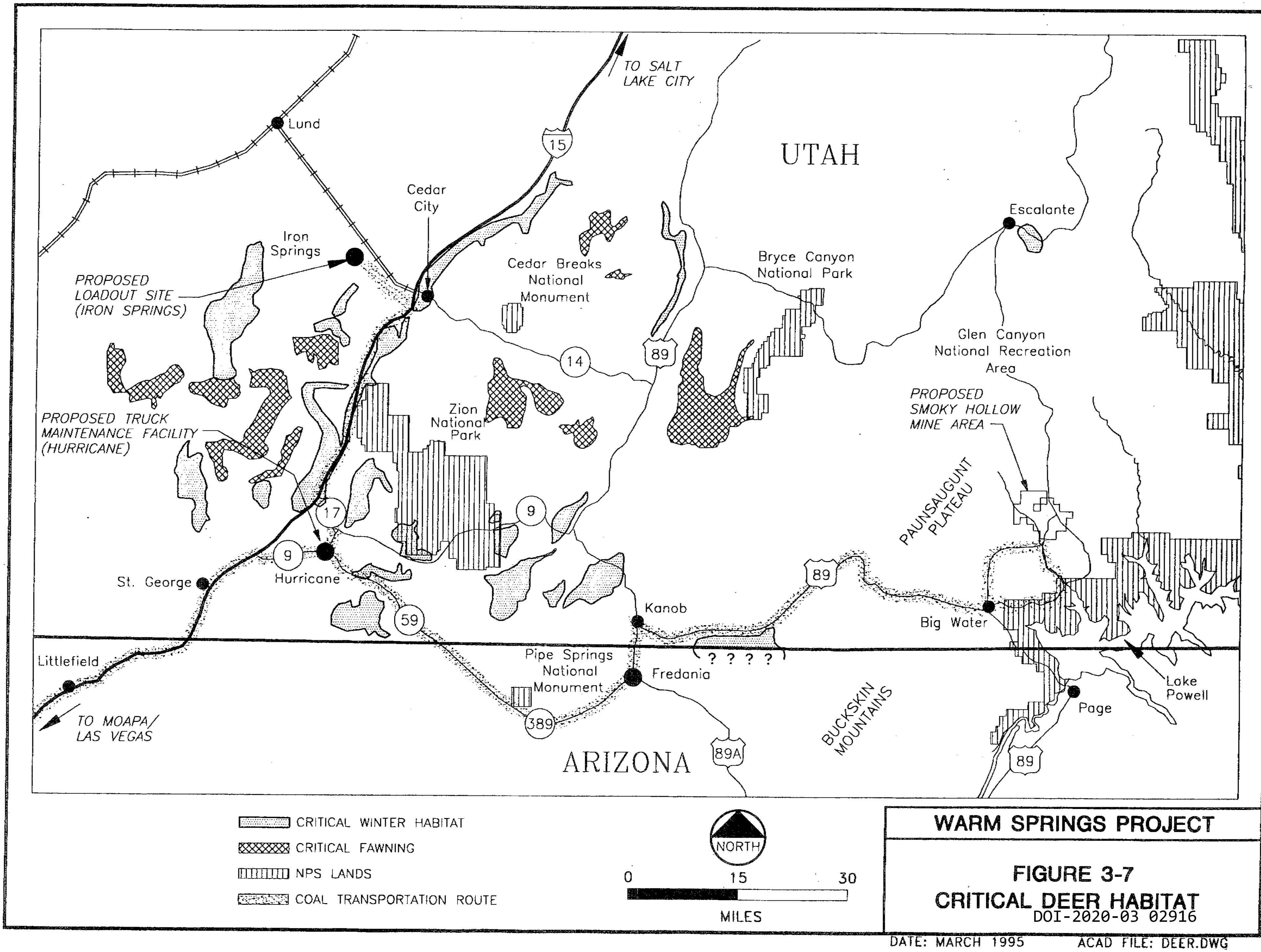
Important nongame animals in this region include, but are not limited to, bats and other small mammals, passerine birds, raptors, reptiles, and amphibians. Important features for nongame species that may occur in the Smoky Mountain area include reptile communal den sites, bat hibernacula and nursery colonies, communal bat roosts, and raptor nest sites (Utah DWR 1992).

Up to 18 bat species are known to occur in southern Utah (Toone 1994). Species that may inhabit the Smoky Mountain area include the Allen's big-eared bat, big free-tailed bat, Townsend's big-eared bat, small-footed myotis, long-eared myotis, cave myotis, long-legged myotis, and Yuma myotis (McDonald 1994). Nongame birds are prominent in the region, with up to 200 species recorded, in addition to game birds and raptors. These bird species have diverse habitat requirements. Amphibian species are limited by available habitat. Reptiles are widely distributed and range from lizard and snake species associated with the Smoky Mountain area to the desert tortoise and gila monster at the Moapa unit-train loadout.

A number of raptor species (or birds of prey) occur in southern Utah, northern Arizona, and southeastern Nevada. Rocky canyons and the small number of riparian areas provide valuable nesting sites for these species. In addition, raptors will use agricultural areas for foraging and roosting, such as the agricultural areas west of Cedar City. Common species in the region include the golden eagle, bald eagle, prairie falcon, peregrine falcon, American kestrel, ferruginous hawk, rough-legged hawk, red-tailed hawk, and a number of owl species. One occupied golden eagle nest was located within 2.5 miles of the existing Warm Creek Road within the Glen Canyon NRA along upper Wahweap Bay (NPS 1992). No other golden eagle nesting is known to occur near or in the Smoky Mountain area. Both golden and bald eagles are also common in the Parowan and Cedar Valleys, northwest of Cedar City, Utah (McDonald 1994). Wintering bald eagles occur throughout the valleys of southern Utah. An estimated 200 to 300 bald eagles winter in the Parowan and Cedar Valleys (McDonald 1994). Although both the American and the Arctic peregrine falcon migrate through the region, only the American subspecies nests in southern Utah, particularly in Zion National Park and in Cedar Valley, with some birds documented around Lake Powell (Staats 1994; McDonald 1994). Red-tailed hawks are fairly common in the Smoky Mountain area. A total of 17 stick nests, possibly representing 6 red-tailed hawk territories, has been identified in Wesses, Stony Point, and Smoky Hollow Canyons. At least one active stick nest was present in each territory (Haney 1994). Several species of raptors have been observed foraging in the Iron Springs area. Although no nests have been recorded, individuals may use the area for nesting. (Scientific names for wildlife species can be found in Appendix E, Table E-3.)

3.6.3 Important Game Species

The mule deer is the principal game species in the region. Mule deer occur within the Smoky Mountain area, along U.S. Hwy. 89 and Interstate-15, and in the Iron Springs area (McMahon 1994). Seasonal movement occurs between summer and winter ranges, typically defined by available forage and water (Atwood et al. 1980). Figure 3-7 depicts the seasonal ranges along U.S. Hwy. 89 and Interstate-15.


TO SALT LAKE CITY
Lund
15
UTAH
Cedar City
Iron Springs
PROPOSED LOADOUT SITE (IRON SPRINGS)
Cedar Breaks National Monument
Bryce Canyon National Park
Escalante
Glen Canyon National Recreation Area
14
89
Zion National Park
PROPOSED TRUCK MAINTENANCE FACILITY (HURRICANE)
PROPOSED SMOKY HOLLOW MINE AREA
PAUNSAUGUNT PLATEAU
17
9
9
St. George
Hurricane
89
Kanab
Big Water
59
Littlefield
Pipe Springs National Monument
Fredonia
? ? ? ?
Lake Powell
Page
BUCKSKIN MOUNTAINS
389
TO MOAPA/ LAS VEGAS
ARIZONA
89A
89
CRITICAL WINTER HABITAT
CRITICAL FAWNING
NPS LANDS
COAL TRANSPORTATION ROUTE
NORTH
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MILES
WARM SPRINGS PROJECT
FIGURE 3-7
CRITICAL DEER HABITAT
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DATE: MARCH 1995
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Mule deer use of the Smoky Mountain area is limited to the marginal deer winter range in the Nipple Bench area (McMahon 1994). A prominent deer herd is present to the west, however, on the Paunsaugunt Plateau. The Paunsaugunt Mule Deer Herd is currently estimated to number about 5,000 animals. Deer from this herd winter in the Fivemile Mountain area within the Buckskin Mountains in northern Arizona and southern Utah and summer on the Paunsaugunt Plateau in southern Utah (Figure 3-7). Migration between these two seasonal ranges is typically concentrated during April/May and October/November (Messmer 1994), with the primary migration route crossing U.S. Hwy. 89 between Big Water and Kanab, Utah, near Kaibab Gulch and Telegraph Flats. The mule deer associated with the Arizona strip in and near the Kaibab National Forest and Shivwits Plateau are nationally recognized as trophy deer. Mule deer in southeastern Nevada inhabit the less populated areas with rougher terrain of the isolated mountain ranges.

Much of southern Utah was once occupied by bighorn sheep. Bighorns prefer rocky canyons and talus slopes, typically avoiding pinyon/juniper woodland. Movements occur primarily in response to the changing availability of water and food. Bighorn populations have declined to a few remnant populations in remote parts of the State. Some were reintroduced at Fiftymile Mountain, located northeast of the Smoky Mountain area. A few bighorn sightings have been reported in the peripheral area of Smoky Mountain in recent years; however, the closest, established bighorn population currently ranges 20 to 30 miles from the Project area. The Smoky Mountain area has been identified as a potential future release site for bighorn sheep by the Utah Division of Wildlife Resources (Utah DWR) (McMahon 1994).

Historically, pronghorn (antelope) inhabited the region but were eliminated by hunting and overall changes in water availability. The species prefers open rangeland and rolling topography and have ranged east of the Hurricane Cliffs in northern Arizona (BLM 1978). Reintroductions were initiated in the Smoky Mountain area by Utah DWR in 1970 on East Clark Bench, but those populations dispersed and are no longer present (McMahon 1994).

Mountain lion occupy canyon and mountain areas throughout the region. The species' range coincides with that of mule deer, their primary prey species.

Upland game birds, such as mourning dove, chukar, and Gambel's quail, occur within the region. However, population numbers for these upland game species are generally low to moderate, largely because of limited water availability, which is particularly important during the brooding period.

The habitat availability for waterfowl and shorebird species is restricted within the region. The deep waters of Lake Powell, the only large water body near the Smoky Mountain area, are surrounded by rock cliffs and desert vegetation and do not provide valuable foraging or nesting habitat for these species. A number of migrants, however, use the reservoir for resting during migration. Appropriate nesting and foraging habitat occurs along the confluences of tributaries to Lake Powell, which provide the necessary riparian habitat and shallow-water areas for a limited number of birds during the breeding season. The closest tributary confluences with the reservoir lie south and west of the Smoky Mountain area.

3.6.4 Threatened, Endangered, and Candidate Species

The Endangered Species Act of 1973, as amended, offers Federal protection to wildlife species listed by USFWS as endangered or threatened. Candidate species, while not protected, are being considered by USFWS for listing at sometime in the future (Section 3.5.2). (See Section 5.3.1, Issues Concerning Threatened or Endangered Wildlife or Plant Species protected by the Endangered Species Act, for a complete description of the Agencies' efforts to comply with the Act.) A variety of animals in the southern Utah, northern Arizona, southeastern Nevada area have been identified as threatened, endangered, or candidate species (USFWS 1994c). Only four of these species (the desert tortoise, the Mexican spotted owl, the peregrine falcon, and the ferruginous hawk) have been observed in the vicinity of the proposed Warm Springs Project or have habitat in the Project vicinity (BLM and OSM 1995).

The desert tortoise (*Gopherus agassizii*) is federally listed as threatened. This species has two distinct populations, the Mohave and the Sonoran. The Mohave population includes all tortoises occurring north and west of the Colorado River in California, southern Nevada, southwestern Utah, and northwestern Arizona (USFWS 1990). In southwestern Utah, the desert tortoise occurs at the northeasternmost edge of the species' range. In this area, tortoises occupy a variety of habitat types, including canyons, mesas, sand dunes, and sandstone outcrops (USFWS 1990). Tortoises occurring in southeastern Nevada and along Interstate-15 through the Arizona Strip generally occupy the creosotebush scrub community on flats, valley bottoms, alluvial fans, and bajadas (USFWS 1990). The Mohave population of the desert tortoise has been declining precipitously for a number of reasons, which are mainly attributed to both direct and indirect human-caused mortality (loss, degradation, and fragmentation of native desert habitat from increased land development, off-road vehicle use, illegal shooting and collection of tortoises, predation on juvenile tortoises, and upper respiratory tract disease) (USFWS 1994a).

The desert tortoise occupies parts of the Moapa unit-train loadout in Nevada, which is designated by BLM as Category III tortoise habitat (Cole 1994). Category III habitat is defined as areas that are of lower value in sustaining viable populations of tortoises on public lands; they can be subjected to less tortoise management then habitats in other categories (Spang et al. 1988). Since the desert tortoise is also known to occur near Hurricane, Utah, it may occupy areas identified for the hypothetical location of the Hurricane truck maintenance facility.

The Mexican spotted owl (*Strix occidentalis lucida*) is federally listed as threatened. This subspecies historically occurred from the Southern Rocky Mountains in Colorado and the Colorado Plateaus in southern Utah, south through Arizona and New Mexico, extending into Mexico (USFWS 1993b; Utah Mexican Spotted Owl Technical Team 1994). In southern Utah, this species' habitat preferences continue to be defined by researchers, although individuals are found to occupy deeply dissected canyons that contain caves or ledges, cooler temperatures, and often some available water (Grandison 1994). This subspecies was federally listed due to loss and modification of suitable habitat, increased predation associated with habitat fragmentation, and lack of regulatory protection. The closest known location of the Mexican spotted owl relative to the Project area is Hackberry Canyon, west of The Cockscomb, about 15 miles northwest of the Smoky Mountain area. Two canyons in the Smoky Mountain area that may support suitable Mexican spotted owl habitat include John Henry Canyon and Wesses Canyon (Linner 1994). Critical habitat has been identified for this subspecies within its range, primarily in Arizona and New Mexico. Limited critical habitat has been identified in southeastern Utah near the Manti-La Sal National Forest and BLM's Dark Canyon Wilderness Area (USFWS 1994c).

The American peregrine falcon (*Falco peregrinus anatum*) is federally listed as endangered. This subspecies historically occurred from Canada and Alaska south to Mexico. Reintroduction and management efforts have reestablished nesting peregrine falcons in many areas of the Western United States. They occasionally migrate through southern Utah, northern Arizona, and southeastern Nevada and are known to nest in and near the Smoky Mountain area, along Interstate-15, and near Cedar City. Peregrine nest sites are often located on cliff faces, 150 feet or greater in height with an overhanging ledge or rock outcrop. They typically nest on cliffs close to water sources or riparian zones that support prey species and provide isolation from human disturbance. The decline of the peregrine falcon is predominantely due to the thinning of eggshells from pesticide poisoning, the taking of falcon nestlings by falconers, shooting, increased human presence and associated disturbances to eyries, and habitat loss. The closest know location of peregrine falcon territories relative to the Project area is along Lake Powell, within about 2.5 miles of the Warm Creek Road. Occasional peregrines have been observed outside Big Water in the area of the Utah DWR's Wahweap Warm Water Hatchery along Wahweap Creek; in Cedar Valley west of Cedar City; and in the Hurricane area. No designated critical habitat, occupied eyries, or optimal forage areas have been documented in any of these areas.

The ferruginous hawk (*Buteo regalis*) is a Federal candidate species. This species occurs in the semiarid regions of the Western United States. In Utah and Nevada, the ferruginous hawk inhabits Great Basin foothills, desert, and submontane elevations and occupies a variety of ecosystems within these zones. Associated habitats include sagebrush/grass, pinyon/juniper, saltbush/grass, blackbrush, grassland, barren, marsh, mesic meadow, and riparian communities (Dalton et al. 1990). The decline of the ferruginous hawk within the Western United States is predominantly due to increased human disturbances, thereby impacting species reproductive success and habitat alteration, resulting in decreased prey base and nest site opportunities (Howard and Wolfe 1976; Jasikoff 1982). Breeding and wintering ferruginous hawks may occur in the Smoky Mountain area, although records are sparse. Wintering ferruginous hawks have been documented near Hurricane along the Virgin River, and migrants are known to move through the Moapa area. The optimal ferruginous hawk habitat associated with the proposed Project would occur near the proposed Iron Springs unit-train loadout; Cedar Valley, northwest of Cedar City, Utah, supports large numbers of wintering birds and migrants.

3.7 TRANSPORTATION

The transportation system in southern Utah, northern Arizona, and southeastern Nevada consists primarily of a roadway network that includes Interstate, Federal, State, and county-maintained facilities (Chapter 1, Figure 1-1). The primary roadway in this region is Interstate-15. Other main regional routes include Utah Route 9, Utah Route 17, Utah Route 56, U.S. Hwy. 89, and U.S. Hwy. 89A/Utah Route 11, with secondary connection provided by Arizona Route 389/Utah Route 59. Local roadways include Hidden Valley Road in

Nevada, Iron Springs Road in Utah, and Warm Creek Road, also in Utah. Existing traffic volume data for selected roads in the area are summarized in Table 3-5.
The function of any transportation system is the movement of people and goods in a safe and efficient manner. The efficiency of a roadway network may be expressed in terms of its capacity, and the network's level of safety may be defined in terms of accident experience.

Capacity is generally defined as the ability of a roadway facility to accommodate vehicles over a defined period of time. Factors which affect the capacity of a roadway include the physical condition of the road, the local terrain, and the composition of traffic using the road. Increased traffic on a road utilizes more of the available capacity and tends to lower the quality of traffic operations. When traffic volumes entering a roadway exceed its capacity, a breakdown in operations occurs, causing congestion, long lines, and unstable flow. Level of service (LOS) is used to qualitatively describe the operational conditions within a stream of traffic, based on delay, freedom to maneuver, and driver perception. The Highway Capacity Manual (Transportation Research Board 1985) defines six levels of service, ranging from LOS "A," the highest, to LOS "F," the lowest, with LOS "A" representing free-flow conditions and LOS "F" representing congested, or forced-flow, conditions. In general, LOS "D" is considered to be acceptable during periods of peak usage. Existing LOS data for selected roads in the area are summarized in Table 3-5.

The State Departments of Transportation (DOTs) collect and maintain accident records for the roadways within their jurisdictions. Table 3-6 represents averages of accident records for selected roadways in the area during the 3-year period from 1990 through 1992. Overall, or total, accident rates are expressed as accidents per million vehicle miles traveled (Mvmt), and truck accident rates are expressed as accidents per million truck miles traveled (Mtmt). Fatal accidents are expressed in terms of fatalities per 100 million vehicle miles (all vehicles) traveled. In general, truck accidents on roadways within the area occur at a lower rate than do total accidents. The exceptions are U.S. Hwy. 89 between Kanab and Big Water, Utah Route 9 between Interstate-15 and Hurricane, and Utah Route 56 between Interstate-15 and Iron Springs Road, where truck accident rates are higher than total vehicle accident rates.

3.7.1 Roadway Network

There are 12 major Federal, State, and county roads along the proposed Warm Springs Project haul routes. All trucks over certain weight limits require Department of Transportation (DOT) permitting in Utah, Arizona, and Nevada. Roadways, bridges, and other highway components in the area are structurally and geometrically adequate to accommodate truck traffic and are subject to routine inspection and maintenance by each respective State's Department of Transportation.

Warm Creek Road runs east through rough terrain from its beginning at the intersection with U.S. Hwy. 89 in Big Water through a corner of the Glen Canyon NRA to Escalante. One branch of this road leaves the NRA and runs northward through Kane County in Warm Creek and Smoky Hollow Canyons and reconnects with a second branch that ascends Kelly Grade. A short section of this road near Big Water is roughly paved; the remainder is gravel surface or unimproved. There is no posted speed limit, but comfortable speeds are between 20 and 30 miles per hour (mph) on the improved section and less than 10 mph on the unimproved sections. This road is maintained by Kane County. The existing traffic volumes on Warm Creek

Table 3-5 — Existing Traffic Volumes and Levels of Service (LOS) on Selected Area Roads

Roadway	Section	ADT[1] 1992-93	Percent Trucks	LOS[2]
COMMON ROUTE TO HURRICANE				
Warm Creek Road	All.	20	5.0	A;A
U.S. Hwy. 89	Big Water to Kanab.	1,575	8.0	A;B
Utah Route 11	Kanab to Arizona State line.	3,340	7.6	A;B
U.S. Hwy. 89A	Utah State line to Fredonia.	3,300	11.0	A;B
Arizona Route 389	Fredonia to Colorado City/Utah State line.	2,900	11.0	A;B
Utah Route 59	Hildale/Arizona State line to Hurricane.	2,800	11.4	B;C
ROUTE TO MOAPA				
Utah Route 9	Hurricane to Interstate-15.	7,080	5.0	C;D
Interstate-15	Utah Route 9 to Arizona State line.	11,975	25.0	A;A
Interstate-15	Utah/Arizona State line to Arizona/Nevada State line.	10,960	25.0	A;A
Interstate-15	Nevada/Arizona State line to exit 88 in Nevada.	12,500	25.0	A;A
Hidden Valley Road	Interstate-15 to Moapa.	195	25.0	A;A
ROUTE TO IRON SPRINGS				
Utah Route 9	Hurricane to La Verkin.	7,535	2.3	C;D
Utah Route 17	La Verkin to Interstate-15.	1,985	9.3	B;C
Interstate-15	Utah Route 17 to exit 59.	10,275	25.0	A;A
Utah Route 56	Interstate-15 to Iron Springs Road.	2,315	8.0	A;A
Iron Springs Road	Utah Route 56 to Iron Springs.	785	5.0	A;A

Sources: Utah Department of Transportation 1992. Kaeer 1994.
Arizona Department of Transportation 1993a.
Berger 1993
JHK & Associates 1993.

[1] Average Daily Traffic Volumes.
[2] LOS "A" is the highest level of service, LOS "F" is the lowest, or worst, level of service. Two letters with a semicolon indicate level of service in morning (7 a.m. to 8 a.m.;afternoon (5 p.m. to 6 p.m.) peak times.

Table 3-6 — Existing Roadway Accident Rates on Selected Area Roads

Roadway	Section	Total Accident Rate (Mvmt)[1]	Truck Accident Rate (Mtmt)[2]	Fatal Accident Rate (100 Mvmt)[3]
COMMON ROUTE TO HURRICANE				
Warm Creek Road	All.	N/A	N/A	N/A
U.S. Hwy. 89	Big Water to Kanab.	1.35	2.08	2.11
Utah Route 11	Kanab to Arizona State line.	1.16	0.00	0.00
U.S. Hwy. 89A	Utah State line to Fredonia.	0.24	0.00	0.00
Arizona Route 389	Fredonia to Colorado City/ Utah State line.	0.51	0.24	2.62
Utah Route 59	Hildale/Arizona State line to Hurricane.	1.02	0.50	2.21
ROUTE TO MOAPA				
Utah Route 9	Hurricane to Interstate-15.	1.22	1.89	0.00
Interstate-15	Utah Route 9 to Arizona State line.	0.75	0.52	1.46
Interstate-15	Utah/Arizona State line to Arizona/Nevada State line.	0.54	0.34	2.27
Interstate-15	Nevada/Arizona State line to exit 88 in Nevada.	0.55	0.32	3.88
Hidden Valley Road	Interstate-15 to Moapa.	N/A	N/A	N/A
ROUTE TO IRON SPRINGS				
Utah Route 9	Hurricane to La Verkin	2.40	2.40	0.00
Utah Route 17	La Verkin to Interstate-15.	1.98	1.07	9.98
Interstate-15	Utah Route 17 to exit 59.	1.25	0.60	2.48
Utah Route 56	Interstate-15 to Iron Springs Road.	0.55	0.99	6.27
Iron Springs Road	Utah Route 56 to Iron Springs.	N/A	N/A	N/A

Sources: Utah Department of Transportation 1994.
Arizona Department of Transportation 1993b.
Nevada Department of Transportation 1993.
[1]Million vehicle miles travelled (all vehicles).
[2]Million truck miles travelled.
[3]100 million vehicle miles travelled (all vehicles).
N/A = Not available.

Road are minimal: only 10 to 20 vehicles per day (vpd) (Rittenauer 1995). The heavy truck traffic component is conservatively estimated at 5 percent, and the existing traffic operations at all times are at LOS "A." No accident data are available for this minimal volume roadway (Utah DOT 1994). The Warm Creek Road currently has variable fair to poor surface conditions along unpaved and paved sections of the roadway.

U.S. Hwy. 89 runs in a basic north-south alignment through Arizona and Utah and serves as the main means of access to Bryce Canyon National Park, Zion National Park, Glen Canyon NRA, and the south rim of the Grand Canyon. Within the study area, U.S. Hwy. 89 runs east and west through Big Water and Kanab. In Utah, U.S. Hwy. 89 is a Utah DOT-maintained, two-lane, paved highway which traverses flat to rolling terrain. The speed limit is 55 mph except through the towns of Big Water and Kanab, where it is reduced to 35 mph. The existing Average Daily Traffic Volumes (ADT) along U.S. Hwy. 89 within the study area is 1,575 vpd, 8 percent of which is heavy truck traffic. The existing peak-season levels of service on U.S. Hwy. 89 are at LOS "A" during the morning peak hour and at LOS "B" during the afternoon peak hour. This roadway experiences accidents at a total rate of 1.35 per Mvmt, with heavy truck accidents occurring at a rate of 2.08 per Mtmt. Fatalities occur at the rate of 2.11 per 100 Mvmt (Utah DOT 1994).

Utah Route 11, which begins in Kanab, runs north-south between Kanab and the Arizona State line, where it continues under the U.S. Hwy. 89A designation. Utah Route 11 is a Utah DOT-maintained, two-lane, paved highway which traverses flat to rolling terrain. The speed limit is 55 mph except through the town of Kanab, where it is reduced to 35 mph. There is a school zone in Kanab along Utah Route 11. Utah Route 11 currently experiences an ADT volume of 3,340 vpd, with a heavy truck traffic component of 7.6 percent. The existing peak-season levels of service on Utah Route 11 are at LOS "A" during the morning peak hour and at LOS "B" during the afternoon peak hour. The overall accident rate for this roadway is 1.16 per Mvmt, with no occurrence of accidents involving heavy trucks or fatalities reported within the 3 years of available data (Utah DOT 1994).

U.S. Hwy. 89A is a parallel route to U.S. Hwy. 89, running east-west through northern Arizona between its junction with U.S. Hwy. 89 south of Page to the Arizona-Utah State line north of Fredonia. This roadway serves as the main connection for tourist traffic between the north rim of Grand Canyon National Park and Zion and Bryce Canyon National Parks. U.S. Hwy. 89A is continued into Utah as Utah Route 11. This Arizona DOT-maintained, paved, two-lane highway runs through level to rolling terrain. Within the study area, the speed limit is 55 mph except through the town of Fredonia, where it is reduced to 35 mph. There is a school zone on this roadway in Fredonia, with a pedestrian crossing posted at 15 mph with a moveable sign which is used when school is in session. The existing ADT along U.S. Hwy. 89A within the study area is 3,300 vpd, 11 percent of which is heavy truck traffic. The existing peak-season levels of service on U.S. Hwy. 89A are at LOS "A" during the morning peak hour and at LOS "B" during the afternoon peak hour. The total accident rate for this roadway is 0.24 per Mvmt, with no occurrence of accidents involving heavy trucks or fatalities reported within the 3 years of available data (Arizona DOT 1993b).

Arizona Route 389 is a paved two-lane highway which runs east and north from Fredonia to the Utah State line, where it continues into Utah as Utah Route 59. The terrain is level to rolling, and the speed limit is 55 mph except through the town of Fredonia, where it is reduced to 35 mph. This roadway is maintained by the Arizona DOT. Arizona Route 389, primarily a service and commuter route, currently experiences an

ADT of 2,900 vpd, with a heavy truck traffic component of 11 percent. Recent closure of local industries, including Kaibab Forest Products, should reduce this component. The existing peak-season levels of service on this roadway are at LOS "A" during the morning peak hour and at LOS "B" during the afternoon peak hour. Arizona Route 389 experiences accidents at a total rate of 0.51 per Mvmt, with heavy truck accidents occurring at a rate of 0.24 per Mtmt. The fatal accident rate on this roadway is 2.62 fatalities per 100 Mvmt (Arizona DOT 1993b).

Utah Route 59 is a continuation of Arizona Route 389, running northwest from the Arizona State line near Hildale to its intersection with Utah Route 9 in Hurricane. This Utah DOT-maintained, paved, two-lane highway runs through generally level terrain except near Hurricane, where it experiences steep grades. A long, steep downgrade, known as Hurricane Hill, exists on the Utah Route 59 eastern approach to Hurricane. Vehicles approaching the town on this downgrade must negotiate a series of curves before entering a school zone on the west side of Hurricane. Westbound traffic must stop at the first intersection, then turn right and proceed one block north to Utah Route 9. The steep downgrade terminating at a stop-sign-controlled intersection, in conjunction with the school zone, is a potentially hazardous situation. The speed limit is 55 mph except in the town of Hurricane, where it is reduced to 30 mph, and on the Hurricane Hill approach, where it is reduced to 40 mph. The approach to Hurricane Hill is clearly posted to warn traffic and trucks to check brakes, and a traffic pullout is provided at the top of the hill for brake checks.

The existing ADT on Utah Route 59 is 2,800 vpd, with a heavy truck traffic component of 11.4 percent. The existing peak-season levels of service on Utah Route 59 are at LOS "B" during the morning peak hour and at LOS "C" during the afternoon peak hour. Accidents occur on this roadway at a total rate of 1.02 per Mvmt, with accidents involving heavy trucks occurring at a rate of 0.50 per Mtmt. The fatality rate on Utah Route 59 is 2.21 per 100 Mvmt (Utah DOT 1994). A 1-mile section of Utah Route 59 on the west side of Hurricane is known as Hurricane Hill. This section of roadway has had eight accidents, one being fatal, over the 3-year period (1990 to 1992) for which accident data was collected. All the accidents involved passenger vehicles (i.e., cars, vans, and pick-up trucks). While this section of roadway comprises 5 percent of the Utah Route 59 haul route segment, 16 percent of the accidents recorded in the 3-year period occurred on Hurricane Hill. Parts of Utah Route 59 may be structurally inadequate to handle continuous heavy truck traffic throughout its entire length and requires reconstruction (Chamberlain 1993).

Utah Route 9 within the study area runs east from its interchange with Interstate-15 north of St. George through the towns of Hurricane and La Verkin, traversing Zion National Park, and terminating at its junction with U.S. Hwy. 89 north of Kanab. Utah Route 9 functions as an important tourist route between Interstate-15 and the nearby National Parks at Zion and Bryce Canyon. Within the study area, this paved highway is typically two lanes; however, a 6-mile-long section immediately east of the Interstate-15 interchange was widened to four lanes in 1994. Current planning calls for the remaining two-lane section of Utah Route 9 between Interstate-15 and Hurricane to be widened to four lanes in 1996 and the two-lane section between Hurricane and La Verkin to be widened to four lanes around the year 2000. (Webster 1995). Utah Route 9 is Utah DOT-maintained, with available data indicating fair pavement conditions. The terrain is typically rolling, and the speed limit is 55 mph except near towns, where the speed limit is reduced to 30 mph in Hurricane and 40 mph in La Verkin. There is a school zone and a pedestrian crossing in Hurricane; the crossing is posted 20 mph and has flashing beacons during school use periods. A school zone also exists along Utah Route 9 in La Verkin.

The ADT on Utah Route 9 ranges from 7,535 vpd, 2.3 percent of which is heavy trucks between La Verkin and Hurricane, to 7,080 vpd and a heavy truck component of 5 percent between Hurricane and Interstate-15. The existing peak-season levels of service on Utah Route 9 are at LOS "C" during the morning peak hour and at LOS "D" during the afternoon peak hour, based on two-lane roadway conditions. On the section of roadway between Interstate-15 and Hurricane, accidents occur at an overall rate of 1.22 accidents per Mvmt, with accidents involving heavy trucks occurring at a rate of 1.89 per Mtmt. No fatal accidents were reported on this section of roadway during the 3 years of available data. On the section of Utah Route 9 between Hurricane and La Verkin, the overall accident rate is 2.40 accidents per Mvmt; however, no heavy truck accidents or fatal accidents were reported on this section during the 3 years covered by the data (Utah DOT 1994).

Interstate-15 is a four-lane, divided interstate freeway that traverses the region between Salt Lake City, Utah, and Las Vegas, Nevada, passing through the northwest corner of Arizona. This interstate is the primary surface connection to Las Vegas. Within the study area, Interstate-15 passes though Cedar City, Utah, St. George, Utah, and Mesquite, Nevada, bypassing Moapa, Nevada. Interstate-15 crosses terrain which varies from level to mountainous, with some steep grades. Speed limits along Interstate-15 are 65 mph, except through the Virgin River Gorge, south of St. George, where a 55-mph speed limit is posted. Interstate-15 in Utah is maintained by Utah DOT, in Arizona by Arizona DOT, and in Nevada by Nevada DOT.

The existing ADT along Interstate-15 within the area range from 10,275 vpd to 12,500 vpd. The heavy truck component of this traffic is 25 percent. Based on Highway Capacity Manual criteria, the existing peak-season levels of service on Interstate-15 range from LOS "A" to LOS "B" during the morning peak hour and are at LOS "C" during the afternoon peak hour. Motor vehicle accidents on Interstate-15 between Cedar City and the Utah Route 17 interchange occur at a total rate of 1.25 accidents per Mvmt, while accidents involving heavy trucks occur on this section at a rate of 0.60 accidents per Mtmt. The fatality rate on this section is 2.48 fatalities per 100 Mvmt. On the section of Interstate-15 between the Utah Route 9 interchange and the Arizona State line, the total accident rate is 0.75 per Mvmt, with a heavy truck rate of 0.52 per Mtmt. The fatality rate on this section is 1.46 fatalities per 100 Mvmt. Interstate-15 in Arizona experiences a total accident rate of 0.54 per Mvmt, with accidents involving heavy trucks occurring at a rate of 0.34 per Mtmt. The fatality rate on this section is 2.27 fatalities per 100 Mvmt. Between the Arizona State line and the Hidden Valley interchange in Nevada, Interstate-15 experiences an overall accident rate of 0.55 per Mvmt, with a heavy truck rate of 0.32 per Mtmt. The fatality rate on this section is 3.88 fatalities per 100 Mvmt (Utah DOT 1994; Arizona DOT 1993; Nevada DOT 1993).

Hidden Valley Road in Nevada is a paved, two-lane road maintained by Clark County. This roadway runs west across level terrain toward Moapa from its interchange with Interstate-15. The speed limit is 45 mph. Hidden Valley Road currently experiences an ADT of 195 vpd, 25 percent of which are heavy trucks. The existing levels of service on this low-volume roadway are at LOS "A" at all times. No accident data are available for this low-volume roadway (Nevada DOT 1993). Parts of the Hidden Valley Road may be inadequate to sustain frequent heavy truck loadings (Maki 1994).

Utah Route 17 runs in a north-south alignment from its junction with Utah Route 9 at La Verkin, through Toquerville, to its interchange with Interstate-15. This roadway provides tourist connection between Interstate-15 and the National Parks at Zion and Bryce Canyon. Utah Route 17 is a Utah DOT-maintained two-lane, paved highway which traverses rolling to mountainous terrain, with some steep grades and sharp curves. The speed limit is generally 50 mph except through the towns of Toquerville and La Verkin, where it is reduced to 40 mph, and on several curves and grades, where the posted speed limit is also 40 mph. There is a school zone and bus route along this roadway in Toquerville. Utah Route 17 currently experiences an ADT of 1,985 vpd, with a heavy truck traffic component of 9.3 percent. The existing peak season levels of service on Utah Route 17 are at LOS "B" during the morning peak hour and LOS "C" during the afternoon peak hour. This roadway experiences accidents at an overall rate of 1.98 per Mvmt, with heavy truck accidents occurring at a rate of 1.07 per Mtmt. A fatal accident rate of 9.98 fatalities per 100 Mvmt was experienced on this roadway during the 3 years of available data (Utah DOT 1994). Parts of Utah Route 17 may be structurally inadequate to handle continuous heavy truck loadings, but currently there are no plans for reconstruction (Chamberlain 1993).

Utah Route 56, primarily a service and commuter route, runs east-west from its interchange with Interstate-15 in Cedar City to the Utah-Nevada State line. Within the study area, this Utah DOT-maintained, paved, two-lane highway runs through level terrain. The speed limit is 55 mph except through Cedar City, where it is 45 mph. The existing ADT on Utah Route 56 is 2,315 vpd, with a heavy truck traffic component of 8 percent. The existing peak-season levels of service on Utah Route 56 are at LOS "A" during both morning and afternoon peak hours. This roadway experiences accidents at an overall rate of 0.55 Mvmt, with heavy truck accidents occurring at a rate of 0.99 Mtmt. The fatality rate on Utah Route 56 is 6.27 fatalities per 100 Mvmt (Utah DOT 1994). Parts of Utah Route 56 may be structurally inadequate to handle continuous heavy truck loadings (Chamberlain 1993).

Iron Springs Road is a paved, two-lane highway which runs northwest through level terrain from its intersection with Utah Route 56. The speed limit on this road is 55 mph. Iron Springs Road currently experiences an ADT of 785 vpd, with a heavy truck component of 5 percent. The existing levels of service on this Iron County-maintained, low-volume roadway are at LOS "A" at all times. Accident data for this roadway are not available for the 1990 to 1992 time period for which accident data was collected for the other roadway segments (Utah DOT 1994). This road was upgraded in 1994 and appears to be adequate for heavy truck loading at this time.

3.7.2 Intersections

There are 10 major roadway intersections along the proposed Warm Springs Project haul route: 4 are grade-separated interchanges, or overpasses, along Interstate-15, and 6 roadways intersect at the same grade along other haul routes. Two of the at-grade intersections are controlled by traffic signals, and the remainder are unsignalized (traffic is controlled by stop or yield signs). Figure 3-8 illustrates the configuration of each intersection. The existing LOS at these intersections is generally in the very good to acceptable range. At the Interstate-15/Utah Route 56 interchange in Cedar City, however, side street operations are in the LOS "D" to LOS "E" range during the afternoon peak hour. This condition is due to the relatively high through-traffic volumes along Utah Route 56 and indicates that the existing traffic levels

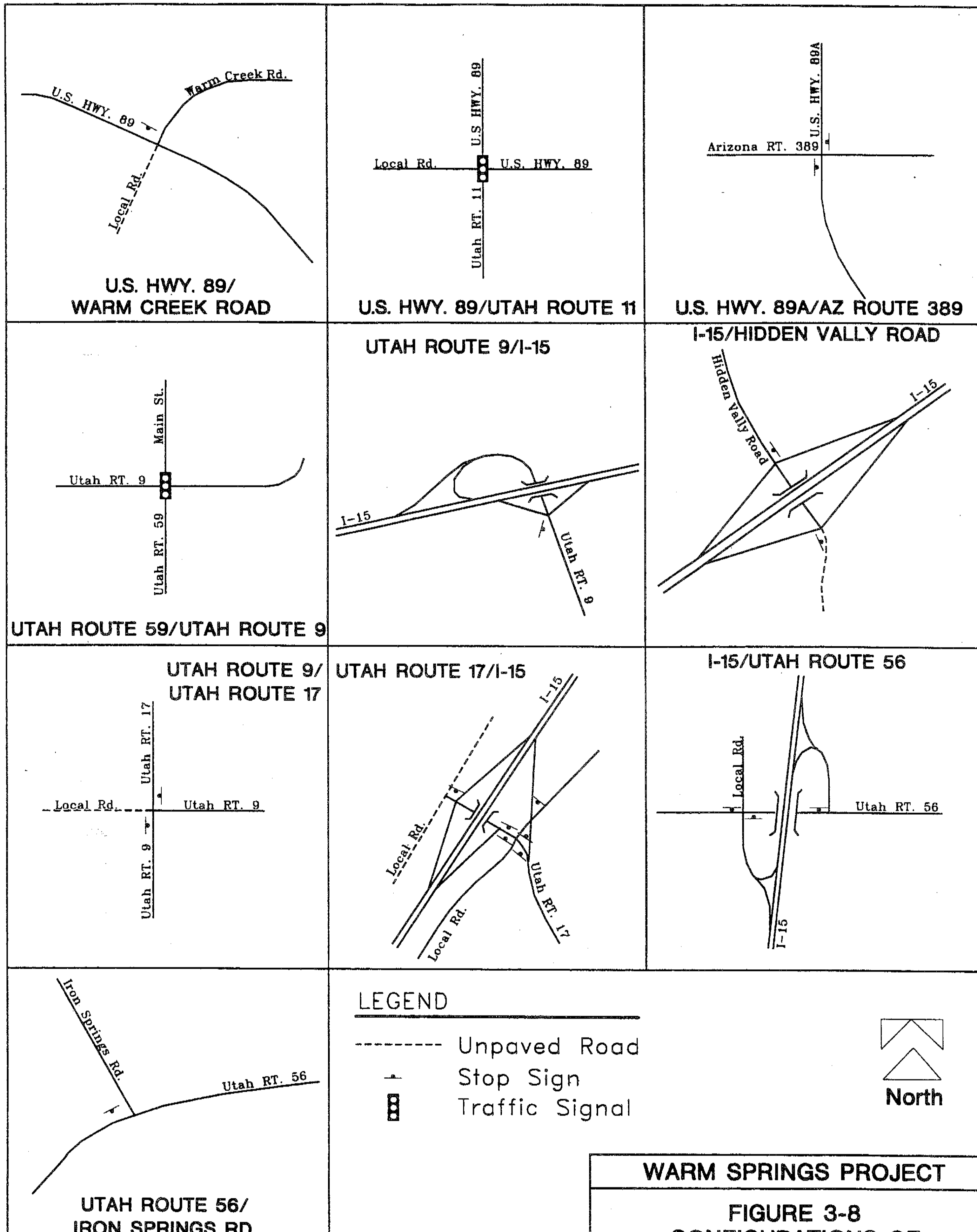

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FIGURE 3-8
CONFIGURATIONS OF
SELECTED INTERSECTIONS

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are approaching the capacity of this facility (Chamberlain 1993). Table 3-7 provides existing LOS data for selected intersections in the area.

Table 3-7 also represents averages of accident records for the selected intersections during the 3-year period from 1990 through 1992. The total accident rates are expressed as accidents per million vehicles entering the facility (Mve). The breakdown of heavy truck accidents is not contained in the available data for these intersections. No fatal accidents were reported within the 3 years of available data at these locations (Utah DOT 1994; Arizona DOT 1993b; Nevada DOT 1993).

The intersection of Warm Creek Road and U.S. Hwy. 89 in Big Water is a "T" configuration with single-lane approaches. Traffic control at this intersection consists of a stop sign on the Warm Creek Road approach. The existing levels of service at this intersection are at LOS "A" during all periods. No accidents were reported at this location during the 3 years of available data (Utah DOT 1994).

The intersection of U.S. Hwy. 89 and Utah Route 11 in Kanab is a four-way, traffic-signal-controlled intersection. All approaches to this intersection have three lanes each. The eastbound/westbound approaches have separate left-turn and right-turn lanes with a single through lane. The northbound/southbound approaches have separate left-turn lanes with two through lanes; right turns occur from the curb lane. The existing traffic-signal-controlled operations at this intersection are at LOS "B." Six accidents occurred at this location, resulting in a rate of 0.44 accidents per Mve (Utah DOT 1994).

In Fredonia, the four-way intersection of U.S. Hwy. 89A and Arizona Route 389 has no signal, but has stop-sign control on the eastbound and westbound single-lane approaches. The northbound and southbound approaches each have three lanes, consisting of an exclusive left-turn lane, an exclusive through lane, and a shared through/right-turn lane. The existing traffic operations at this intersection are at LOS "A" during both morning and afternoon peak hours. No accidents were reported at this location during the 3 years of available data (Arizona DOT 1993b).

The Utah Route 9/Utah Route 59 intersection in Hurricane is four-way, with traffic-signal control. Each approach has three lanes consisting of a separate left-turn, right-turn, and through lane. Signalized traffic operations at this intersection are currently at LOS "B." The data indicate 11 accidents at this intersection for a rate of 0.75 accidents per Mve (Utah DOT 1994).

The Interstate-15/Utah Route 9 interchange west of Hurricane consists of a "half-diamond" configuration on the east side of Interstate-15, with a "trumpet" configuration on the west side (Figure 3-8). All approaches to this interchange are single lane, and there is no traffic-signal control. The existing levels of service at this interchange are at LOS "A" during all periods. Only one accident occurred at this location during the 3 years of available data, resulting in an overall accident rate of 0.09 accidents per Mve (Utah DOT 1994).

In Nevada, the Interstate-15/Hidden Valley Road interchange near Moapa is a "diamond" configuration. The west ramp intersection has stop-sign control on the southbound approach, and the east ramp intersection has stop-sign control on the northbound approach. All approaches are single lane. The existing levels of service at this interchange are at LOS "A" during both peak hours based on Highway Capacity Manual

Table 3-7 — Existing LOS and Accident Rates at Selected Area Intersections

Roadway	LOS[1]	Total Rate (Mve)[2]
COMMON ROUTE TO HURRICANE		
U.S. Hwy. 89 at Warm Creek Road	A;A	0.00
U.S. Hwy. 89 at Utah Route 11	B;B	0.44
U.S. Hwy. 89A at Arizona Route 389	A;A	0.00
Utah Route 59 at Utah Route 9	B;B	0.75
ROUTE TO MOAPA		
Utah Route 9 at Interstate-15	A;A	0.09
Interstate-15 at Hidden Valley Road	A;A	0.00
ROUTE TO IRON SPRINGS		
Utah Route 9 at Utah Route 17	A;A-C	1.20
Utah Route 17 at Interstate-15	A;A	1.07
Interstate-15 at Utah Route 56		
Utah Route 56	A;A	
Interstate 15	C-D;D-E	0.12
Utah Route 56 at Iron Springs Road	A	0.00

Sources: Utah Department of Transportation 1994.
Arizona Department of Transportation 1993b.
Nevada Department of Transportation 1993.

[1]LOS "A" = highest level of service; LOS "F: = lowest, or worst, level of service. Two letters with a semicolon identify LOS during the morning (7 a.m. to 8 a.m.) and afternoon (5 p.m. to 6 p.m.) peak hours, respectively. Two letters separated by a dash indicates that the level of service varies by turning direction.

[2]Million vehicles entering intersection (all vehicles).

methods. No interchange-related accidents occurred at this location during the 3 years of available data (Nevada DOT 1993).

The intersection of Utah Route 9 and Utah Route 17 in La Verkin is a four-way, unsignalized intersection with stop-sign control on the eastbound and westbound approaches. The northbound approach has three lanes, consisting of exclusive left- and right-turn lanes and a single through lane. The southbound approach has a separate left turn lane with a shared through/right-turn lane. The westbound approach consists of a shared left-turn/though lane with an exclusive right-turn lane, and the eastbound approach is a single lane. In general, the existing operations during all periods are at LOS "A"; however, the westbound left turn experiences LOS "C" during the afternoon peak hour. There were 10 accidents at this location in the 3-year period, resulting in a rate of 1.20 accidents per Mve (Utah DOT 1994).

The Interstate-15/Utah Route 17 interchange north of La Verkin is a "diamond" configuration. The west ramp intersection has stop-sign control on the southbound approach. The east off-ramp intersection has stop-sign control on the northbound approach. A frontage road intersects both Utah Route 17 and the east on-ramp to the east of the highway. There is stop-sign control on all frontage road approaches to these intersections. All intersection approaches at this interchange are single lane. The existing levels of service at this interchange are at LOS "A" during all periods. The two reported accidents translate to an average rate of 1.07 accidents per Mve (Utah DOT 1994).

The Interstate-15/Utah Route 56 interchange in Cedar City is a "two quadrant cloverleaf" design (Figure 3-8). The west ramp intersection is four-way, with stop-sign control on the northbound and southbound approaches. The north leg of this intersection serves a residential area. The east ramp intersection is a "T" configuration, with stop-sign control on the southbound approach. Each side street approach has a single lane, whereas the Utah Route 56 approaches have separate left-turn lanes with two through lanes. Right turns on Utah Route 56 occur from the outside lanes. The existing levels of service at this interchange are at LOS "A" during both peak hours for traffic on Utah Route 56. For traffic on the stop-sign-controlled west ramps, LOS "C" is experienced during the morning peak hour and LOS "D" during the afternoon peak hour. Operations on the stop-sign-controlled east ramp are at LOS "D" during the morning peak hour and at LOS "E" during the afternoon peak hour. Three accidents were reported in the 3-year period, resulting in an overall accident rate of 0.12 accidents per Mve (Utah DOT 1994).

The intersection of Iron Springs Road and Utah Route 56 west of Cedar City is a "T" configuration (Figure 3-8). The Iron Springs Road approach consists of a stop-sign-controlled, single lane. The eastbound Utah Route 56 approach to this intersection is single lane. The westbound approach provides a separate left-turn lane. The existing levels of service at this intersection are at LOS "A" during all periods. No accidents were reported at this location during the 3 years of available data (Utah DOT 1994).

3.8 NOISE

3.8.1 Introduction

Sound is technically described in terms of loudness (amplitude) and frequency (pitch). The standard unit of measurement of the loudness of sound is the decibel (dB). Since the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear.

Decibels are based on the logarithmic scale. The logarithmic scale compresses the wide range in sound pressure levels to a more usable range of numbers in a manner similar to that of the Richter scale used to measure earthquakes. In terms of human response to noise, a sound that is 10 dBA higher than another is judged to be twice as loud, a sound that is 20 dBA higher is four times as loud, and so forth. For example, a gas lawnmower at 100 feet would be about twice as loud (74 dBA) as heavy traffic at 300 feet (64 dBA). Noisy urban daytime sounds (84 dBA) would be perceived as being four times as loud as heavy traffic at 300 feet. Everyday sounds normally range from 30 dBA (very quiet) to 100 dBA (very loud). (Examples of various sound levels in different environments are shown in Figure 3-9.) Rural and backcountry areas generally have dBA levels from 25 to 45 dBA. Suburban and urban areas generally have dBA levels that range from 35 to 85 dBA. Estimated noise levels for heavy freeway traffic at 60 mph, measured at a distance of 300 feet, are between 60 and 65 dBA. Estimated noise levels at 300 feet from heavy traffic in commercial areas approach 70 dBA. Traffic noise levels tend to decrease as average speeds decrease. As background traffic diminishes after peak daytime activity, evening and nighttime noise levels generally drop below 60 dBA (EPA 1974).

Sound levels decrease with distance from the source as a result of wave divergence, atmospheric absorption, and ground attenuation (e.g., the influence of topography and vegetation). The sound wave travels away from the source, and the sound energy is dispersed over a greater area, thereby dispersing the sound power of the wave (divergence). Atmospheric absorption also influences the levels that are received by the observer. The greater the distance traveled, the greater the influence and the resultant fluctuations. The degree of absorption is related to the frequency of the sound, as well as to the humidity and temperature of the air. Turbulence and gradients of wind, temperature, and humidity also play an important role in determining the degree of ground attenuation.

Noise has been defined as unwanted sound, and it is known to have several adverse effects on people. From these effects of noise, criteria have been established to help protect the public health and safety and to prevent disruption of certain human activities. These criteria are based on such known effects of noise on people as hearing loss, communication interference, sleep interference, physiological responses, and annoyance.

Hearing loss is, in general, not a concern in community noise problems. The potential for noise-induced hearing loss is more commonly associated with occupational noise exposures in heavy industry or with very noisy work environments causing noise exposure over an extended period of time. Communication

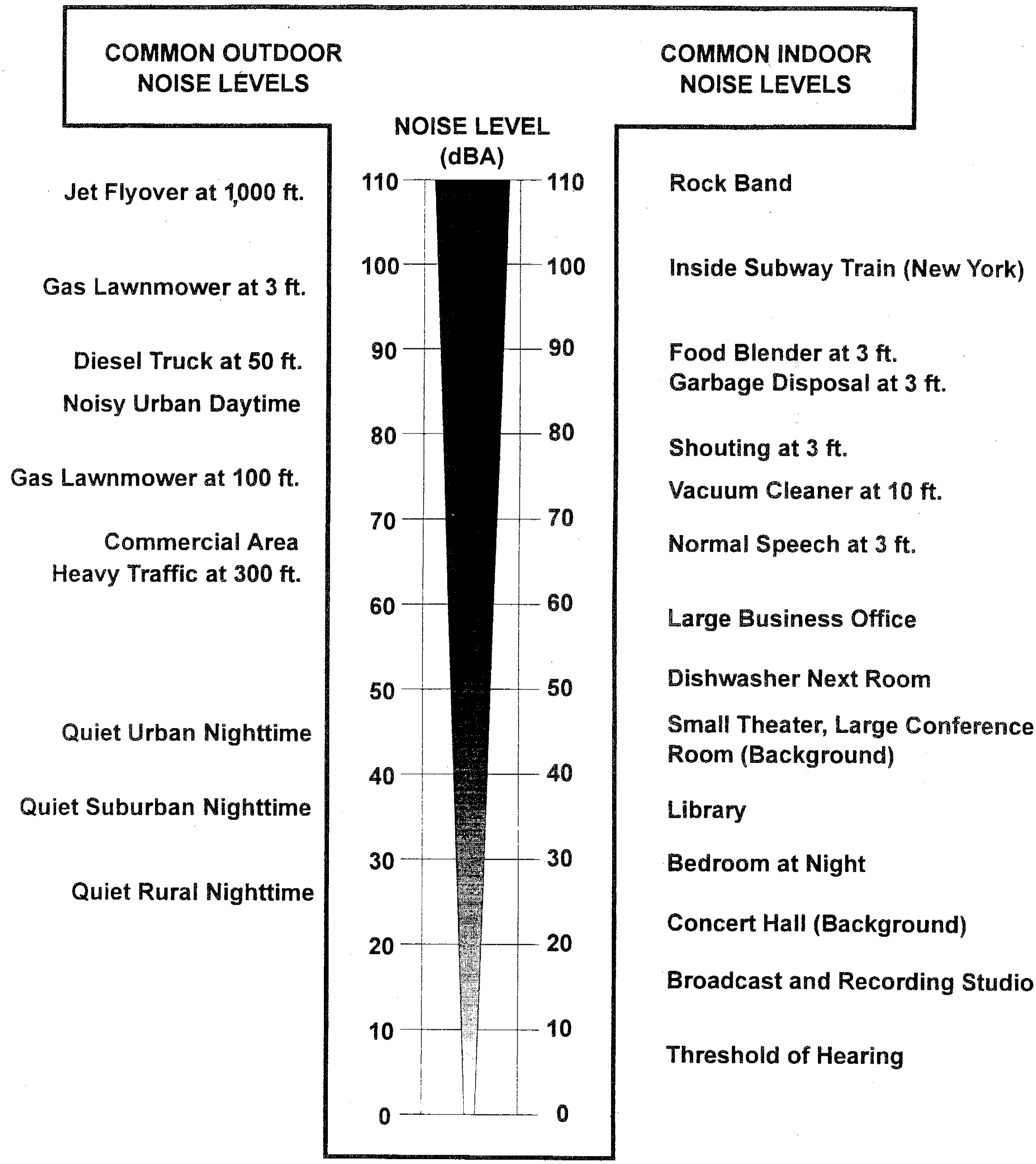

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FIGURE 3-9
COMPARATIVE NOISE LEVELS

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interference is one of the primary concerns in environmental noise problems. Communication interference includes speech interference and other activities, such as watching television. Normal conversational speech is in the range of 60 to 65 dBA, and any noise in this range or louder may interfere with speech.

Sleep disturbance is another major cause of annoyance due to community noise. Extensive research has been conducted on the effect of noise on sleep disturbance. Recommended values for desired sound levels in residential bedroom space range from 25 to 45 dBA, with 35 to 40 dBA being the norm. The National Association of Noise Control Officials has published data on the probability of sleep disturbance with various single-event noise levels. Based on experimental sleep data as related to noise exposure, a 75 dBA interior noise-level event will cause noise-induced awakening in 30 percent of the cases.

Physiological responses are those measurable effects of noise on people, such as changes in pulse rate, blood pressure, etc. Although these effects can be induced and observed, the extent to which these physiological responses cause harm is not known. Generally, physiological responses are a reaction to a sudden loud noise, such as a rifle shot or a very loud jet overflight.

The effects of noise on humans depends on a combination of physiological and behavioral traits. By nature, these effects are difficult to describe because different people react differently to noises. For example, a jet airplane flying overhead may disrupt a conversation between people and cause momentary hearing loss. One person might term this occurrence as extremely annoying, whereas another person may find it only a mild nuisance.

Annoyance is the most difficult of all noise responses to describe. Annoyance is a very individual characteristic and can vary widely from person to person. What one person considers tolerable can be quite unbearable to another of equal hearing capability. The level of annoyance, of course, depends on the characteristics of the noise (i.e., loudness, frequency, and duration), and on how much activity interference (e.g., speech or sleep interference) results from the noise. However, the level of annoyance is also directly related to the attitude of the receiver. Personal sensitivity to noise varies widely. Attitudes are affected by the relationship between the person and the noise source. (Is it our dog barking or the neighbor's dog?) Whether we believe that someone is trying to abate the noise will also affect the level of annoyance.

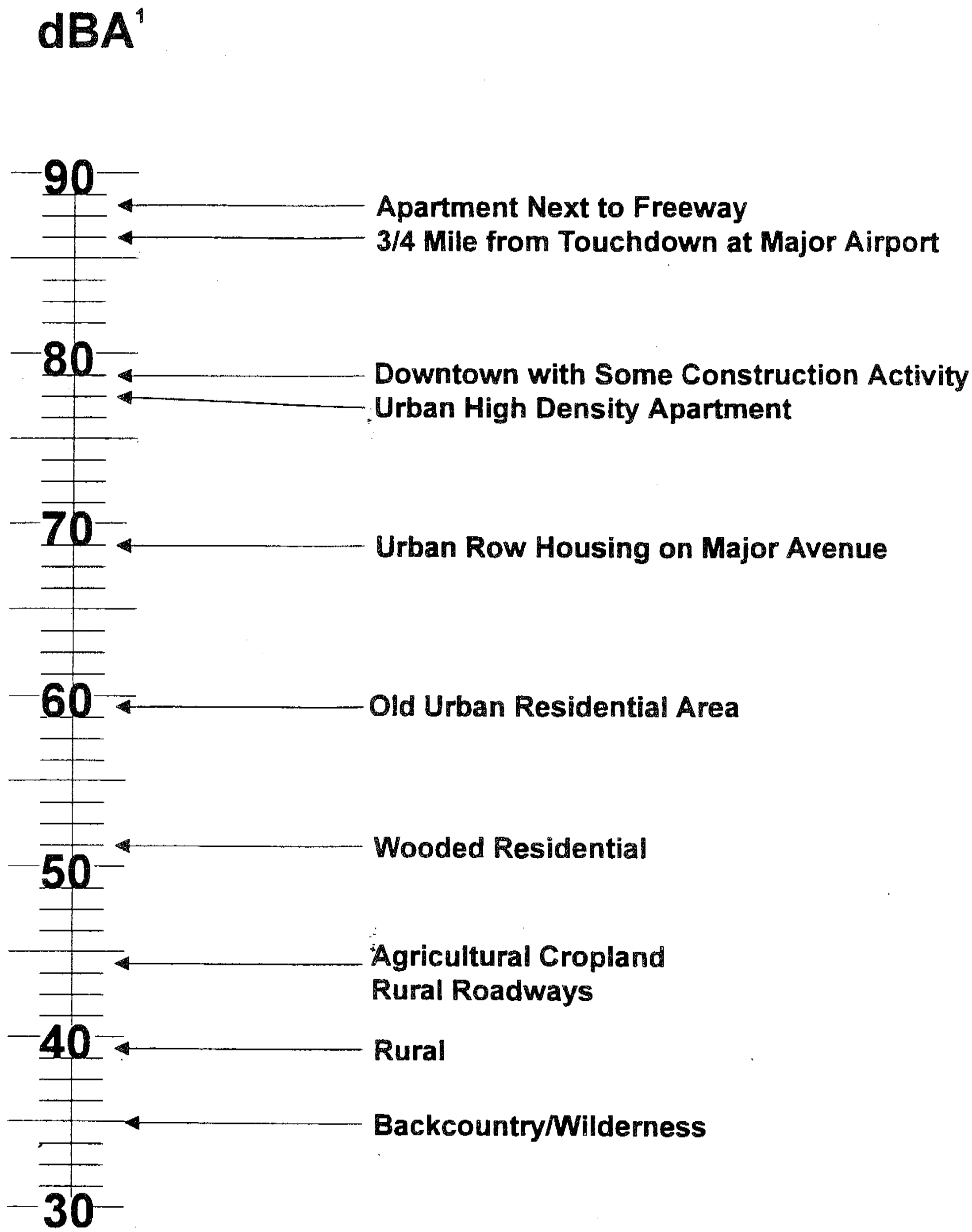
The description, analysis, and reporting of community noise levels is made difficult by the complexity of human response to noise and the myriad of noise-measurement methods that have been developed for describing noise impacts. Each of these noise-measurement methods attempts to quantify noise levels with respect to community response. These noise-measurement approaches can be divided into two categories: single event and cumulative. A single-event noise measurement describes the noise levels for a single event, such as an individual truck passing by. For example, as a truck approaches, the sound of the truck begins to rise above ambient noise levels. The closer the truck gets, the louder it is until the truck is at its closest point directly adjacent to the person hearing the noise. Then, as the truck passes, the noise level decreases until the sound level again settles to ambient levels. The highest noise level reached during the episode is, not surprisingly, called the "Maximum Noise Level." It is this noise level to which people instantaneously respond when a large truck or other piece of large machinery passes by.

Cumulative noise measurements average the total noise over a specific time period, which typically is 24 hours. Cumulative-noise-measurement scales have been developed to assess community response to noise. They are useful because these scales attempt to include the loudness of each event, the duration of these events, the total number of events, and the time of day these events occur into a single-number rating scale. They are designed to account for the known health effects of noise on people. Based on these effects, the observation has been made that the potential for a noise to impact people is dependent on the total acoustical energy content of the noise. A number of noise scales have been developed to account for this observation.

The term "metric" is used in environmental noise analysis to refer to the unit or quantity that measures or represents the effect of noise on people. The metric called the day-night average sound level (Ldn) has been adopted by the U.S. Environmental Protection Agency (EPA) as the rating method used to describe community noise. Ldn is a 24-hour, time-weighted, average noise, or average dBA, level. It is a measure of the overall noise experienced during an entire day. The term "time-weighted" refers to the fact that noise that occurs during certain sensitive time periods is penalized for occurring at these times. In the Ldn scale, those events that take place during the night (10 p.m. to 7 a.m.) are penalized by 10 dBA. This penalty was selected to attempt to account for increased human sensitivity to noise during the quieter period of a day, during which sleep is the most probable activity. Community reaction surveys have found that prolonged Ldn noise levels approaching or above 80 dBA generally disturb people enough that they take vigorous community action to try to reduce or eliminate the noise source. Figure 3-10 identifies general Ldn levels for various outdoor noise environments. Table 3-8 outlines public reactions to various noise sources and levels. Ldn levels generally range from 35 Ldn in backcountry/wilderness areas to 70 to 85 Ldn for urban areas along major highways (EPA 1974).

EPA has also identified a range of yearly day-night sound levels sufficient to protect public health and welfare from the effects of environmental noise (EPA 1974, 1978). Outdoor yearly levels on the Ldn scale are sufficient to protect public health and welfare if they do not exceed 55 dBA in sensitive areas (residences, schools, and hospitals). With the 10-decibel nighttime weighting applied, an Ldn of 55 would be achieved by a continuous sound level at 48.6 dBA. Inside buildings, yearly levels on the Ldn scale are sufficient to protect public health and welfare if they do not exceed 45 dBA. Maintaining an Ldn noise level of 55 dBA outdoors should ensure adequate protection for indoor living. Because these protective levels were derived without concern for technical or economic feasibility, and contain a margin of safety to ensure their protective value, EPA has indicated that they should not be viewed as standards, criteria, regulations, or goals. Rather, they should be viewed as levels below which there is not reason to suspect that the general population will be at risk from any of the identified effects of noise (EPA 1974, 1978).

The Department of Housing and Urban Development (HUD) has provided noise levels for addressing suitable conditions for housing, and the Federal Highway Program Manual provides a Federal guideline for acceptable background noise conditions. In both cases, a level of 55 dBA is generally given as a maximum for what would be considered "most critical" requirements, such as private residences, or "parks, amphitheaters, * * * or activities requiring special qualities of serenity and quiet" (Acoustical Engineers, Inc. 1994).



1 - dBA in Ldn Scale
Source: EPA 1974

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FIGURE 3-10
TYPICAL OUTDOOR
NOISE ENVIRONMENTS

DATE: APRIL 1995 ACAD FILE: BLANKS

Table 3-8 — Relative Scale of Various Noise Sources

Public Reaction	Noise Level (dBA)	Common Indoor Noise Levels	Common Outdoor Noise Levels	Comparative Noise Levels[1]
	110	Rock band	Jet Flyover at 1,000 ft.	
Local committee activity with influential or legal action	100	Inside subway train (New York).	Gas lawnmower at 3 ft.	
Letter of protest	90	Food blender at 3 ft.	Diesel truck at 50 ft.	4 times as loud.
Complaints likely	80	Garbage disposal at 3 ft.; shouting at 3 ft.	Noisy urban daytime.	Twice as loud.
Complaints possible	70	Vacuum cleaner at 10 ft.	Gas lawnmower at 100 ft.	Reference point.
		Normal speech at 3 ft.	Commercial areas, heavy traffic at 300 ft.	
Complaints rare	60	Large business office.		One-half as loud.
	50	Dishwasher next room.	Quiet urban daytime.	
	40	Small theater; large empty conference room (background).	Quiet urban nighttime.	
		Library.	Quiet suburban nighttime.	
	30	Bedroom at night; empty concert hall (background).	Quiet rural nighttime.	
	20	Broadcast and recording studio.		
	10	Threshold of hearing.		
	0	No detectable sound.		

Source: Hatano 1980.

[1] The indoor reference point for comparison between noise levels is a vacuum cleaner at 10 feet. The outdoor reference point is a gas lawn mower at 100 feet. For example, a dBA of 80 is twice as loud as a vacuum cleaner at indoor noise levels and twice as loud as a lawn mower at outdoor noise levels.

3.8.2 Existing Noise Environment

Noise levels in southern Utah, northern Arizona, and southeastern Nevada generally range from the low 30s (Ldn) in wilderness areas to the upper 80s (Ldn) in high-density urban areas near freeways (EPA 1974). Noise levels in the Smoky Mountain area are estimated to range from 30 to 40 Ldn, typical of backcountry and rural areas with no major noise sources (EPA 1974) (Figure 3-10).

Existing noise levels along the Warm Creek Road and other rural dirt roads in the region are principally due to low levels of vehicular traffic. They range from about 40 to 45 Ldn (EPA 1974). Current noise levels along regional roadways range from 55 to 60 Ldn along rural highways, such as U.S. Hwy. 89, Arizona Route 389, Utah Route 59, and Utah Route 17, to 68 to 80 Ldn along Utah Route 9 in Hurricane and along Interstate-15 (EPA 1974). Noise levels along paved rural roads with low levels of vehicular traffic, such as the Hidden Valley Road and the Iron Springs Road, are estimated to range from 45 to 50 Ldn.

Existing noise levels in urban areas in the region, including Kanab, Fredonia, Hurricane, La Verkin, Toquerville, Cedar City, and St. George, are primarily related to vehicular traffic and are estimated to range from 50 Ldn for scattered residential areas to 78 to 80 Ldn in residences next to the freeway in Cedar City, Utah (EPA 1974). An elementary school is located near the intersection of Utah Route 59 and Utah Route 9 in Hurricane and is considered a sensitive noise receptor. Table 3-9 identifies current peak-hour-traffic noise levels along selected roadway segments in the area at current traffic volumes. Current peak hour noise levels along Utah Route 9, Arizona Route 389, and Utah Route 59 indicate that some complaints regarding noise levels could be elicited now under current traffic conditions (Tables 3-8 and 3-9). (Calculations and data used in determining existing noise levels are provided in Appendix E.)

3.9 SOCIOECONOMICS

3.9.1 Employment, Personal Income, and Population

The southern Utah, northern Arizona, and southeastern Nevada area comprises a diverse socioeconomic environment. From sparsely populated Kane County, Utah, with a 1990 population of 5,169 residents in an area of nearly 4,000 square miles, the area also encompasses Clark County, Nevada. Clark County is among the fastest growing counties in the country owing to growth of the Las Vegas metropolitan area. A similar contrast exists in the diversity, scale, and composition of the local economies. In 1992, total personal incomes and employment in Kane County, $71.9 million and 2,497 jobs, respectively, equaled only 0.5 percent of the equivalent measures in Clark County (U.S. Bureau of Economic Analysis 1994a, b). Washington and Iron Counties in Utah also support economies several orders of magnitude larger than that in Kane County. The economy of Coconino County, Arizona, although very large in aggregate, is dominated by the activity in and around Flagstaff, Arizona. However, Flagstaff is located in the south-central part of the county, quite distant from the northern communities of Page and Fredonia, Arizona.

Table 3-9 — Current Peak Hour Traffic Noise Levels Along Selected Area Roads

Roadway	Section	Existing Noise Levels[1]
COMMON ROUTE TO HURRICANE		
Warm Creek Road	All.	46.7
U.S. Hwy. 89	Big Water to Kanab.	67.3
Utah Route 11	Kanab to Arizona State Line.	70.3
U.S. Hwy. 89A	Utah State line to Fredonia.	71.6
Arizona Route 389	Fredonia to Colorado City/Utah State line.	71.1
Utah Route 59	Hildale/Arizona State line to Hurricane.	71.1
ROUTE TO MOAPA		
Utah Route 9	Hurricane to Interstate-15.	72.2
Interstate-15	Utah Route 9 to Arizona State line.	80.4
Interstate-15	Utah/Arizona State line to Arizona/Nevada State line.	80.1
Interstate-15	Nevada/Arizona State line to exit 88 in Nevada.	80.6
Hidden Valley Road	Interstate-15 to Moapa.	62.6
ROUTE TO IRON SPRINGS		
Utah Route 9	Hurricane to La Verkin.	70.3
Utah Route 17	La Verkin to Interstate-15.	68.8
Interstate-15	Utah Route 17 to exit 59.	79.8
Utah Route 56	Interstate-15 to Iron Springs Road.	68.9
Iron Springs Road	Utah Route 56 to Iron Springs.	62.6

[1] In A-weighted decibel scale (dBA).

Tourism and recreation, supported by of attractions ranging from the gaming and convention activity in Las Vegas, Nevada, to the natural and outdoor recreation opportunities at the Grand Canyon National Park and Glen Canyon National Recreation Area, are critical to all the economies in the region. This dependency is reflected in the high level of trade and services employment in the local economies (Table 3-10). Federal, State, and local government employment comprises another important segment of the region's economic base. Government's influence is most pronounced in the smaller economies, where Federal land resource management agency offices and district offices of State agencies rank among the larger employers. Industrial employment typically accounts for less than one-fifth of all local employment. Kane and Iron Counties continue to have viable agricultural sectors.

Agriculture was the dominant industry when much of the region was initially settled by Euro-Americans. The region's ties to natural resources since then have included mineral mining, timber harvest, and lumber production in Iron County and northern Arizona. A combination of market forces, environmental and public resource management decisions, and other factors have resulted in cutbacks or closures of many of these operations.

St. George, Utah, which is growing rapidly, is the largest trade and service center in the immediate region. Private establishments and public institutions in St. George serve residents and businesses throughout southern Utah, northern Arizona, and parts of southeastern Nevada. Las Vegas, Nevada, the only major metropolitan area in the immediate region, is about 40 miles south of Moapa. Consumers in Page have a stronger linkage to Flagstaff and Phoenix, Arizona, for shipping and services.

Cedar City, Utah, and Page, Arizona, are the next largest tier of trade centers in the region. These communities host the offices of various governmental agencies, institutions of higher education, and a variety of trade and service establishments serving residents and visitors to the region. Kanab, Utah, is centrally located among five major National parks and recreation areas and lies at the junction of several important travel routes; it supports a healthy hospitality sector. Other communities in the region function primarily as local trade and service centers.

Economic growth, as measured by employment, has not been limited just to the counties of Clark, Nevada, and Washington, Utah (Table 3-11). Between 1980 and 1990, all five counties experienced noteworthy increases in employment. Major factors causing the economic growth include immigration of many retirees, industrial development, and increased tourism and recreation visitation throughout the region. Both Washington and Iron Counties, which are traversed by Interstate-15, have enjoyed recent success in attracting new specialty and light industrial manufacturing and distribution firms.

By the year 2000, employment in Washington, Iron, and Kane Counties, Utah, is projected to increase by more than 27,100 jobs. In Coconino County, Arizona, total employment is anticipated to top 69,000, a gain of more than 20,300 jobs over that in 1990. The Page, Arizona, area will experience some growth, but most of these gains will be in the southern part of the county. Driven by higher demands in both the resident consumer and hospitality markets, Clark County, Nevada, employment is projected to expand by nearly 50 percent to 680,026 jobs.

Table 3-10 — Regional Economic and Employment Characteristics, 1992

County	Personal Income (Millions)	Employment Total Employees	Farm (%)	Industrial[1] (%)	Services[2] (%)	Government (%)
Coconino, AZ	$1,740.3	52,146	0.6	17.7	58.1	23.6
Kane, UT	71.9	2,497	6.5	13.0	59.8	20.7
Washington, UT	700.5	24,250	1.8	24.0	61.2	13.0
Iron, UT	265.8	11,163	4.4	20.4	51.4	23.8
Clark, NV	17,562.9	477,991	0.1	18.2	70.0	11.8

Source: U.S. Bureau of Economic Analysis 1994a.
[1]Includes agricultural services, mining, construction, manufacturing, transportation and wholesale trade.
[2]Includes retail trade, financial, and other services.

Table 3-11 — Regional Employment, 1980 to 2000

County	Employment 1980	1990	2000[1]	Change[1] 1990-2000
Coconino, AZ	35,183	48,707	69,036	20,329
Kane, UT	1,541	2,343	4,070	1,727
Washington, UT	9,396	21,162	41,046	19,884
Iron, UT	7,340	10,068	15,591	5,523
Clark, NV	268,849	456,400	680,026	223,626

Sources: U.S. Bureau of Economic Analysis 1994a.
[1]With existing growth trends.

Per capita incomes of the three Utah counties fell below those in the two neighboring States. Per capita personal income in the region has consistently lagged behind the National averages. Annual per capita personal income at the county level in 1990 ranged from $8,539 in Iron County to $10,708 in Clark County in 1990 (Table 3-12), 26 to 41 percent below the National average of $14,420 (U.S. Bureau of the Census 1992a).

Factors contributing to the pattern of subpar incomes include limited growth in the numbers of skilled industrial and professional positions, losses of mining and timbering jobs, and the heavy dependency on tourism-related employment. The latter is characterized by lower paying, seasonal and/or part-time jobs. Below average incomes and their corollary, comparatively low wages and salaries, underlie economic and industrial development activities in the region, acting as both a stimulus and a locational advantage for recruitment efforts. Recent economic development successes in Iron and Washington Counties can be expected to increase per capita incomes of residents of those counties.

The population growth and industrial development occurring in Las Vegas, St. George, and Cedar City have not precipitated similar growth in Kane County and northern Coconino County. Rather, economic conditions in these latter areas are characterized by some area residents as offering inadequate employment opportunities and, in part, being responsible for some economic outmigration from the region (Adams 1994).

The entire region experienced population growth between 1980 and 1990, punctuated by growth in Las Vegas/Clark County, Nevada, and St. George/Washington County, Utah (Table 3-13). During the decade, the respective population of the two counties increased by 60 and 86 percent. A heavy influx of retirees and successful economic development efforts are oft-cited factors underlying that growth. These trends are expected to continue over the foreseeable future. Clark County's population is expected to top 1.1 million by the year 2000 and 1.5 million 10 years later (University of Nevada, Reno no date and 1993). Washington County's population is projected at 81,845 in the year 2000, with St. George approaching 50,000, a milestone which would qualify it as a metropolitan statistical area. By the year 2010, Washington County's population is projected at 118,934 (Utah GOPB 1993a). The economic growth centered around St. George has resulted in spinoff growth in the outlying communities and unincorporated areas of Washington County, including Hurricane, Toquerville, and La Verkin.

The rural areas of the region have also grown, but at a more moderate pace. The combined increase of Kane and Iron Counties, Utah, and northern Coconino County, Arizona, totaled 6,441 residents between 1980 and 1990. Growth in Fredonia and the Kanab area temporarily abated between 1989 and 1993 because of layoffs in the mining and timbering industries. Population growth has since resumed, particularly in Kanab. Growth in Kanab is attributed to a combination of tourism-related business expansion, retirees, households reportedly moving in from Washington County, and individuals with flexible employment situations that allow more latitude in choices of where to live. The Page and Cedar City communities have been growing consistently since 1990. For example, Iron County's 1993 population estimate of 23,800 is an increase of 2,900 residents in just 3 years.

Continued economic expansion and population growth are expected throughout the rural counties. For example, compared to a population of 20,789 in 1990, 14,000 additional residents are projected in Iron

Table 3-12 — Regional Income and Unemployment, 1990

	Per Capita Income	Unemployment Rate (%)
Coconino County, AZ	$10,580	9.0
Kane County, UT	8,721	6.9
Washington County, UT	9,450	4.8
Iron County, UT	8,539	6.5
Clark County, NV	10,708	6.7
U.S.	14,420	6.3

Source: U.S. Bureau of the Census 1992b.

Table 3-13 — Selected Regional Population Trends, 1980 to 2010

	1980	1990	2000	2010	Change 1980-2010	Average % change per year
COCONINO COUNTY, AZ						
Page	4,907	6,596	8,125	9,862	4,955	3
Fredonia	1,040	1,207	1,486	1,804	764	2
Entire County	75,008	96,591	118,950	144,375	69,367	2
KANE COUNTY, UT						
Kanab	2,148	3,289	4,448	5,978	3,830	6
Big Water	154	315	426	573	419	9
Entire County	4,024	5,169	6,990	9,395	5,371	5
WASHINGTON COUNTY, UT						
Hurricane Area	4,061	6,174	8,235	15,122	11,061	9
St. George	11,350	28,502	48,038	69,808	58,458	17
Entire County	26,065	48,560	81,845	118,934	92,869	12
IRON COUNTY, UT						
Cedar City	10,972	13,443	17,770	22,528	11,556	4
Entire County	17,349	20,789	27,480	34,838	17,489	3
CLARK COUNTY, NV						
Moapa Valley CDP	NA	3,444	5,189	7,194	[1]3,750	5
Entire County	463,087	741,459	1,117,190	1,548,770	1,085,683	8

Sources: Northern Arizona University 1992.
U.S. Bureau of the Census, 1981 and 1992b.
University of Nevada - Reno, no date.
Utah Governor's Office of Planning and Budget (Utah GOPB) 1993.

[1] Population numbers from 1990 were used to calculate population change.

N/A = Not available.

County by the year 2010. Moderate growth is expected in northern Arizona and in Kane County during the same period, with about 3,860 and 4,230 additional residents, respectively (Table 3-13). Projected population growth through the year 2010 ranges from 2.0 percent annually in Coconino County, Arizona, to 4.6 percent annually in Washington County, Utah. These growth rates are indicative of expected healthy economic development, growth in regional tourism, and sustained attractiveness for retiree immigration.

3.9.2 Public Sector Fiscal Conditions

There are numerous governmental and other public entities providing an array of public services across southern Utah, northern Arizona, and southeastern Nevada. Available public services range from State agencies, providing administrative services for their entire State, from a single, centralized location, to special improvement districts providing services on a very localized level. The spectrum also encompasses county and municipal governments and school districts.

Each type of entity has had funding mechanisms established for it that are designed to provide it with revenues to meet operating and capital expenditure requirements. For example, towns and cities in Utah rely on sales taxes to finance their general funds, whereas, the counties rely more heavily on property taxes and intergovernmental transfers. In Arizona, property tax reform measures have reduced the dependence of local governments on property taxes, although such revenues are still the primary support for debt service on locally issued general obligation debt. Statutory requirements in all three States require all levels of State and local government to maintain a solid financial footing and prohibit deficit spending. Thus, all public entities engage in a continuous process of weighing funding priorities against available revenue resources in the determination of levels of service, staffing, capital outlays, and operating budgets.

State governments provide a wide range of administrative and support services to residents, businesses, and visitors. Among these are public tax revenue collection and distribution, provision and maintenance of safe highway systems, judicial systems and corrections, and public education.

In 1990, the general revenue budgets of the three respective States were $6.98 billion in Arizona, $3.53 billion in Utah, and $2.27 billion in Nevada. General fund expenditures for the same period were $7.54 billion, $3.47 billion, and $2.37 billion, respectively (Table 3-14). Population is but one factor driving the budgets of State government. However, using a per capita basis, annual revenues are relatively consistent across the States, ranging from $1,888 in Nevada to $2,049 in Utah. Per capita expenditures in 1990 were even more narrowly clustered, ranging from $1,968 in Nevada to $2,056 in Arizona.

The three States differ with respect to the key sources of revenue and distribution of expenditures by major function. Arizona and Utah both impose personal and corporate income taxes. Nevada has neither, but derives substantial revenues from taxes on gaming and the net proceeds of precious mineral mining. All three States levy State sales taxes. Tax revenues from all sources accounted for just over half (50.1 percent) of Utah's total revenues, but nearly 70 percent of Nevada's revenues. Intergovernmental revenues, mostly from the Federal Government, consistently account for the second major source of revenues for the States, ranging from 28.4 percent in Utah to 16.8 percent in Nevada (U.S. Bureau of the Census 1992a).

Table 3-14 — State Fiscal Revenues and Expenditures, 1990

State	Total (Millions)	General Revenues: Per Capita	Taxes (%)	Charges (%)	Intergovernmental (%)
Arizona	$6,984	$1,905	62.7	15.3	22.1
Utah	3,529	2,049	50.1	21.5	28.4
Nevada	2,270	1,889	69.7	13.5	16.8

State	Total (Millions)	General Expenditures: Per Capita	Education (%)	Highways (%)	Public Welfare (%)	Other (%)
Arizona	$7,535	$2,056	36.6	19.5	14.3	29.6
Utah	3,471	2,014	47.9	10.1	13.2	28.8
Nevada	2,366	1,968	35.8	12.5	9.3	42.5

Source: U.S. Bureau of the Census 1992a, b.

Funding for public education, including higher education, accounts for the single largest category of expenditures in all three States. In Utah, nearly half of the State's total expenditures is for education. This compares to about 36 percent in both Arizona and Nevada. Demographic factors, particularly larger segments of retired and elderly within the overall populations of the latter two States, likely account for some of the differences.

Spending on highways ranges from 10.1 percent of the total in Utah, to 12.5 percent in Nevada, and 19.5 percent in Arizona. Public welfare and other functions (e.g., the criminal justice systems) account for the remaining general expenditures.

Revenues and expenditures of all three States will increase in the future. Statutory requirements ensure that revenues and expenditures will be balanced.

Local governments in the region are tasked with the responsibilities for providing services, such as local administration, judicial systems, public safety, utility infrastructure, and local roads and bridges. Table 3-15 summarizes current fiscal conditions for local governments in the region (Utah Foundation 1992; and municipal budgets).

Differences in the sizes of the populations served, the levels of services provided, and local economies are evident in fiscal structures of the local governments. In terms of scale, annual general fund revenues range from $64,554 in Big Water to $6.0 million in Cedar City, and from $1.9 million in Kane County to almost $7.0 million in Washington County. Big Water, along with the counties, relies heavily on property taxes. The other Utah communities collect substantial property taxes but rely more heavily on sales tax receipts and other revenues, such as licenses and charges for services. Fredonia and Page collect no property taxes to support their general funds and rely on intergovernmental transfers and sales taxes.

Local governments in both Arizona and Utah receive funds from the respective States for the expressed purpose of constructing and maintaining local roads and bridges. Each community's share of their respective statewide distributions are based on formulas that take into consideration population and other factors (Utah Department of Transportation 1991; Njord 1994; Kimball, B. 1994a, b). Such funds are included as intergovernmental transfers (Table 3-15) for some communities, whereas others have established separate funds outside the general fund.

In addition to the general funds, the cities operate enterprise funds, such as water systems. These funds are essentially self-supporting, based on user fees and other revenues (Utah Foundation 1992). In several instances, they generate surplus revenues, which can be transferred to the general fund.

General fund expenditures among the municipalities increase with population. However, the distribution of expenditures by major function varies between the towns (Table 3-15). Big Water, providing a limited range of services and having the smallest population, has the lowest expenditures, $52,329 (Joseph, D. 1994). Most of the total is for general administrative functions, which, for Big Water, includes contract operations of the post office. Three of the cities, Fredonia, Kanab, and Hurricane, are clustered midway in the range of expenditures with annual expenditures ranging from $0.52 to $1.08 million. Page, Arizona, and Cedar

Table 3-15 — Selected Local Government Revenues and Expenditures, 1992

Jurisdiction	General Fund Revenues						
				Sources of Revenue - Percent of Total			
	Tax Rate (%)	Property Tax Valuation (Millions)	General Fund Revenue	Property Taxes (%)	Sales Taxes (%)	Intergov't Transfers (%)	All Other (%)
CITIES							
Big Water, UT	0.5706	$6.1	$64,554	47.8	0.0	30.6	21.6
Cedar City, UT	0.4523	287.3	6,028,536	19.9	28.0	8.4	43.7
Hurricane, UT	0.2445	83.9	1,109,193	19.2	26.9	7.4	46.5
Kanab, UT	0.2858	75.6	891,140	17.5	34.8	12.5	35.2
Fredonia, AZ	0	3.0	524,133	0.0	12.4	64.3	23.3
Page, AZ	0	27.8	4,242,000	0.0	32.0	53.1	14.9
COUNTIES							
Iron, UT	0.2804	687.1	6,347,652	32.6	2.7	41.0	23.7
Kane, UT	0.2531	210.5	1,932,509	45.9	6.7	20.4	27.0
Washington, UT	0.1835	1,556.9	6,956,448	35.7	2.2	29.0	33.1

Jurisdiction	General Fund Expenditures						
			Distribution by Major Function - Percent of Total				
	General Fund Expenditures	Per Capita (Est.)	General (%)	Public Safety (%)	Streets & Facilities (%)	Parks & Rec. (%)	Other (%)
CITIES							
Big Water, UT	$52,329	$159	74.2	11.9	4.2	1.9	7.8
Cedar City, UT	6,028,535	436	29.3	17.9	18.2	12.8	21.8
Hurricane, UT	1,076,284	260	14.2	28.9	24.5	2.2	30.2
Kanab, UT	770,136	225	27.7	28.3	13.8	9.2	21.0
Fredonia, AZ	524,130	434	10.8	23.8	27.1	8.0	30.3
Page, AZ	5,063,000	761	27.3	28.2	15.6	8.9	20.0
COUNTIES							
Iron, UT	6,347,652	283	31.1	12.5	15.9	3.0	37.5
Kane, UT	1,932,509	361	51.5	21.4	0.6	0.9	25.6
Washington, UT	6,956,448	126	38.0	15.2	0.9	1.1	44.8

Source: Utah Foundation 1992.

City, Utah, both of which have substantially larger populations and serve as trade centers, have the largest budgets, $5.06 and $6.03 million, respectively.

Budgeted expenditures in 1992 for the three counties parallel revenues; $1.93 million in Kane County, $6.35 million in Iron County, and $6.96 million in Washington County. On a per capita basis, general fund expenditures range from $126 per person in Washington County to $361 in Kane County, and from $156 per person in Big Water to $761 in Page. Several of the local governments with comparatively high per capita spending reflect extraordinary capital outlays made in 1992. All of the municipalities in the region, but particularly Kane County and the cities of Kanab, Utah, and Page, Arizona, face additional demands for services from the influx of tourists and visitors to the region.

Expenditures for general government operations, public safety, and road and bridge maintenance typically account for the three largest categories of general fund outlays. High road and maintenance expenditures occur partly because certain intergovernmental funds received from the States must be dedicated to such purposes. The comparatively low expenditures for streets and public improvements in Washington and Kane Counties are largely due to their use of separate accounts for road and bridge construction and maintenance.

Existing needs, future growth, and inflation will result in higher budgets for all local governments in the region. This will require local officials to balance available resources with needs to maintain or improve services to a growing service base.

Both Arizona and Utah provide State financial support for public education. In fact, such support constitutes the single largest category of State expenditures. Local districts are required to impose mandated levels of property taxes to support operating expenses, as well as provide for capital outlays and debt service. School districts then receive funds from the State to raise total revenues to its allowable revenue ceiling. The ceilings are the primary determinant in determining operating expenditures and are calculated by the State on the basis of enrollment and other variables, such as the number of students with special needs, or high costs associated with operating smaller schools in rural areas. The districts also receive Federal funds tied to specific programs (Utah Department of Education 1993; Arizona Department of Education 1994; Robins 1994; Pogreva 1994).

The State support programs help insulate districts from the direct fiscal shocks that may accompany growth or decline in enrollments and tax base. However, owing to the way that the State programs are structured, the relative dependence on locally derived versus State-derived revenues can shift in response to local growth or decline. In fiscal year 1992-93, the levels of locally derived revenues ranged from 31.2 percent in Washington County to 52.0 percent for the Page Unified School District (Table 3-16). Washington County School District is facing rapidly expanding enrollments and staff, which is decreasing the average assessed valuation per student. The high level of local revenue for the Page Unified School District reflects the substantial valuation associated with the Navajo Generating Station (Sides 1994). (See Appendix B, Section B.2.15, Navajo Generating Station Scrubber Project).

Table 3-16 — Selected School District Finances, Fiscal Year 1992-93

District	Property Tax Valuation	Revenues: Total	Revenues: Locally Derived (%)	Expenditures: Operating	Expenditures: Debt Service and Capital	Expenditures: Total	Outstanding Debt
Iron County	[1]$975.6	$19.8	36.7	$16.28	$2.29	$18.57	$11.80
Kane County	270.7	6.5	32.6	5.54	0.79	6.33	3.70
Washington County	1,993.4	47.3	31.2	38.95	13.49	52.44	52.00
Fredonia/ Moccasin	12.9	2.5	32.7	1.77	0.79	2.56	2.20
Page	125.1	20.6	52.0	13.64	5.73	19.37	27.00

Source: Arizona Department of Education 1994, Utah Department of Education 1993.
[1]All dollar values are in millions.

School district operating expenditures range from $1.77 million per year in Fredonia-Moccasin, Arizona, to nearly $39 million per year in Washington County School District, Utah. The latter has increased dramatically in recent years owing to higher enrollment. To address growth pressures, the Washington County School District has also increased its capital and debt service outlays and the amount of long-term debt outstanding. School districts in Iron and Kane Counties and in Page have also recently undertaken or are anticipating near-term capital expansion programs.

Capital expenditures for facility improvements funded by means of bonded indebtedness are accounted for separately from maintenance and operating expenditures. At the present time, all five school districts have outstanding indebtedness. The amounts range from about $2.2 million in Fredonia to $52 million in Washington County. Washington County School District is presently engaged in a capital facility expansion program, and Page Unified School District anticipates undertaking new construction within the next 2 to 3 years.

3.9.3 Community Resources

Communities in southern Utah, northern Arizona, and southeastern Nevada are notable for both their diversity and similarity. The communities differ in size, and their local economies vary in level of activity and composition; however, all share the region's growing reliance on tourism and recreation. Differences in tax base and expenditure constraints coexist with a unifying theme of making do with limited resources in the face of existing growth trends. Although social structures, lifestyles, and material facilities and services vary somewhat from place to place, most of the region's communities view growth and the economic development of natural resources, when properly managed, as potentially enhancing the quality of life. (For a status summary of public facilities and services in southern Utah, northern Arizona, and southeastern Nevada communities, see Appendix E, Table E-3.)

3.9.3.1 Page

Begun as a new town in 1957, today Page is an established community whose economy depends on power generation and recreation-based tourism. Page was planned and built by the U.S. Bureau of Reclamation to support the Glen Canyon Dam Project. Construction of the dam and subsequent creation of Lake Powell gave the city its tourism base. Page then went on to support a second major construction project, the Navajo Generating Station coal-fired powerplant.

The Glen Canyon Dam and Navajo Generating Station projects created two cycles of population growth and decline for Page, lasting until the mid-1970s. Since then, there has been gradual, but sustained, growth supported by the permanent employment at the powerplant, tourism at Lake Powell, Federal and local government operations (including the local schools), and the construction sector. In 1994, another heavy construction boom began in Page because of the start-up of the Navajo Generating Station Scrubber Project (Appendix B, Section B.2.15).

Although churches, schools, culture, and recreation are all important social structures in Page, much social interaction focuses on city government. There are two distinct political groups differentiated by their attitude toward change: long-time residents that prefer the status quo and newcomers who favor continued growth and development. The Page/Lake Powell Chamber of Commerce, an influential business group, was instrumental in the adoption of a master plan for the city, intended to accommodate and facilitate growth and diversification and to further define Page as a year-round economy (City of Page 1989).

Page residents relate well to each other and are accepting of strangers. This may be attributed to the fact that Page annually caters to millions of visitors and hosts hundreds of seasonal residents who work in the tourist industry. Page residents tend to support the development of natural resources, including extractive development even though there has been little direct employment in mining per se in Page over the years. This coincides with community support of economic development in general, an attitude based on the perception that jobs in tourism are low-paying and seasonal, and the job market is limited for high school graduates who want to remain in the community.

Many community resources in Page are straining to meet the demands of recent growth. As a result, some services are making do with existing facilities and capabilities, whereas others are planning, or are in the process of completing, expansions.

Page's Police Department needs two additional officers to meet the demands of the growing population, particularly in the summer and during special events. The All-Volunteer Fire Department is generally adequate to meet the needs of the existing population, but daytime response is a concern. The ambulance service also relies on volunteers and can be stretched thin when called upon to respond to distant emergencies (Nichols 1994). The Page Hospital is generally well equipped to serve the community well into the future, based on expansion plans to be implemented within the next few years (Truman 1993).

Demand for water from Page often exceeds the storage capacity of 4.5 million gallons and, on some days, exceeds the city's allocation of 3 million gallons per day from Lake Powell by as much as 2 million gallons per day. The city currently is deciding whether to pursue an increase in its Federal water allocation or to obtain an alternative water source. A doubling of sewage-treatment capacity by the city is to be completed in in the next few years (Nichols 1994).

The Page Unified School District has completed several expansions to accommodate the recent enrollment growth of 4.5 to 5 percent per year. As a result, the elementary and middle schools are adequate to handle additional growth, but the high school is at capacity. A bond issue to fund further expansions will be put to district voters, and the school district is also considering year-round school and additional modular units at the high school to accommodate further growth. These decisions would be made after the voters decide on the bond issue. Another factor affecting school enrollment in the District could occur in the 1995-96 school year, when Native American students currently attending Bureau of Indian Affairs (BIA) schools will have the option of attending Page Unified District Schools (Dobb 1994).

Availability of housing, especially rental housing, is an issue which can be managed directly in Page. Most of the developable land, which is in adequate supply, is owned by the city and is sold to the private sector when development is needed. Historically, a constraint on housing has been the conservative approach to financing on the part of local commercial banks; a potential future constraint on housing development is water availability. Nevertheless, considerable growth in housing availability is projected for Page over the next 5 years. Intended partly to accommodate the labor force of the Navajo Generating Station Scrubber Project, the city has approved 527 lots, plus additional mobile home lots, for development. As a result, total housing is projected to increase from 2,539 units in 1994, to 3,151 by the year 2000 (Jentzsch 1994).

3.9.3.2 Big Water

Big Water is an extremely small town that has recently experienced some growth, but where everyone still knows everyone else. Most Big Water residents are employed at Lake Powell or in Page; a few people hold jobs in Kanab. The public school and some small businesses offer a few jobs in Big Water.

Big Water residents view themselves as independent. Households, including one multiple-household extended family (NBC News 1993), are the most important social structure. Much social interaction in Big Water revolves around municipal politics.

Big Water was founded in 1957 in anticipation of the construction of the Glen Canyon Dam. Originally known as "Fourteen-Mile" because of the construction camp's distance from the Colorado River, it was later named "Glen Canyon City." Glen Canyon City was promoted as an alternative to living in Page, Arizona, during construction on the Glen Canyon Dam project and, later, during construction on the Navajo powerplant project. The city became Big Water when the community incorporated in 1984, a move accompanied by population and economic growth, improvements in infrastructure and services, and more involvement by municipal government in planning for the future (Big Water 1985). Newcomers are accepted readily because they stimulate the economy and help to expand the possibilities of local politics and social life.

In general, residents of Big Water have a positive view of natural resource development, including the gravel pits and the Nielson, Inc., asphalt batch plant nearby (Appendix B, Section B.2.6). Some residents have complained about damage to roads and vehicles from this activity.

Essential public facilities and services, namely fire protection, a public water supply, and public schools, are available in Big Water. Water supplies, provided by two water wells, are currently adequate for the existing population. Residences use septic systems for wastewater disposal. Some services, however, show existing deficiencies in level of service and capacity.

Law enforcement, provided by the Kane County Sheriff's Department, is limited to 2 hours per week, which is inadequate for the current population of Big Water (Jackson 1994). The Volunteer Fire Department needs a new building and makes do with a 1957 pumper truck. The city also lacks the resources to upgrade or regularly maintain its roads, which are graveled and lack street signs (Joseph, D. 1994).

The Big Water school, which houses grades K through 12, was recently built and could double its current enrollment before reaching its capacity of 150 students (Bayles 1994).

Housing historically has been limited in Big Water and its vicinity, despite an abundance of developable land within the city limits and nearby. Some housing growth is projected for the future, and developable sites could accommodate more, if the demand were to materialize. However, no speculative building has occurred recently, in spite of demand for housing in nearby Page and the fact that prices on existing lots are one-fourth the cost of lots in Page (Joseph, B. 1994).

Big Water had 173 housing units in 1990 but is projected to have 203 units by 1995 and 221 units by the year 2000 (Jentzsch 1994). Within the city limits of Big Water, lots ready for development currently are available in an 18-acre subdivision, and a 10-acre parcel could be subdivided for 26 lots. Developable land also exists just outside Big Water in unincorporated Kane County (25 1-acre and 2-acre lots) and east of Big Water in Greenehaven, a mixed resort and residential planned-unit development on the Lake Powell shore in unincorporated Coconino County, Arizona. Greenehaven is zoned for 1,100 single-family, mobile-home, and vacation-condominium units (Joseph, B. 1994).

3.9.3.3 Kanab

Despite recent growth, Kanab residents still enjoy a small-town lifestyle, where people feel a part of the community, know where they stand in relation to others, and have a sense of control over the decisions that affect their future. Overall, social groups relate well to one another, and people attribute any contention to personal frictions rather than to conflicts of values. However, residents acknowledge the existence of different viewpoints on growth, development, and natural resources use.

Kanab's important social structures are churches, school PTAs, political parties, civic clubs, and senior citizens associations. Families residing in the community for years are a noted presence in Kanab, as are retirement and lifestyle move-ins. The LDS Church is the dominant social organization. A group of community-involved people with no affiliation to any particular group or organization is also present in the community.

Kanab began as an LDS farming and ranching settlement that also counted mining and logging as part of its traditional economic base. Now, ranching's economic importance is greatly diminished, although it is still an important land use. Many high-paying jobs in logging and mining were lost after the 1990 cutbacks at Kaibab Forest Products and Energy Fuels Nuclear, both in Fredonia (Five County Association of Governments 1991). More jobs were lost with cutbacks at Energy Fuels in 1994 and the closure of Kaibab Forest Products in 1995.

Kanab's growth over the last 10 years has been due to two factors: tourism at Lake Powell, Grand Canyon, and other nearby National parks and the influx of retirees and lifestyle immigrants. As a result, Federal, State, and local government, the schools, and tourism businesses are the most important sources of employment for Kanab residents today. Nevertheless, Kanab residents perceive that economic well-being has declined overall and may continue to decline for several reasons: lower pay and seasonality in the tourism business, the lack of good jobs for high school graduates, and a widespread fear that forest products employment may shrink further or disappear entirely.

Given the economic climate, there are Kanab residents who approve of growth in general and support the organized efforts to attract new industry. Because of their traditional importance, natural resource industries continue to be accepted and welcomed, especially if they are perceived as not overly damaging to the environment or other parts of the economic base. Environmentalists, defined locally as extreme opponents to growth and development, are thought to be nonlocal.

Kanab's leaders, both in and out of government, are seen as proactive in preparing for growth. People are aware that the city of Kanab is planning for an infrastructure capable of supporting a population of 10,000, that the high school currently is being expanded, and that the schools are planning for expansion at other grade levels. This has led to the belief that the quality of life, in terms of the level and character of public services, would be maintained as Kanab grows in the future.

Residents of Kanab and adjacent Kane County have access to an array of facilities and services that meets local expectations. These facilities and services are adequate for existing conditions, with some notable exceptions.

Schools at all levels are at or over capacity in Kanab and in Kane County because of existing growth trends. At present, the school district is arranging for additional capacity to accommodate existing and projected enrollment. Options being considered include larger classes at the elementary school, installing portable classrooms, and reconfiguring classrooms. A scheduled addition to the high school would also be used to alleviate overcrowding in the middle school, and a bond election is planned for 1998 to fund a new middle school in Kanab. The high school needs four classrooms now and is over capacity by 12 students, the elementary school is 12 students over capacity, and the middle school is at capacity (Bayles 1994).

The local housing market is limited, both in terms of housing for rent and for sale. However, new housing development is being projected for the Kanab area, partly to accommodate demand from the Navajo Generating Station Scrubber Project and partly due to demand created by retirement and lifestyle in-migration. At least 600 approved lots are available in two major subdivisions, the Kanab Creek Ranchos area and a golf course development, and there are developers who would build in the area as the demand for housing escalates. Due to existing growth trends, the value of existing homes, buildable lots, and developable property generally has been increasing in the past several years throughout the study area (Alvey 1994; Solie 1994).

In addition, some public safety agencies, mental health services, and the city water system face existing or potential concerns. In the area of public safety, the Kanab Police Department needs two more officers to adequately serve the existing population (Crosby 1994). The all-volunteer Kane County Ambulance Service is stretched thin by the need to cover a service area that reaches the north rim of the Grand Canyon and sometimes involves patient transport to the hospital in St. George (Houston 1993). Southwest Utah Mental Health/Alcohol and Drug Center operates an outpatient facility in Kanab, which may require additional staff if growth continues at current rates (Five County Association of Governments 1994).

The city of Kanab is understaffed in the area of street maintenance, and the city is drilling a new water well to serve the existing population and the currently projected growth (Merrill 1994). Sewer capacity in the town is adequate for the existing population; however, 85 to 90 percent of the new housing is being built in the Kanab Creek Ranchos area. If growth continues in this area, and should the ground be unable to handle the number of septic systems, a sewer system may need to be built for this area (Merrill 1994).

3.9.3.4 Fredonia

Fredonia has economic and social roots in farming and ranching, but agriculture's importance has diminished greatly since the 1950s. Now, Fredonia depends more on industries that rely upon publicly owned natural resources, such as timber and minerals, and on tourism and recreation on public lands.

Fredonia's logging and mining employment base has declined since 1990 by more than 300 jobs and ceased to exist in February 1995. Although service jobs in tourism and recreation have grown recently, tourism and recreation employment is seasonal and relatively low paying. As a result, growth in Fredonia has stagnated, and residents are looking for ways to stimulate the local economy. In a 1994 opinion poll, economic development followed water, sewer, and TV improvements as a priority for community action (Fredonia Planning Commission 1994).

Fredonia has a small-town lifestyle, and social interaction revolves around the LDS Church, municipal government, and the family. Residents also interact and jointly operate a school district with Native Americans who reside on the Kaibab Paiute Indian Reservation, about 14 miles west of Fredonia. Senior citizens who have moved to Fredonia over the past 5 to 10 years are an influential social and political group. In general, Fredonia residents relate well to each other and readily accept newcomers.

Fredonia has many residents who favor growth because of the economic opportunity it would represent. However, a group consisting of long-time residents and recently arrived senior citizens tends to oppose growth because of the belief that it would adversely impact the cost of living and Fredonia's small-town quality of life. Community residents who favor natural-resource-based economic development contrast themselves with environmentalists, who are perceived as nonlocal and interested in stopping natural resource development regardless of local economic consequences.

Community facilities and services available in Fredonia are police and fire protection, a municipal water system, gas, electricity, and telephone, and public schools. Fredonia does not have public sewage collection and treatment; all housing in the community is served by individual septic systems. Public infrastructure capacity is intact and adequate to serve a much larger population than now resides in Fredonia. If population were to increase, most facilities and services would require only minor upgrading (Kimball 1994a).

The Fredonia Police Department (1 part-time and 2 full-time officers) is adequate for existing needs, with backup from the Coconino County Sheriff. The Volunteer Fire Department is also adequate, and a new fire station is proposed. Fredonia is served by one physician. Hospital and emergency services are provided by the Kane County Hospital and the Kane County Ambulance Service, both in nearby Kanab (Kimball 1994a, b).

With a 15-million-gallon reservoir and two storage tanks fed by three wells located in Utah, Fredonia has adequate water for some additional growth, although the distribution system may need some upgrading to extend service to new development. The need for interstate agreements to supply the town's water could limit overall growth. The town is studying whether a public sewage system should be built in Fredonia; residents are currently using septic systems for wastewater disposal. The town administration believes a sewage system would be desirable to accommodate a population increase (Kimball 1994a).

The number of vacant housing units available in Fredonia is limited, but there is an adequate supply of sites for relatively low cost housing development. In addition, Fredonia is actively pursuing an affordable housing grant. Existing housing resources include numerous mobile home lots for sale at around $5,500 per lot with utilities, 100 to 105 mobile home lots with water and streets, and another 100 lots for sale that are suitable for either site-built or modular dwelling units (Kimball 1994a, b).

All of Fredonia's schools are well below enrollment capacity because of the recent declines in local employment and population (Tate, B. 1994).

3.9.3.5 Washington County Communities

Washington County contains the St. George and the Hurricane areas, the latter consisting of the cities of Hurricane, La Verkin, and Toquerville. All originated as LDS agricultural settlements. There has been no economic dependence on mining, other than sand and gravel, for many decades. St. George and surrounding communities comprise an expanding urban center whose economic base depends on tourism, retirement, and lifestyle in-migration, and serves as the trade center for southwestern Utah and northwestern Arizona. As the county seat, St. George is also the focus of political and institutional activity within Washington County. Over the past decade, growth which originally had been attracted primarily to St. George has begun to expand into adjacent communities, such as Hurricane.

Key employers in the Hurricane area are an outdoor clothing manufacturer, the Wal-Mart Regional Distribution Center (Appendix B), and businesses supplying goods and services to tourists who are mainly on their way to Zion National Park and Lake Powell via Utah Route 9. La Verkin has a small business district along Utah Route 9; Toquerville is almost entirely residential, even along Utah Route 17, the highway to Interstate-15. Construction, real estate, and land development are important employment sectors in Hurricane, La Verkin, and Toquerville, with those people who work in construction traveling to job sites all over southwestern Utah and northwestern Arizona.

Residents of Hurricane say that the local lifestyle and quality of life have changed noticeably in the last few years because of growth. Positive effects have been more jobs and shopping and improved business conditions. Negative effects are less familiarity with others in town; more crime, especially juvenile crime and drug abuse; pressure on the schools; and increased traffic on the main highway through town. La Verkin residents cite similar trends in the quality of life, but, because local employment growth is just beginning to take off, positive economic effects are less pronounced. Toquerville residents mainly cite the increase in traffic as having diminished the quality of life. Toquerville still has no businesses, partly because residents do not encourage business development. Hurricane area residents as a whole remain accepting of newcomers, but resentment exists on the part of some long-time residents who regret the decline in small-town character apparent in all three communities in varying degrees.

Local governments in all three communities have been proactive in addressing growth-related issues. In La Verkin, the city has annexed territory and is developing infrastructure to accommodate growth. Hurricane continues to support development in several large and already approved developments and is also considering growth management. In Toquerville, the town's main concerns are assuring a future water supply and finding an alternate route for Utah Route 17 traffic that currently comes through the main section of town. Some residents in each community want to stop growth entirely, either for lifestyle or environmental reasons.

Hurricane residents are concerned about the growing level of traffic in general, and that of truck traffic in particular, on Hurricane's main streets. Their concern is focused on the issues of congestion, noise, fumes, and the safety of pedestrians, especially the children who attend the elementary school located on the main street. There also is widespread concern over the safety implications of a steep and winding part of Utah Route 59 east of Hurricane, known as Hurricane Hill, due to the perceived potential for runaway trucks.

Although facilities and services currently are being stretched to meet the demands of growth throughout Washington County, the potential for impact from even relatively small increments of growth due to specific projects is greater in the small communities of the Hurricane area, especially Hurricane. Other municipalities may also be affected but to a limited degree.

The Hurricane police force of five full-time and five reserve officers is inadequate to serve the existing population. Two additional officers are needed immediately, and as many as four more officers would be needed in the next 5 years to accommodate the existing growth trend (Fawcett 1994). Other communities in the Hurricane area receive police protection under contract with the Washington County Sheriff's Department. Although this department is relatively large (15 deputies and 17 jailers) it is understaffed for existing conditions and trends. Identified needs include a doubling of the existing staff and additional patrol cars with equipment (Five County Association of Governments 1994).

Fire protection and ambulance services are adequate for the existing population in Hurricane (Five County Association of Governments 1994); however, the Hurricane Volunteer Fire Department, which has a salaried chief, has identified the need for a satellite station to keep response times low and to provide service to rural developments. La Verkin is served by its own Volunteer Fire Department, but Toquerville is served by the Hurricane Fire Department (Fawcett 1994). Hurricane area police, fire, and emergency response services are integrated within the Washington County centralized dispatch system, which operates under a federally mandated emergency response plan outlining command and control systems. Hurricane area residents have good access to the Dixie Regional Medical Center in St. George, a full-service hospital with 137 beds, 70 physicians, and visiting specialists (Five County Association of Governments 1994).

The city of Hurricane is nearing its capacity for both water supply and storage. The city has two springs, one well, and 3.25 million gallons of storage. The housing projects already approved for development within the city would use up all existing water rights, and, because available water rights are scarce and expensive, water availability and cost may constrain growth in Hurricane in the future (Fawcett 1994). Water supply is also a concern for Toquerville, which relies on one spring and has 354,000 gallons of storage. Ash Creek Sewer and Sanitation District provides sewage treatment for both Hurricane and Toquerville. The district's sewage lagoons are at 90 percent of capacity, and a new treatment plant would be needed by 1998 to accommodate existing growth trends (Five County Association of Governments 1994).

The Washington County School District is accommodating growth in enrollment in the Hurricane area by a variety of means. The district has implemented year-round schools at all elementary schools, a measure which has not yet been needed at the middle schools or high schools. The district also has been shifting portable classroom units from school to school. Capital projects include expansions of the La Verkin elementary school and the Hurricane High School and a new elementary school in Hurricane that is planned for the 1995-96 school year (Peterson, S. 1994).

The market value of housing has increased, and the supply of available units has declined in the Hurricane area in the past several years because of rapid growth. Therefore, the potential for housing growth and increased construction activity exists, especially in Hurricane. The city of Hurricane, which has 400 to 500 approved residential lots available for development, issued 37 residential building permits in 1991 and 93 permits in 1992 (Fawcett 1994). Toquerville also has considerable potential for housing growth, with more than 450 lots in preliminary review stages. However, Toquerville is withholding approval of new development until permits are obtained to drill a new water supply well (Wahlquist 1994).

In Hurricane, where property values in general have increased due to recent growth trends, a segment of Utah Route 59 at the base of Hurricane Hill passes through two blocks of residential land use. Recent increases in truck traffic have impacted this specific area and caused two or three households to sell their homes for what were perceived as low prices. In all, a total of 8 or 10 homes are located very close to that segment of Utah Route 59 (Van Wagoner 1994).

Property values also have been in an upward trend in Toquerville. Truck traffic which passes through Toquerville on Utah Route 17 passes through an entirely residential area, excepting the Toquerville Post Office. In Toquerville, homes located along Utah Route 17 sit very close to the shoulder of the highway. However, the existing level of traffic along Utah Route 17, including trucks, apparently has not had an impact on the value of residential properties in Toquerville to date (Wahlquist 1994).

3.9.3.6 Moapa/Glendale

Moapa and Glendale are very small towns situated in the middle of a sparsely populated rural area containing irrigated agriculture, a dairy farm, the Reid Gardner Powerplant, and some light manufacturing (Appendix B, Sections B.2.13 and B.2.19). The communities adjoin the Moapa Paiute Indian Reservation (Appendix E). Most Moapa and Glendale residents commute to Las Vegas to work, some commute to Mesquite, and some residents work on local farms or at the powerplant. A few local businesses provide goods and services to residents and travelers on Interstate-15. Most residents of the Moapa/Glendale area feel removed from the powerplant, and they feel little impact from existing traffic, which includes agricultural trucks and coal trucks making deliveries to the powerplant. Moapa and Glendale offer limited public facilities and services, and those that are available can serve the occasional small increment of growth in service population.

Moapa is the shortened form of the name of the Paiute Tribe which originally inhabited the region. The tribe was known as the "Moapariats," meaning "Mosquito Creek People." It was originally established as a "cotton mission" by the LDS church in 1864 because of the fertile soils along the Muddy River. Recurring floods have resulted in many boom-bust cycles and large fluctuations in the population. Glendale was established as a trading center at the intersection of the Old Spanish Trail, which encouraged east-west travel between Santa Fe, New Mexico, and southern California, and the Old Stagecoach Road, which promoted north-south travel between Pioche, Nevada, and Prescott, Arizona (Nevada Discovery Tours 1995).

3.9.3.7 Cedar City Area

Begun as an iron mining and smelting town, Cedar City had a large number of mining jobs until the iron mines began closing in the 1960s. Today, although there is commercial agriculture in the surrounding county, more than half of Cedar City's employment is service jobs in tourism and at Southern Utah University. To diversify, Cedar City and Iron County officials have aggressively pursued light manufacturing; these efforts are now beginning to show considerable success.

As a small urban center with less small-town feeling than in the past, there is a diminished quality of life for long-time residents and recent in-migrants who came for the Cedar City area's small-town lifestyle. However, residents still find the community a pleasing place to live, and Cedar City's image continues to attract move-ins from California and Nevada. Combined with continuing local efforts to recruit light industry to the area, Cedar City and nearby parts of Iron County have strong growth prospects. At the same time, some residents feel there is enough growth already in Cedar City; for this group, concerns coalesce around issues such as crime, juvenile misbehavior, rising taxes, and traffic.

Cedar City provides a range of public facilities and services typical of a small urban center. Most service providers are in the process of planning for current and future growth. Despite current growth pressures, service providers have generally been able to absorb an occasional small addition to the service population without directly incurring additional expense or noticeably degrading the level of service being delivered.

3.10 CLIMATE AND AIR QUALITY

3.10.1 Climate

The climate in southern Utah, northern Arizona, and southeastern Nevada is classified as semiarid to arid, with elevations below 4,000 feet receiving the least amount of precipitation; mountainous areas are considerably wetter. Arid and semiarid climates are characterized by low rainfall, low humidity, clear skies, and relatively large annual and diurnal temperature ranges (NOAA 1974).

Average annual precipitation varies widely throughout the region because of terrain elevation and slope orientation relative to the prevailing winds. Lower elevations and leeward slopes of mountain ranges receive about 8 inches of precipitation annually, whereas higher elevations receive 12 inches or more annually. Precipitation generally falls as rain, although from late November into March much of the precipitation is in the form of snow, especially at higher elevations. Precipitation is fairly evenly distributed throughout the year, although May is generally the driest month. The summers are hot and dry, with temperatures often exceeding 100 degrees Fahrenheit (°F) during July and August. The midsummer monsoon frequently produces thunderstorms in the afternoon and evening hours, leading to a peak in rainfall in July. During the winter, larger scale storms produce widespread rain and snow across the region, which show up as a second peak in the precipitation records. Winter temperatures are cool, with nighttime lows during January near 20° F and daytime highs reaching only about 45° F (NOAA 1974).

Because of the typically dry atmosphere, bright sunny days and clear nights frequently occur. This, in turn, allows rapid heating of the ground surface during daylight hours and rapid cooling at night. Because heated air rises and cooled air sinks, winds tend to blow uphill during the daytime and downhill at night. This upslope and downslope cycle occurs generally in all the geographical features, including mountain range slopes and river courses. The larger the horizontal extent of the feature, the greater the volume of air that moves in the cycle. Complexity of the terrain features cause complex movements in the cyclic air patterns, with thin layers of moving air embedded within the larger scale motions. The lower level, thermally driven winds are also embedded within larger scale upper wind systems (synoptic winds). Synoptic winds in the region are predominantly from the west. Regional winds, then, are characterized by daily weather variations that enhance or diminish the boundary layer winds and that are channeled by regional and local topography (NOAA 1974).

Winds in the area are generally from the south-southwest at speeds of 8 to 10 mph. Higher wind speeds are common because of afternoon thunderstorms and the passage of larger scale storm systems across the region (NOAA 1974).

3.10.2 Air Quality

Three important meteorological factors influence the dispersion of pollutants in the atmosphere: mixing height, wind speed, and wind direction. Mixing height is the height above ground within which rising warm air from the surface will mix by convection and turbulence. The degree to which pollutants are diluted in this mixed layer is determined by local atmospheric conditions, terrain configuration, and source location. Mixing heights vary diurnally with both local weather systems and season. Wind speed has an important effect on area ventilation and the dilution of pollutant concentrations from individual sources. Light winds, in conjunction with large source emissions, may lead to an accumulation of pollutants that can stagnate or move slowly to downwind areas. Local wind direction often determines the degree of impact from pollution sources. A receptor close to, but generally upwind from, a pollution source may not be affected as much as a receptor farther away but downwind from the source. During stable conditions, downwind usually means downvalley, or toward lower elevations.

Morning atmospheric stability conditions tend to be stable because of the rapid cooling of the layers of air nearest the ground. Afternoon conditions, especially during the warmer months, tend to be neutral to unstable because of the rapid heating of the ground surface under clear skies. During the winter, periods of stable afternoon conditions may persist for several days in the absence of synoptic-scale storm systems to generate higher winds with more turbulence and mixing. A high frequency of inversions in the area during the winter can be attributed to the nighttime cooling and sinking air flowing from higher elevations to the low lying areas in the basins. Although winter inversions are generally very shallow, they tend to be more stable because of reduced ground surface heating.

For southern Utah, northern Arizona, and southeastern Nevada, the mean annual morning mixing height is estimated to be about 300 feet. During the winter months, the mean morning mixing height is about 200 feet (Holzworth 1972). The mean annual afternoon mixing height exceeds 2,600 feet. Mixing is strongest during the summer afternoons and weakest during winter mornings. During the winter months, several days may pass without a major storm moving through the area. These days are characterized by light winds and an increased potential for higher concentrations of pollutants.

Air quality is defined by the concentration of various pollutants and their interactions in the atmosphere. Pollution effects on receptors have been used to establish a definition of air quality. Measurement of pollutants in the atmosphere is expressed in units of parts per million (ppm) or as micrograms per cubic meter ($\mu g/m^3$). Both seasonal climatic factors and daily weather fluctuations are considered part of the air quality resource because they control dispersion and affect concentrations. Physical effects of air quality depend on the characteristics of the receptors and the type, amount, and duration of the exposure. Air quality standards specify acceptable upper limits of pollutant concentrations and duration of the exposure. Air pollutant concentrations within the standards are generally not considered to be detrimental to public health and welfare.

The relative importance of pollutant concentrations is generally determined by comparison with an appropriate National and/or State ambient air quality standard (NAAQS). Current Federal ambient air quality standards for particulate matter (dust) include only particles having a diameter less than or equal to 10 micrometers (μm) (PM_{10}), because those are the particles that can be inhaled into the windpipe, upper lung, and deep lung (alveolar) regions of the human respiratory tract. Particles that can be carried into these areas pose a greater health risk than larger particles. Because of the low risk of adverse health impacts from deposition of larger particles in the respiratory passages of the head, particles larger than 10 μm were excluded from the Federal standards. Other pollutant emissions include exhaust emissions from diesel-powered construction equipment, trucks, and other motor vehicles, and stack or ventilation emissions from the mine, diesel generator, and coal preparation facilities. Pollutants from these sources include carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and particulates (PM_{10}).

An area is designated by EPA as being in attainment for a pollutant if ambient concentrations of that pollutant are below the NAAQS. An area is not in attainment if violations of NAAQS occur for that pollutant. Areas where insufficient data are available to make an attainment status designation are listed as unclassified and are treated as being in attainment for regulatory purposes. The existing air quality in southern Utah, northern Arizona, and southeastern Nevada is typical of the largely undeveloped regions of the Western

United States. These areas are considered in attainment for all National and State ambient air quality standards.

Under the provisions of the Clean Air Act of 1955, as amended (CAA), States with areas that are in compliance with NAAQS are required to adopt a permit program for the preconstruction review of new sources to prevent significant deterioration of the existing air quality. The Federal Prevention of Significant Deterioration (PSD) program is implemented in large part through the use of "increments" and area classifications that effectively define "significant deterioration" for individual pollutants. Increments are the maximum allowable increases over an established baseline under the requirements of PSD. The CAA classification scheme for PSD establishes three classes of geographic areas and applies increments of different stringency to each class. The CAA established Class I for areas of special National concern, where the need to prevent significant deterioration in air quality is greatest. Consequently, the most restrictive increments apply in Class I areas. Class I areas include all National parks, National wilderness areas, and National memorial parks exceeding certain sizes. Less restrictive increments apply in areas designated as Class II or Class III. Class II areas are all areas that are designated as in attainment or unclassified with respect to the NAAQS and are not classified in the CAA as Class I. Class III area designation would permit more deterioration in air quality in specific areas designated by the States for higher levels of industrial development and emissions growth. Most of southern Utah, northern Arizona, and southeastern Nevada is classified as Class II under Federal PSD regulations. There are, however, a number of Class I areas in this region, including Glen Canyon NRA, Zion National Park, Bryce Canyon National Park, Grand Canyon National Park, and Lake Mead National Recreation Area. There are no Class III areas in Utah, Arizona, or Nevada. Class III areas are generally limited to very large urban areas, such as Los Angeles, where severe air-pollution problems exist.

Minor and major sources contribute to the air pollution in a given area and are therefore said to "consume" the available PM_{10} increment. All permitted sources are required to show that they do not contribute to increment consumption violations. Current emissions levels in the Smoky Mountain, Moapa, and Iron Springs areas are less than 100 tons per year and are classified as minor sources.

Background concentrations of criteria pollutants in the Smoky Mountain, Iron Springs, and Moapa areas are compared with NAAQS in Table 3-17. These data represent existing pollutant concentrations that are expected to be present at these locations as a result of ongoing activities in the region not associated with mine development (Conger 1992a, b; Environmental Science Consultants 1992).

Visibility impairment (haze) in the southern Utah, northern Arizona, and southeastern Nevada region is caused primarily by fine suspended particles (aerosols), of which particulate sulfur is a major component. Particulate sulfur consists mostly of sulfate aerosols that are secondary pollutants; that is, particles that are formed from emitted gaseous SO_2 via chemical reactions in the atmosphere. Major sources for aerosols in the project area include powerplants located within the region, such as the Navajo Generating Station (NGS) in Arizona, as well as long-range transport of particulate sulfur and other species of fine particulates from urban centers to the west.

Table 3-17 — Background Concentrations and National Ambient Air Quality Standards (NAAQS)[1]

(Micrograms per cubic meter)[2]

Pollutant	Averaging Period	Existing Background Concentration: Smoky Mountain	Existing Background Concentration: Moapa Area	Existing Background Concentration: Iron Springs Area	NAAQS Primary[3]	NAAQS Secondary[3]
Particulate Matter (PM_{10}):	24-hour Annual Mean	30 8	26.1 9.2	30 8	150 50	150 50
Carbon Monoxide (C):	1-hour 8-hour	0 0	NA NA	0 0	40,000 10,000	40,000 10,000
Sulfur Dioxide (SO_2):	3-hour 24-hour Annual	117 52 13	9.1 6.0 3.6	117 50 13	— 365 80	1,300 — —
Nitrogen Dioxide (NO_2):	Annual	0	6.0	30	100	100

Sources: Conger 1992a.
Environmental Science Consultants 1992.

1 Southern Utah, northern Arizona, southeastern Nevada, and National ambient standards are the same for these criteria pollutants.
2 $\mu g/m^3$.
3 Primary standards define levels of air quality that EPA has judged necessary to protect public health. Secondary standards define levels for protecting the public welfare (40 CFR 50.2).

3.11 VISUAL RESOURCES/AESTHETICS

The consideration of visual resources/aesthetics is based upon principles and concepts contained in the BLM Visual Resource Management (VRM) program. This program sets forth procedures for the systematic inventory and management of visual resources. Under this program, visual resources are first inventoried and classified through a process that considers: (1) the inherent scenic quality of the landscape, (2) the sensitivity of viewers who may see the landscape from key viewpoints, and (3) the distance from which the landscape is commonly seen. These variables are independently evaluated according to preestablished criteria. The results of these three investigations are then combined through a standardized matrix to determine visual resource management classes. These classes recommend the degree of protection which should be afforded the lands that have been inventoried. There are four VRM Classes: I through IV. The management prescriptions associated with each of these classes is briefly described, as follows (BLM 1986a):

Class I - The objective of Class I is to preserve the existing character of the landscape. It provides for natural ecological changes but does not preclude limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention. This class generally applies to legislated areas, such as National parks and wilderness areas.

Class II - The objective of Class II is to "retain" the existing character of the landscape. The level of change to the landscape should be "low." Management activities may be seen, but should not attract the attention of the casual observer. Any changes "must" repeat the elements of the predominant natural features of the landscape. This class constitutes the highest scenic quality with the greatest visual sensitivity of nonlegislated areas. Examples might include scenic vistas along highways or more heavily traveled roads.

Class III - The objective of Class III is to "partially retain" the existing character of the landscape. The level of change to the landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes "should" repeat the elements of the predominant natural features of the landscape. Examples might include distant (background) vistas along highways or closer vistas along less heavily traveled roads.

Class IV - The objective of Class IV is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the landscape can be "high." 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 (landscape) elements. This class has common scenery with the least visual concern. Examples might include seldom-seen areas away from roads or other areas frequented by the general public.

Proposed landscape modifications are evaluated based on their ability to comply with the management prescriptions identified above. This is determined through a Contrast Rating process whereby the visual appearance of the existing and future condition landscapes are compared against each other (BLM 1986b).

This process involves an evaluation of the way in which onsite disturbances would be seen by viewers from sometimes distant viewpoints. To facilitate this evaluation and best assure consistency, the contrast rating process has been divided into three distinct steps. The first step is to accurately characterize the nature and extent of the onsite disturbance to the landform and vegetation from the addition of any proposed structures, within the context of the existing setting. This is referred to as the degree of *physical contrast*. Second, the level of visibility is determined from each potentially affected viewpoint, through consideration of such variables as distance, duration, orientation, screening, backdrop, angle of view, and scale. Third, the level of onsite physical contrast, as modified by the visibility level, is used as the basis to determine the level of *visual contrast* (i.e., the nature and degree of contrast that is seen by the viewer). Impacts are then assigned on the basis of compatibility of the predicted levels of visual contrast with the VRM class.

3.11.1 Visual Resources in the Smoky Mountain Area

Broadly speaking, the Smoky Mountain area is characterized by a series of three broad, stairstepping mesas that descend from the Kaiparowits Plateau down to Lake Powell. These mesa tops are arid, flat to rolling expanses covered principally by sage-shadscale scrub vegetative communities. The mesas are occasionally interrupted by deeply dissected drainages, which extend inward from the face of the major cliff formations that separate each step in this geologic staircase. Colorful and interestingly eroded escarpments of 800 to 1,000 feet high or more are typical of the cliff formations in this area. In some areas, such as John Henry Canyon, Tibbett Canyon, and Smoky Hollow, a series of deep, narrow canyons converge to form an enclosed, remote setting. Canyon bottoms are typically dry, with varying amounts of riparian vegetation. All public lands within the area have been inventoried for visual resources. Some private lands and lands within the Glen Canyon NRA have not been inventoried. In the Smoky Mountain area, VRM Classes range from II to IV because of the diversity of landscape types and the differences in viewing opportunities and conditions.

Opportunities to view the landscape are highly variable within this region. The most commonly used viewpoints tend to be concentrated to the south and west and include the communities of Big Water, Utah, and Greenehaven and Page, Arizona; U.S. Hwy. 89; and recreation sites and access points associated with the Glen Canyon NRA. Opportunities to view the back country to the north are afforded principally by the Warm Creek Road (with several side roads, including branches that extend through Tibbett Canyon, Smoky Hollow, and across Romana Bench and Smoky Mountain); the Nipple Creek Road (which extends northward to intersect the Smoky Mountain Road near Pilot Rock); and numerous other four-wheel-drive roads. The Wahweap and Burning Hills Wilderness Study Areas (WSAs) can be accessed via these roads.

Views from any of these viewpoints are primarily limited to the mesa on which the viewer is standing and the cliff formation which separates it from the mesa above. Because of the prominence of the cliff formations, views are most strongly directed to the immediate foreground and the cliffs (even if relatively distant); the middleground landscape serves merely as a link between the two in most viewing situations because of the general lack of distinctiveness of the mesas. Views from within the canyon drainages are almost always limited to a relatively short segment of the actual drainage, owing to the deep, narrow, and twisting topography.

Within the Smoky Mountain area, most of the lands are in a natural or natural-dominated condition. Modifications tend to be limited in both scale and extent. Existing modifications of note within the area include U.S. Hwy. 89 and various four-wheel-drive roads, the communities of Big Water and Greenehaven, various Glen Canyon NRA recreation locations and access roads, a 138-kV power transmission line south and west of Big Water, disturbance from a previous coal mining operation in Smoky Hollow, and an abandoned landing strip on Smoky Mountain.

Because of the visual prominence of the cliff formations, their scenic quality and lack of disturbance, these areas have generally been classified as VRM Class II. In addition, most of the major canyons have also been designated as VRM Class II because of their scenic quality, especially those that contain access roads. The mesas have all been designated as VRM Class IV, owing primarily to the low scenic quality, but also because many afford a low visibility/sensitivity.

Within the Glen Canyon NRA, visual resource management is not formalized but is generally guided by the NRA's enabling legislation that requires NPS "to preserve scenic, scientific and historic features contributing to public enjoyment of the area" (Appendix D, Section D.1.4). This part of the NRA is designated as a "Recreation and Resource Utilization Zone," which, according to the General Management Plan, indicates that utility and transportation systems may be allowed where appropriate.

3.11.2 Visual Resources in Other Selected Areas

The lands in the Iron Springs area slope gently but noticeably to the north. Vegetation consists of a sage/grassland community with widely scattered junipers in the upper reaches. The effects of previous mining operations on adjacent lands are still very much in evidence, principally through large tailings piles located to the south and east. The area contains existing dirt roads and a few isolated remnant structures; it is crossed by the Iron Springs Road (county), a branch of the Union Pacific Railroad, and several wood-pole power distribution lines. The Iron Springs area has been designated as VRM Class IV because of the low scenic quality.

The lands in the Moapa area are typical of the Mojave Desert; wide expanses of rolling terrain with sparse shrub vegetation (principally creosotebush) . The Nevada Power Company's Reid Gardner Powerplant is a dominant element in this open landscape. It is also strongly influenced visually by three high-voltage power transmission lines. Aside from Interstate-15, this area is generally not visible to any sensitive viewpoints. This area has been designated as VRM Class IV because of its low scenic quality.

The lands surrounding Fredonia are flat to gently sloping and are covered with thick stands of medium height shrub species. The visual quality of the area selected for the hypothetical truck maintenance facility is influenced by a few widely scattered residences and industrial buildings (principally refining operations across the highway). This area is adjacent to U.S. Hwy. 89A at the northern edge of an unzoned part of the town of Fredonia, Arizona. Because this area is located on private land, it has not been previously inventoried or classified for visual resource values. On the basis of surrounding land use and visual characteristics, this area would probably be designated as Class IV if it were formally inventoried.

The lands west of Hurricane are gently sloping, sparsely vegetated, and rather nondescript. They are already influenced to some degree by a mixture of existing, housing, industrial, and commercial development. The land selected for the hypothetical truck maintenance facility is in private ownership and has not previously been inventoried or classified for visual resources. Adjacent public lands are presently designated as Class IV, and this private land would probably also be designated as Class IV if a formal inventory were to be conducted.

3.12 RECREATION

3.12.1 Regional Overview

The southern Utah, northern Arizona, southeastern Nevada area is a region endowed with many spectacular recreation areas, including Zion National Park, Bryce Canyon National Park, Cedar Breaks National Monument, Grand Canyon National Park, Pipe Springs National Monument, Glen Canyon National Recreation Area (NRA), and Coral Pink Sand Dunes State Park. (See Appendix E for discussions on these recreation areas.)

Recreation use at these areas has been steadily increasing over the past several years. This increase in use is reflected in the number of visits recorded. For example, between 1984 and 1991, the number of visits to the Glen Canyon NRA increased at an annual rate of 7.1 percent; the number of visits to Pipe Springs National Monument increased at an annual rate of almost 10 percent over that same time period (University of Arizona 1991). About 3,615,000 people visited Glen Canyon NRA in 1993; 52,556 people visited Pipe Springs National Monument that year (Gediman 1994a, Davis 1994). Tourism contributes approximately 4.5 percent to the total income in the Southwest region and 7.3 percent in Kane County (Utah GOPB 1993a).

Recreational use in the region generally consists of dispersed recreational activities, such as hunting, rockhounding, sightseeing, and off-road vehicle (ORV) use. Urban areas provide recreational facilities and services, such as city parks.

3.12.2 Smoky Mountain Area

The majority of recreational activities occurring in the Smoky Mountain area are dispersed activities, such as hunting, off-road vehicle (ORV) use, hiking, and primitive camping. Recreational use is relatively light, primarily because of difficult access, the lack of developed facilities, and the lack of special features to attract a large number of recreationists. Facilities are limited to trailhead parking. Unimproved roads in the area, particularly on Nipple and Tibbett Benches, provide recreational four-wheel-drive opportunities.

The existing Warm Creek Road passes through a corner of the Glen Canyon NRA. The area is used for dispersed recreational activities, such as photography, sightseeing, hiking, and horseback riding. Lake Powell can be accessed from the Warm Springs Road via Crosby Canyon and provides boating, sightseeing, and fishing opportunities (Appendix E). Off-road vehicles and mountain bikes use the Warm Creek Road. There is illegal ORV use of this area, as well. NPS does not have recreation use data specific to this area of the NRA, but its use is estimated to be less than 500 visits per year.

According to the General Management Plan for the Glen Canyon NRA, the Warm Creek Road is located within a "Recreation and Resource Utilization Management Zone" (NPS 1979). Examples of development permitted within this management zone include mining facilities, utility lines, unpaved roads, and primitive trailhead facilities, such as parking and sanitary devices. NPS has no plans or proposals for any recreation development in the vicinity of the road corridor.

3.13 WILDERNESS

3.13.1 Wilderness Characteristics

In the Wilderness Act of 1964, Congress defined wilderness and directed that each wilderness area be managed to preserve its wilderness character. Under the definition in Section 2(c) of the Wilderness Act, certain wilderness characteristics are mandatory; others are optional. The mandatory wilderness characteristics include size, naturalness, and outstanding opportunities for solitude or a primitive and unconfined type of recreation, and are described as follows:

- Size. Section 2(c) of the Wilderness Act states that a wilderness area should have at least 5,000 acres of land or be of sufficient size to make practicable its preservation and use in an unimpaired condition.

- Naturalness. "Naturalness" refers to the requirement in Section 2(c) of the Wilderness Act that a wilderness area "generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable."

- Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation. A wilderness area does not have to possess outstanding opportunities for both solitude and primitive recreation; it only has to possess one or the other. For the purpose of BLM's wilderness review process, solitude has been defined as (1) "the state of being alone or remote from habitations; isolation; (2) a lonely, unfrequented, or secluded place." The emphasis is on the opportunities a person has to avoid the sights, sounds, and evidence of other people within a particular wilderness study area (WSA), rather than on opportunities for solitude in comparison to habitations of man. For the purpose of the BLM wilderness review process, "a primitive and unconfined type of recreation" refers to those activities that provide dispersed, undeveloped recreation not requiring facilities or motorized equipment.

In addition to the mandatory characteristics for wilderness, Section 2(c) of the Wilderness Act states that a wilderness area "* * * may also contain ecological, geological, or other features of scientific, educational, scenic or historical value." Although these values and features do not need to be present in an area for a wilderness designation to be given, Section 4(b) of the Wilderness Act recognized the importance of such values in wilderness by stating that "* * * wilderness areas shall be devoted to the public purpose of recreation, scenic, scientific, educational, conservation, and historical use."

3.13.2 Utah Wilderness Study Areas, Historical Perspective

The passage of the Federal Land Policy and Management Act (FLPMA) in 1976 mandated that BLM inventory all lands under its jurisdiction, including 22 million acres of land in Utah, as part of its wilderness inventory suitability review. BLM used the mandatory wilderness characteristics identified in the Wilderness Act in their wilderness inventory to determine which roadless areas qualified to become WSAs. The initial step was to identify all BLM-administered lands which met the primary criteria of "wilderness," as defined by the Wilderness Preservation Act of 1964, described above. WSAs were identified throughout the State of Utah. The following parcels within about a 6-mile radius of the Smoky Mountain area were identified as potential wilderness:

- Wahweap
- Burning Hills
- Nipple Bench
- Head of the Creeks
- Warm Creek

The Fiftymile Mountain parcel, which has also been recommended by BLM as a WSA, lies about 15 miles east-northeast of the Smoky Mountain area. (See Appendix E for discussions on the Wahweap, Burning Hills, and Fifty-Mile Mountain WSAs.)

Following this initial determination as potential wilderness, BLM then began its initial wilderness review. The purpose for this review was to determine which areas might possibly meet the criteria for wilderness, as outlined under the Wilderness Act, and would subsequently require more intensive inventory, in contrast to those areas which clearly did not possess sufficient wilderness characteristics to meet the Act's criteria.

In April 1979, BLM released its Initial Wilderness Inventory Proposal, which included recommendations that the Wahweap and Burning Hills units be included in the next round of wilderness review (intensive inventory). The report also recommended that the Nipple Bench, Head of the Creeks, and Warm Creek units not be included in any further wilderness review, because of their lack of wilderness qualities. Specifically, the Nipple Bench unit did not qualify for further inventory and was recommended to be dropped from the wilderness review process because numerous roads, tracks, and range developments were identified within this unit. The naturalness of the unit had been impaired by engineering investigations associated with the Kaiparowits Power Project. Likewise, the naturalness of the Head of the Creeks unit had been impaired by engineering investigations associated with proposed coal mine development. The unit also contained range developments and ways, or roads and tracks. Exploratory drilling had substantially impaired naturalness. Finally, the Warm Creek unit contained range developments and numerous drillholes and roads associated with coal exploratory drilling that had substantially impaired the naturalness of this unit. BLM concluded that these units "clearly and obviously" did not meet the criteria for identification as WSAs.

In August 1979, after receiving public comments, BLM released its final Initial Wilderness Inventory. The Wahweap and Burning Hills units were recommended for further (intensive) inventory study. BLM formally dropped from further wilderness review the Nipple Bench, Head of the Creeks, and Warm Creek units. The decision to drop these units was not contested or appealed at any time during the inventory process.

In November 1980, BLM concluded its intensive wilderness inventory. At that time, BLM formally designated as WSAs all remaining areas which met the wilderness criteria as outlined in the BLM Wilderness Inventory Handbook. Neither the Wahweap unit nor the Burning Hills unit was included as a WSA following this intensive inventory because each has limited solitude and recreational opportunities and a lack of features of National or regional importance, as defined by the Wilderness Inventory Handbook. These decisions and others were appealed to the Interior Board of Land Appeals (IBLA). IBLA ruled to remand these areas back to BLM for reconsideration. BLM restudied these areas and, by redefining the units' boundaries, later reclassified them as WSAs.

3.13.2.1 The Final Utah Wilderness EIS

In November 1990, BLM released its Final Utah Wilderness EIS to the Secretary of the Interior (the Secretary) and recommended that 1.9 million acres in Utah be permanently designated as part of the National Wilderness Preservation System. Neither the Wahweap unit nor the Burning Hills unit was recommended by BLM for wilderness. BLM concluded that although all of the Wahweap WSA is in a natural state, only about 10 percent of the WSA has outstanding opportunities for solitude. About 17 percent of the WSA has high scenic values, in six scattered locations. Opportunities for primitive recreation are not outstanding. About 1,000 acres of comparatively old pinyon and juniper trees and 11,700 acres of features with geologic interest in the WSA are not considered to be of National or regional importance.

In contrast to the relatively low wilderness values, the Wahweap WSA has known coal reserves and a comparatively high potential for oil and gas development in the future. The WSA is located in the southern part of the Kaiparowits Coal Field and within the Kaiparowits Known Recoverable Coal Resource Area. About 12 percent of the WSA is currently leased for coal, with preexisting rights. The most likely location for coal mining would be on the existing leases, which may include those in the Wahweap WSA. The recommendation for no wilderness designation in the Wahweap WSA was based on overall low wilderness qualities and long-term future potential for energy mineral extraction (BLM 1991). (See Appendix E for additional information on the Wahweap WSA.)

All of the Burning Hills WSA is in a natural state. Less than half of the WSA (45 percent) has outstanding opportunities for solitude and parts have scenic values, but nowhere are the opportunities for primitive recreation considered to be outstanding. The WSA is within the Kaiparowits Coal Field and about 21 percent of the WSA is leased for coal, with preexisting rights. The most likely location for coal development would be on existing leases, including those in the Burning Hills WSA. The future potential for coal mining in the WSA was given precedence over the wilderness values (Appendix E, Section E.9.2, Burning Hills Wilderness Study Area) (BLM 1991).

The Secretary reported his recommendations for wilderness or nonwilderness designation to the President in October 1991. Under the Secretary's proposal, 1.9 million acres of BLM-managed land in Utah would be designated as wilderness. It did not recommend either the Wahweap WSA or the Burning Hills WSA for wilderness. The President sent the Secretary's recommendations to the Congress in 1992. No formal action was taken until 1995, when two companion wilderness bills (S-884 and HR-1745) were introduced by the Utah congressional delegation. These bills generally followed the Secretary's recommendation, but only proposed wilderness designation for 1.8 million acres of BLM-managed land in Utah. Once again, neither the Wahweap WSA nor the Burning Hills WSA was included. To date, the Congress has not acted on final wilderness legislation. Until Congress acts, the Secretary is required to manage all existing WSAs under the "Interim Management Policy and Guidelines for Lands Under Wilderness Review" in a manner that will not impair their suitability for preservation as wilderness. This may include restricting motorized vehicle travel and mineral development. This management is subject to certain exceptions and conditions, including recognition of valid rights and grandfathered uses.

3.13.2.2 The Utah Wilderness Coalition Proposal

The Utah Wilderness Coalition (Coalition) is an alliance of 37 public-interest organizations that support the protection of Utah's desert wildlands. With the Coalition's support, Utah Congressman Wayne Owens introduced a wilderness bill (U.S. House of Representatives [HR] Bill 1500) to Congress in 1989, separate from BLM's recommendations. HR Bill 1500 proposed about 5.7 million acres as wilderness in Utah. Within the Smoky Mountain area, HR Bill 1500 included the Wahweap and Burning Hills WSAs as well as two other units that generally corresponded to the Nipple Bench and Warm Creek units that BLM had determined during its Initial Wilderness Inventory "clearly and obviously" did not qualify for designation as WSAs. HR Bill 1500 at that time omitted most of the proposed Smoky Hollow Mine area from WSA designation. Congressional action was not taken on the original HR Bill 1500.

In the House of Representatives, bills not acted on must be reintroduced annually. HR Bill 1500 was subsequently revised and reintroduced by Congressman Owens in 1990, 1991, and 1992, and by New York Congressman Maurice Hinchey in 1993, 1994, and 1995. In the 1995 version, the bill became known as "America's Redrock Wilderness Protection Act." The revised versions of HR Bill 1500 included the Wahweap and Burning Hills WSAs, as well as the Nipple Bench and Warm Creek units contained in the original version. The revised versions did expand to include the Head of the Creeks unit which contained most of the proposed Smoky Hollow Mine area, another area that BLM had determined during its Initial Wilderness Inventory "clearly and obviously" did not qualify for designation as WSAs. To date, congressional action has not been taken on any of the revised versions of HR Bill 1500.

3.14 CULTURAL RESOURCES

3.14.1 Cultural History of the Region

Human occupation of southern Utah, northern Arizona, and southeastern Nevada is believed to have been established about 12,000 years ago. Indigenous occupation includes the Paleo-Indian stage (10,000-6,000 B.C.), Archaic stage (6,000 B.C.-A.D. 500), Formative stage (Fremont and Anasazi, A.D. 500-1300/1700), and Protohistoric stage (Ute and Paiute, A.D. 1250/1300 until historic times, ca. A.D. 1850). Evidence of Paleo-Indian habitation in the region is limited, consisting mainly of isolated artifacts. Sites of this tradition are generally lithic scatters, often with little or no other evidence of occupation. The Archaic stage is typically characterized as exhibiting a hunting and gathering economy contingent upon seasonally available food resources. An increase in utilization of milling stones indicates greater dependence on plants and seeds. There is also evidence of seasonal expeditions into higher elevations for hunting and plant gathering (Tipps et al. 1989). The Formative stage is typified by sedentary populations, a horticulture-based economy, and extensive use of ceramics and masonry (Tipps 1984). Predominant cultural traditions are the Virgin Anasazi and the Fremont (Tipps 1984). The Protohistoric stage is characterized by Numic-speaking peoples, the Ute and the Paiute. These groups are generally believed to have entered the Great Basin from the west, perhaps as early as A.D. 900 or 1000, and to have inhabited the area from around A.D. 1250/1300 to historic times (Tipps 1984).

The earliest documented incursion of peoples of European extraction into the region occurred in 1776 with the Dominguez-Escalante expedition. This expedition forded the Colorado River at the point now known as The Crossing of the Fathers, submerged under the waters of Lake Powell just east of the Smoky Mountain area. Spanish trading expeditions followed, leading to the eventual development of the Old Spanish Trail (Tipps et al. 1989, p. 20-38; Robinson 1970). Mormon settlers constituted the majority of those who sought permanent habitation in the region, beginning in the 1850s. Following directions from church leader Brigham Young, who saw a need to establish missions among the Indians in conjunction with extending the range of Mormon territory, various groups set forth from Salt Lake City. Conflict with Indians greatly slowed the progress, and settlements were often abandoned for reasons of security (Robinson 1970). Cedar City and nearby Parowan were settled in the early 1850s, and, following the discovery of iron ore and coal deposits, the area was established as an iron smelting center. Despite early successes, the industry never fully developed and did not compete effectively with imported metal goods after the railroads entered southern Utah in the 1870s. By this time, agriculture had become the principal economic base. The St. George area, known to the Mormons as "Dixie" because of its warm climate, was settled in the 1850s and officially colonized in the early 1860s. It was established as an agricultural center, and numerous crops, including cotton, were produced. St. George also became a seasonal refuge for Mormons from the north, and Brigham Young maintained a winter home there. Kanab, located to the east of St. George just north of the Arizona border, was formally incorporated in 1870, although the immediate area had been settled at least by the early 1860s. It was also an agricultural center, but with an emphasis on ranching (Bancroft 1889; Anderson 1942; Robinson 1970; Poll 1978; May 1985).

3.14.2 Prehistoric and Historic Cultural Resources

A prehistoric cultural resource is defined as the physical remains of prior human activity that predates the advent of written records. Sites may vary greatly in size and physical expression and include artifact scatters and concentrations (lithics [chipped stone], ground stone, ceramics); features (pit houses, pueblos, hearths, roasting pits, game drives, miscellaneous rock alignments, depressions); rock art; and various combinations thereof. Prehistoric sites occur in both open and sheltered contexts. Isolated artifacts, usually consisting of lithic tools and debitage, have also been found. Prehistoric cultural resources are indicative of Native American activity. Depending on their age, complexity, physical integrity, data content, and relationship to other archaeological remains, sites may be important because of their potential to yield information about preexisting cultures and now-extinct lifeways.

A historic cultural resource is defined as the physical remains of prior human activity that followed the advent of written records. As with the prehistoric sites, historic remains vary greatly in size and physical expression and are known to include artifact scatters (glass, cans, ceramics, miscellaneous metal, etc.) and artifact concentrations, including refuse dumps, inscriptions, and various features and feature combinations (railroad grades, railroad-related camps, tent foundations, mines, brush fencing, and depressions). Isolated historic artifacts also occur and usually consist of cans, but also include glass fragments and miscellaneous metal items. Historic cultural resources are most often associated with Euro-American activity but may also reflect relatively recent Native American activity. Historic sites may have research potential in the same manner as prehistoric sites, but historic sites are more often considered important because of their association with notable historical persons or events, or as examples of distinctive architectural styles.

3.14.3 Pertinent Cultural Resource Legislation

Pertinent historic preservation statutes include the National Historic Preservation Act of 1966, as amended (NHPA), the American Indian Religious Freedom Act of 1978 (AIRFA), and the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA). NHPA established the National Register of Historic Places and the Advisory Council on Historic Preservation. In Section 106, it described a five-stage process involving the appropriate State Historic Preservation Officer (SHPO), Advisory Council, and appropriate Federal agency for the purpose of ensuring that the effects on historic properties are fully considered in the planning and execution of Federal projects (defined as projects involving Federal lands, funding, or licensing) (Carnett 1991). Consideration for listing on the National Register is given to "districts, sites, buildings, structures and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association" and that are (a) related to events that have made an important contribution to the broad patterns of our history; or that are (b) associated with the lives of persons important in our past; or that (c) bear a pattern of distinctive characteristics of historic, architectural, archaeological, engineering or cultural importance; or that (d) have yielded or may in the future yield important information as to our history or prehistory (Carnett 1991). Executive Order 11593 of 1971 specifically invoked NHPA and directed that Federal agencies inventory their lands for cultural properties and make appropriate nominations to the National Register of Historic Places.

AIRFA mandated that Federal agencies and departments protect and preserve Native American religious cultural rights and values. In practice, AIRFA has fostered a set of procedures whereby tribal representatives are notified and asked to comment on Federal actions which may adversely affect known sites of religious or cultural value. The Archeological Resources Protection Act of 1979 (ARPA) specifically references AIRFA with respect to protection of culturally significant sites.

NAGPRA is a wide-reaching statute, the primary purpose of which is ensuring proper and timely repatriation of Native American human remains housed in museums and other institutions. NAGPRA also mandates that Federal agencies establish procedures for responding to unanticipated discoveries of human remains and related cultural materials on Federal and tribal lands.

3.14.4 Cultural Resources Associated with the Warm Springs Project

In the proposed Smoky Hollow life-of-mine area, 35 cultural resource localities (34 sites, 1 isolated find) have been identified to date. Of these 35 cultural resource localities, 33 are eligible for the National Register of Historic Places (NRHP) and 2 are not eligible. (Details on the cultural surveys conducted in the Project area are provided in Appendix E.)

Thirty-nine cultural resource localities (27 sites, 12 isolated finds) have been located to date within potential impact areas associated with the proposed 138-kV power transmission line. Another 13 localities (all of which are sites) have been recorded within one-half mile of the line. Of the 39 cultural resources located within potential direct impact areas, 13 are eligible for the NRHP pending SHPO concurrence, 25 are not eligible, and 1 is unevaluated. Of the 13 cultural resources within one-half mile of the line, 2 are eligible for the NRHP pending SHPO concurrence, 2 are not eligible, and 9 are, as yet, unevaluated.

No cultural resources have been recorded to date within the boundaries of any of the three areas associated with the proposed microwave communication system. Nine cultural resource localities (eight sites, one isolated find) are known to exist within one-half mile of the proposed Big Water terminal linkage facility. Of these nine localities, two are eligible for the NRHP pending SHPO concurrence, five are not eligible, and two are, as yet, unevaluated.

Fourteen cultural resource localities (12 sites, 2 isolated finds) have been identified to date within potential impact areas associated with the proposed reconstruction and realignment of the Warm Creek Road. Another 15 cultural resources (all of which are sites) have been recorded within one-half mile of the road. Of the 14 cultural resource localities within potential direct impact areas, 11 are eligible for the NRHP, pending SHPO concurrence and 3 are not eligible. Of the 15 cultural resource localities within one-half mile of the road, 6 are eligible for the NRHP pending SHPO concurrence, 5 are not eligible, and 4 are, as yet, unevaluated.

Fourteen cultural resource localities (11 sites, 3 isolated finds) have also been located within potential impact areas associated with the proposed Benchtop Road. Another 21 cultural resource localities (19 sites, 2 isolated finds) have been recorded within one-half mile of the road. Of the 14 cultural resources within potential impact areas, 5 are eligible for the NRHP pending SHPO concurrence, and 9 are not eligible. Of the 21 cultural resources within one-half mile of the proposed road, 11 are eligible for the NRHP, 8 are not eligible, and 2 are, as yet, unevaluated.

No cultural resources have been recorded to date within the boundaries of the proposed Iron Springs unit-train loadout facility, but two localities (one site, one isolated find) are known to exist within one-half mile of the areas. The single site is eligible for the NRHP pending SHPO concurrence, and the isolated find is not eligible.

Thirty-five cultural resource localities (13 sites, 22 isolated finds) have been identified to date within potential impact areas at the proposed Moapa unit-train loadout. Another 24 localities (21 sites, 3 isolated finds) have been recorded within one-half mile. Of the 35 cultural resource localities within potential impact areas, 2 are eligible for the NRHP pending SHPO concurrences, and 33 are not eligible. Of the 24 cultural resource localities within one-half mile of the loadout and/or associated facilities, 1 is eligible for the NRHP pending SHPO concurrence, 7 are not eligible, and 16 are, as yet, unevaluated.

One cultural resource locality (a site) is known to exist within the boundaries of the area selected for the hypothetical Hurricane truck maintenance facility, and four other localities (three sites, one isolated find) are located within one-half mile. The site within the boundaries of the hypothetical facility is eligible for the NRHP pending SHPO concurrence. Of the four cultural resource localities within one-half mile of the hypothetical facility, one is eligible for the NRHP pending SHPO concurrence, and three are not eligible. No cultural resources are known to exist currently within or near the area selected for the hypothetical Fredonia truck maintenance facility.

One historic site, the Naegle House, is situated in Toquerville, Utah, proximate to Utah Route 17. It was built between 1866 and 1868 by John Conrad Naegle and served principally as a winery until at least 1888. It is enrolled on the NRHP (USDOI 1979a). Pipe Springs National Monument is adjacent to Arizona Route 389 in northern Arizona just south of Kanab, Utah, and includes several structures dating to the period of early Mormon colonization of the Kanab Creek Valley, ca. 1863-1870s. Prehistoric archaeological remains are present as well. Cultural remains at Pipe Springs are also listed on the NRHP (USDOI 1987 p. 4-5).

3.14.5 Native American Religious and Cultural Concerns

Native American (traditional) religious and cultural concerns include sites, areas, and materials important to Native Americans for religious or heritage reasons. Sensitive resources could include some types of prehistoric sites, features and artifacts, rock art, contemporary sacred areas, burial sites, traditional use areas (e.g., native plant habitat), and sources for materials used in the production of sacred objects and traditional tools.

The ecology of the general southern Utah, northern Arizona, and southeastern Nevada area suggests that it was used extensively by small population groups and, most likely, on a seasonal basis. The area's low aboriginal population density, its distance and general inaccessibility from historic Anglo-American settlements, and the general historic lack of competition for the land have resulted in the area and its ethnohistoric populations being relatively little studied. Specific documentation on topics such as traditional use areas is especially lacking. The sacred, private, and personal aspects of ritual use areas suggest that the location and use of these areas may not be disclosed even if the geographic area had been subjected to more intensive ethnographic research (Stoffle 1980). From a Native American perspective, all living things have spirits (i.e., sacred elements), and humans are to live in harmony and balance with their environment. Plants, animals, and some trails and places used (and thereby considered sacred) by the Southern Paiute have been identified in the region (Stoffle 1980). No published ethnographic literature confirming the presence of specific Native American ritual and traditional use areas in the Smoky Mountain area is available; however, the absence of ritual or traditional use areas cannot be assumed. Knowledge of site-specific traditional and ritual uses of this area would require specific input from individual Native Americans. Sensitive places may include geophysical features (e.g., mountain peaks, buttes, mesas, or promontories), water courses (seeps, springs, creeks, or ephemeral water courses), or collection areas for the production of food, traditional tools, or sacred objects.

Native American groups with traditional ties and concerns in the southern Utah, northern Arizona, southeastern Nevada area primarily include several Southern Paiute Bands, Navajo, and Hopi, and secondarily, other Paiute and Ute groups. (See Appendix E for brief discussions about these Native American Groups.) Individuals belonging to these Native American ethnic groups may be represented by (1) formal, land-based reservation organizations (e.g., Navajo Nation, Hopi Tribe, Kaibab Paiute Tribe), or (2) reservationless (landless) local councils (e.g., Southern Paiute Tribe, White Mountain Ute Council, Blue Mountain Dine'). Members of the Cedar City, Indian Peaks, Kanosh, Koosharem, and Shivwits Bands of southern Utah represent something of a special case, as their reservations were terminated under Public Law 83-762, effective March 1, 1957; however, these groups had their Federal recognition and reservations reestablished in the early 1980s.

Although the region may not have supported large or sedentary aboriginal populations, it appears to have been used by a number of groups. Based on their oral history of migration traditions, members of a number of Hopi Clans migrated through and inhabited the southern Utah-northern Arizona area and thus claim cultural and ancestral affinity to the prehistoric inhabitants of the region. The Hopi Tribe has stated that Hopi ancestral sites, now archaeological sites, are regarded as integral to Hopi religion. They noted that habitation sites may contain village shrines that have not been "ritually retired," but did not specify individual sites or locations (Jenkins 1993). The Navajo Nation observed that parts of the proposed Warm Springs Project area are within the area of "aboriginal Navajo land" and that specific important localities could exist in the Smoky Hollow life-of-mine area or along truck haul routes, but that the identification of such places would have to be made by members of local communities (Roberts 1993). In the ethnohistoric period, eastern bands of the Southern Paiute were present in south-central Utah. The Smoky Mountain area was inhabited by the Kaiparowits Band, and the Kaibab and San Juan Bands were located across the Paria and Colorado Rivers, respectively, from the Kaiparowits Band. Northwest of the Kaiparowits Band were the Panguitch, another of the eastern bands of the Southern Paiute. The Ute were found to the northeast beyond the Waterpocket Fold, and the Navajo and Hopi were present to the southeast, beyond the Klethla Valley and Moencopi Plateau areas. The Havasupai were located to the southwest, beyond the Kaibab, and across the Colorado River (Kelly 1976). It is difficult to distinguish among bands, because of a general fluidity of band group membership and trade and intermarriage between bands (Kelly 1976). Trade took place among tribal groups in the region and beyond; marriage outside one's own tribal group also occurred.

Tribal affiliation for at least some in the area was less than precise. Basic tribal affiliation among the Kaiparowits and some adjacent groups was sometimes difficult or impossible to pinpoint, and informants used such terms as "almost Ute" and "half Ute" to describe some individuals (Kelly 1976). The several Paiute reservations, created in the late 19th-early 20th century, drew from this imprecise band organization and imposed a geographic "home" previously lacking for many Paiutes.

Further adding to the geographic and cultural mix of the area, in the late 19th-early 20th century, was the continuing expansion of Navajo tribal members into the Smoky Mountain area from the south and of Southern Ute tribal members into the area near Blanding and beyond (Euler 1966). The band and tribal mixing present here has close parallels with that which occurred in southern San Juan County, Utah, immediately to the east of the Smoky Mountain area (Weber 1980).

ENVIRONMENTAL CONSEQUENCES

CHAPTER 4

4.1 ASSUMPTIONS OF THE IMPACT ANALYSIS

In order to perform the impact analysis contained in this chapter, certain assumptions were made. The following assumptions are for the purposes of this analysis only and are not intended to be the final projection of future activities that may or may not materialize in the area over the next 54 years.

4.1.1 Assumptions for the Approval Alternative

The assumptions used by the Agencies to perform the impact analysis for the approval alternative include:

- The Permit Application Packages submitted by Andalex for mining and mining-related operations associated with the proposed Warm Springs Project, with conditions attached, are in compliance with applicable State and Federal laws.

- The proposed Project facilities, mine layout, and development schedules described in Appendix A may be refined by the Applicants upon final detailed engineering, acquisition of permits/authorizations, and implementation.

- Final reclamation of some permanent facilities, such as the Warm Creek/Benchtop Road, the UP&L 34.5-kV power distribution line near Iron Springs, and the truck maintenance facility, may not take place when other final reclamation activities would be expected to take place (year 41 or 42 of the Project).

- The proposed truck maintenance facility locations at Fredonia and Hurricane are hypothetical for the purposes of this analysis. The actual location and number of facilities would be selected by the specific private contractor chosen to provide truck haul and maintenance services for the Project.

- Mining and reclamation technology would not change substantially throughout the life of the Smoky Hollow Mine.

- Labor, equipment, and/or market shortages/surpluses would not materially change projected levels of development associated with the Project.

- Impacts to the coal supply or demand of market coal (regional or otherwise) are beyond the scope of this EIS.

- The life of the Smoky Hollow Mine would be about 54 years: 1 to 2 years for premining development, equipment installation, and limited coal recovery and delivery; 40 years to recover and deliver 100 to 120 million tons of coal; 2 years to complete necessary postmining reclamation activities; and at least 10 years to obtain final bond release.

- Activities associated with the proposed Warm Springs Project, as described in Appendix A, would be initiated in 1998.

- Final reclamation would be initiated when a disturbed area was no longer needed for either mining or production operations. No reclaimed acres would be available for postmining land use until the end of the mine life (e.g., postmining land use at the surface facilities complex, 138-kV power transmission line, microwave communication sites, and the Moapa and Iron Springs unit-train loadouts would begin after final bond release at the Smoky Hollow Mine).

- The local short-term impacts of the Project are those that would occur during the period from premining development through final bond release at the Smoky Hollow Mine (i.e., about 54 years). Long-term impacts of the Project are those that would persist beyond or occur after final bond release.

- An irreversible and irretrievable commitment of resources would occur when resources were consumed, committed, or lost as a result of the Project-related activities. The commitment of a resource would be "irreversible" if Project-related activities started a "process" (chemical, biological, and/or physical) that could not be stopped. As a result, the resource, or its productivity, and/or its utility would be consumed, committed, or lost forever. Commitment of a resource would be considered "irretrievable" when Project-related activities directly eliminated the resource, its productivity, and/or its utility.

- Qualitative terms are used to describe the anticipated magnitude of impacts and, where appropriate, the anticipated importance of impacts to the human environment. The terms "major," "moderate," "minor," "negligible," and "none" describe magnitude. "Significant," "potential to become significant," and "insignificant" describe importance. Impacts are assumed to be insignificant unless identified otherwise.

- Cumulative impacts are defined as collective impacts of the Project when considered in conjunction with other past, present, and reasonably foreseeable activities. (These activities are described in Appendix B of the EIS.) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

- The geographical limits for the analysis of probable impacts in this EIS primarily encompass the acreages directly involved with the proposed Smoky Hollow life-of-mine area, the Benchtop and Warm Creek Road corridors, the proposed 138-kV power transmission line corridor, the microwave communication sites, the truck maintenance facility sites, the truck haul routes, and the Moapa and Iron Springs unit-train loadouts. Larger geographical limits were established in some areas to allow for required analyses and assessment of impacts. They include:

Geology and Paleontology. The geologic rock units of concern evaluated during the analysis of the Smoky Mountain area included all members of the Middle Jurassic to upper Cretaceous Age formations, with emphasis on the Upper Cretaceous Straight Cliffs Formation. Geographically, the area of analysis ranged from Escalante Bench on the south to Nipple Bench on the north and from Wahweap Creek on the west to Rees Canyon on the east.

Surface Water Hydrology. The impact analysis considers that area drained by the major surface drainages and their tributaries that cross the proposed Smoky Hollow life-of-mine area, including Weese's Canyon, Smoky Hollow Canyon, and Squaw Canyon. The impact analysis for the construction of the proposed Warm Creek/Benchtop Road includes those drainages that are potentially affected by disturbance activities including Warm Creek Canyon, John Henry Canyon, Tibbet Canyon, and Wahweap Creek. The impact analysis also considers the potential surface water impacts to the drainages that cross or are immediately adjacent to the proposed loadout locations. At the proposed Iron Springs loadout, the potential impacts to Iron Springs Creek are considered, and at the proposed Moapa loadout, the potential impacts to California Wash are considered.

Groundwater Hydrology. The impact analysis in the Smoky Mountain area concentrated on the strata in the Straight Cliffs and Navajo Sandstone Formations. Geographically, the area of analysis ranged from Escalante Bench on the south to Nipple Bench on the north and from Wahweap Creek on the west to Rees Canyon on the east. The impact analysis in the Iron Springs and Moapa areas included the potential aquifers that underlie the proposed loadout locations.

Wildlife. The wildlife study areas relevant to the proposed Project components allowed for an adequate buffer area surrounding each component. These buffer areas were typically resource dependent and were intended to reflect the limits that wildlife resources may be influenced by proposed Project development.

Socioeconomics. The geographic extent of the socioeconomic study area for the proposed Warm Springs Project encompasses six counties in three States: Kane, Washington, and Iron Counties in Utah; Clark County in Nevada; and Coconino and Mohave Counties in Arizona. However, Mohave County, Arizona, one of the six counties, is not being considered for location of any of the proposed facilities and would only be affected by traffic on highways through a sparsely populated area and, thus, is not addressed further. Incorporated municipalities of primary interest in the study area include Fredonia and Page, Arizona; Moapa and Glendale, Nevada; and the communities of Big Water, Cedar City, Hurricane, Kanab, La Verkin, St. George, and Toquerville, Utah. Although indirect and induced impacts would be expected to occur outside the study area, their geographic dispersion and magnitude relative to the underlying baseline environmental conditions allow them to be excluded from further analysis.

Visual Resources. A limit of 15 miles was established as the outside limit of potential visual impact for all proposed project facilities except the 138-kV power transmission line; a limit of 5 miles was established as be the outside limit of potential adverse visual impact for the proposed 138-kV power transmission line.

Cultural Resources. The geographical area of study for solicitation of Native American concerns relative to culturally or religiously sensitive localities was expanded to include all tribes in the greater southern Utah, northern Arizona, and southeastern Nevada region because of the fluidity of cultural boundaries over time, particularly during the historic period.

Additional assumptions for specific resource analysis include:

Transportation. The transportation analysis assumes that all loaded coal trucks (100%) would go to one of the proposed unit-train loadouts; either the Iron Springs loadout or the Moapa loadout. All coal trucks would go to the proposed truck maintenance facility location, which hypothetically would be located in either Fredonia or Hurricane.

- Coal haul trucks would operate continuously over 24-hour periods. Mine employees, loadout employees, and truck maintenance employees would be on shift operations of three shifts per day. Andalex would not sponsor employee transportation; the mine employees, loadout employees, and truck maintenance facility employees would provide their own transportation. The vehicle occupancy for employee traffic would average 1.3 employees per vehicle.

- The existing haul route roadway lineage, intersection geometry, and traffic control, plus any improvements currently under construction or immediately planned, would remain in place throughout the life-of-mine. Current accident rates per vehicle mile traveled would continue throughout the life-of-mine. Routine maintenance and reconstruction of area roads would occur on a regular basis.

Socioeconomics. The socioeconomic analysis assumes that either the hypothetical Fredonia truck maintenance facility or the hypothetical Hurricane truck maintenance facility would be built, but not both, (i.e., all of the impacts related to a truck maintenance facility would occur because of development at one site).

- Baseline economic and demographic projections for Utah counties have been assembled by the State of Utah (Utah GOPB 1993). The current analysis contains no assessment or evaluation of the economic or demographic assumptions underlying those projections.

- Projected population and employment effects of the proposed Project are characterized at two points in time: the point at which maximum employment occurs during premining development and the point at which mining production levels and operations employment stabilize for the life-of-mine.

- Local residents would be hired for 21 percent of the new jobs generated directly and indirectly by the Warm Springs Project. This may be a conservative (low) employment figure.

- The number of secondary jobs created within the study area for each direct Project-related job is represented by an average employment multiplier of 0.84. This means that 84 new jobs would be created in the secondary job market for every 100 new direct Project-related jobs. Additional jobs would be created outside the study area, but the economic impact on other economies would be so widely dispersed that the effects would be negligible compared to existing and projected conditions.

- The average population-to-employment ratio for in-migrating workers would be 2.56. This means that the total population would increase by 2.56 people for every worker who newly establishes residency in the study area to take a direct or secondary job associated with the proposed Project.

- The residency distribution of in-migrating workers reflects detailed assumptions made for each proposed Project facility. Impacts on a particular community may reflect the combined effect of in-migration due to more than one proposed Project facility.

- The fiscal and public facilities and services analysis addresses the local governments and communities identified as being the most vulnerable to impacts from the proposed Project. Therefore, the local governments and communities discussed may differ from impact topic to impact topic.

- Intergovernmental revenue sharing mechanisms would remain unchanged over the life of the mine. A key example is apportionment of truck registration fees and motor fuel taxes among the States in which Project coal haul trucks would operate.

- The contract sales price of coal produced by the Project would average $19.50 per ton (1994 dollars) for the life-of-mine.

Air Quality. Assumptions used in the air modeling analysis were conservative. For the haul truck analysis, TSP emission rates derived from AP-42 formulas were doubled. TSP emissions included engine exhaust emissions. For the two-lane roads, emissions from 350 trucks per day were modeled, inasmuch as 175 trucks would be loaded per 24-hour day. For the four-lane road, 175 trucks on each side of the median were modeled. Forty-nine days of worst-case meteorological data were used for the haul truck modeling study. Seventy-two days of worst-case meteorological data were utilized for input to the surface facility/mine models. Emissions estimates were derived from EPA-approved standard emission factors.

- The analysis includes impacts of Project activities at the surface facilities complex and loadouts that require permits from the governing State agency, as well as an assessment of impacts on public areas due to coal truck traffic on haul routes. The responsible State agency has reviewed and accepted the modeling impact analyses submitted with the air permit applications for the facility.

Visual Resources. The visual resource analysis assumes that the 138-kV power transmission line construction would not involve physical disturbance to cliff/escarpment faces; construction would be accomplished by driving around these prominent and visually sensitive features.

- To provide a standardized basis for the visual assessment, the BLM Visual Contrast Rating process was utilized. On public lands with natural dominated landscapes that had not been inventoried by BLM for visual resources, an interim VRM Class designation was assigned for study purposes. At the two privately owned hypothetical truck maintenance facility locations, visual impacts were assessed on the basis of compatibility with the character and condition of the existing landscape.

Wilderness. Wilderness characteristics in the Smoky Mountain area have been extensively inventoried and evaluated by BLM and others (e.g., Utah Wilderness Coalition). This EIS does not recreate the work already completed and published concerning wilderness in the proposed Warm Springs Project area, which includes BLM Utah Final Initial Wilderness Inventory, 1979; Utah BLM Statewide Wilderness Final Environmental Impact Statement, 1990; and Utah Wilderness Coalition's Wilderness at the Edge, 1990. This EIS does not resolve the differences between various wilderness recommendations, including the differences between BLM's recommendations, HR Bill 1500, and others.

4.1.2 Assumptions for the Disapproval Alternative

The assumptions used by the Agencies to perform the impact analysis for the disapproval alternative include:

- The Warm Springs Project would be placed on indefinite hold, and the permit application packages for the Smoky Hollow Mine and all right-of-way applications would be withdrawn.

- Existing resources in the proximity of the Project would not be disrupted by any activity related to coal mining. They would, however, be subject to the continuing human and natural processes, including those uses and management activities currently being applied. To accurately evaluate the impacts of disapproving proposed mining-related activity on these resources, analysis of impacts under this alternative examine, to the extent possible, the effects of current management and natural processes on existing resources through the year 2052, the year assumed for final bond release (1998 plus 54 years).

- The life-of-mine area and ancillary facility sites would be managed for grazing, wildlife habitat, and recreation:

  - Livestock stocking rates and management practices would continue at current, premining levels.

  - Wildlife management and recreation opportunity would correspond to current agency management plans for the area.

- The area surrounding the Project would be maintained in its current or proposed use:

  - No new coal mines would be developed.

  - State, county, and county-maintained roads would be subject to existing maintenance schedules and current use levels.

4.2 IMPACTS OF APPROVAL UNDER ALTERNATIVE 1

4.2.1 Geology and Topography

4.2.1.1 Impacts to Topography in and Around the Smoky Mountain Area with Mining-Related Subsidence

The effects of subsidence from proposed longwall mining can be described by three impact zones (Appendix C, Figure C-3): the fragmented zone, the fractured zone, and the deformation zone. The fragmented zone, which would fracture and collapse, would begin immediately above the active mined-out area and may extend up to as much as 90 to 120 feet in the overburden above the coal extraction area. The next zone, the fractured zone, may extend 450 to 600 feet above the extraction area, where rocks of the overburden in this zone would fracture and deform. The deformation zone would extend upward from the fracture zone to the surface. In the deformation zone, it is expected that the rocks would deform without major fracturing, but some cracking may develop at the surface. Most of the cracks and all other surface subsidence effects are expected to weather and close during the first few months following subsidence.

The surface effects of subsidence depend on characteristics of the overburden, depth of mining below the surface, height of the coal removed, mine layout, and mining direction. For the proposed Project, the average overburden depth would be 650 feet (Andalex Resources, Inc. 1994a); the average mining height would be 9 feet (varying from 5 to 12 feet depending on seam thickness); the subsidence factor would be 65 percent; and the angle of draw would be about 30 degrees. (Appendix C provides a discussion of these subsidence parameters.) The estimated angle of draw is based on experience with similar rocks (Upper Cretaceous) in other mining areas in Utah. The maximum average subsidence that could be expected to occur is nearly 6 feet (65 percent of 9 feet). This may vary from 4 to 8 feet, depending upon the mining height in any particular area. The subsidence in any particular trough (the surface expression of subsidence above the mined-out area) would be deepest above mined out areas, graduating to little or no subsidence about 375 feet beyond the maximum extent of coal extraction (based on the angle of draw, as discussed in Appendix C). The bulking factor (the property of fractured rocks to increase in overall bulk volume, as described in Appendix C) may result in subsidence that would be less than what might be predicted from the mining height and subsidence factor relationship.

Mining-related subsidence has the greatest potential to alter drainage patterns and impact slope stability where steep slopes, weathered materials, and unstable ground conditions exist within the subsidence trough. The lowering of the ground surface, sloughing of slopes, and related filling of drainages and alteration of drainage patterns would be most evident around the bases of canyons. Sloughing of slopes related to subsidence, and resulting changes, would be an acceleration of natural erosional processes that act on the topography above the coal removal area. Erosion and weathering would continue to occur at natural rates in all areas beyond the limits of subsidence activity.

Slope instability and failure, rock toppling, and alteration of topography and drainage patterns have the greatest potential to occur where thinner overburden, steep slopes, weathered materials, and unstable structural conditions exist over the subsidence trough. The overburden over the proposed mining panels ranges from 100 feet in the southern parts of the life-of-mine area to over 800 feet on Smoky Mountain and as much as 1,790 feet under Ship Mountain Point (Appendix A, Figure A-4). Thicker overburden would lessen the surface effects of subsidence because those surface effects would be dominated by the characteristics of the deformation zone. The effects of subsidence in these areas of thick overburden are expected to be characterized by gentle troughs with cracks and slumps above the limit of the mined-out coal. In areas where the overburden is not as thick, the deformation zone would be smaller and the surface effects would be dominated by characteristics of fragmented or fractured zones.

The effects of subsidence would predominantly occur over the short term because the failure of rock above a mined-out panel would occur immediately after support is removed. These effects would be expected to occur for 2 to 5 years after the specific coal panel has been mined. Subsidence would occur in the southern and eastern sections of the life-of-mine area for the first years of the mine life. Subsequent subsidence would occur in the western and northern parts of the mine (Appendix A, Figure A-4). After mining activity ceased in a particular area, limited subsidence activity would continue for several more years as the barrier pillars between panels eventually are crushed by the weight of the overburden. Most subsidence-related activity would be complete within 5 to 10 years in a particular area after mining had ceased. Subsidence effects may continue for many years beyond the end of the mine life in some areas. The surface effects of barrier pillar failure are expected to be less than those effects that would be expected over mined-out voids.

Andalex would conduct monitoring of the subsidence at the surface (Appendix A, Section A.3.5.6.4, Subsidence). Photogrammetric measurements over mined-out areas would allow for calculation of site-specific subsidence parameters (angle of draw, subsidence factor, extent of subsidence). Knowledge of site-specific parameters and visual monitoring for cracks and other surface effects would enable the mine operators to close off areas to access and ensure the safety of the public until the cracks or other effects are repaired or close naturally.

Following mine closure, subsidence would continue for several years in some areas until the mined area stabilized, after which, subsidence should cease. Subsidence monitoring would continue for a minimum of 10 years during this period. Topographic, hydrologic, and erosional changes due to subsidence would be permanent and would continue after mine closure.

The Agencies conclude that impacts to topography in and around the life-of-mine area with mining-related subsidence would be minor to moderate over the short term and negligible to minor over the long term. The impacts on topography would be irreversible.

4.2.1.2 Impacts to Mineral Resources in and Around the Smoky Mountain Area with Project-Related Activities

Because of coal seam thickness and extensiveness in the Smoky Mountain area, longwall mining would be the most efficient and technologically advanced method of coal extraction for this project. However, because of height, quality, and environmental limitations (Appendix C), some coal within the area would not be removed. This coal would be lost as a resource, given present technology, because the coal not minable through longwall mining would not be recoverable. Longwall mining cannot recover coal that remains in a seam that is thicker than the longwall mining height (12 feet). Also, coal that is less than 5 feet thick cannot be mined. Coal that is reduced in quality because of rock content or other factors that prevent it from meeting contract specifications would not be mined. Coal in barrier pillars, underlying other mined seams, or with shallow overburden under drainages would also not be recovered. It is estimated that within the life-of-mine-area, 200 to 300 million tons of the coal resource would not be recoverable. Other coal reserves located outside the life-of-mine area would remain available for future recovery.

The extraction of coal and subsequent subsidence may interfere with the potential development of oil and natural gas. Oil and gas exploration would be precluded during coal mining operations and access could be limited over subsidence areas until activity ceases. Current oil and gas leases are present within the life-of-mine area; however, there are no active oil- and gas-producing fields in the nearby vicinity, and there are no current applications for drilling permits in the life-of-mine area.

If, during the operation of the mine, an applicant wishes to drill an oil or gas well in the proposed mining area, the applicant would be required to comply with BLM policy concerning issuance of new oil and gas permits on coal lands. New oil and gas leases on coal lands would be issued with no surface occupancy (NSO) or controlled surface use (CSU) stipulations, which would restrict access and modify oil and gas well production facility design until coal operations had been completed (BLM 1994).

The presence of the Warm Springs/Benchtop Road and the 138-kV power transmission line could enhance the potential for further development of coal, oil and gas, and other mineral resources. Improved access and the availability of electricity in the area could facilitate exploration in the Smoky Mountain area and possible development of resources. This enhancement would not apply to areas beyond the Smoky Mountain area.

The proposed Project could create a demand for the gravel resources identified at Wahweap Creek, the nearest source of gravel. Gravel would mainly be used in road construction. It is not anticipated that the proposed Project would require a large amount of local sources of gravel, inasmuch as most material is expected to be obtained from within the Warm Creek/Benchtop Road ROW.

The Agencies conclude that impacts to mineral resources in and around the Smoky Mountain area with Project-related activities would be minor over the short term and negligible to minor over the long term. Removal of coal would be an irretrievable commitment of the resource.

4.2.1.3 Impacts to Topography Along the Warm Creek/Benchtop Road with Construction and Reclamation Activities

The proposed construction of the Benchtop Road or the reconstruction and realignment of the Warm Creek Road would introduce permanent changes in topography along segments of the proposed route. The effects would be most noticeable in those parts of the road in the Nipple Creek, John Henry, Warm Creek, and Smoky Hollow Canyons. Construction of bridges, relocation of the road up out of the streambed, placement of riprap, installation of culverts, blasting to facilitate removal of solid rock, and numerous cuts and fills would be necessary to meet the design criteria. In areas of steep canyon topography, the cuts would be more noticeable than on flatter terrain. Impacts on flatter terrain, particularly on Nipple and Tibbett Benches and along the Warm Creek Road from Big Water to Warm Creek would be limited to a raised roadbed and small cuts and fills.

The proposed construction of the Warm Creek/Benchtop Road would increase access into the area and may increase off-road-vehicle (ORV) impacts to the terrain. After construction, disturbed areas outside the maintained segment of the road would be regraded, revegetated, and blended into the surrounding topography, except in areas of talus or rock outcrops. Also, excess cut-and-fill material would be removed from the right-of-way as much as possible.

Kane County's plans to provide long-term public access to Smoky Mountain suggests that changes to topography along the proposed Warm Creek/Benchtop Road would be permanent and remain in place following mine closure. Access into the area provided by the proposed Warm Creek/Benchtop Road could increase ORV use in the area and the potential for increased disturbance in the future.

The Agencies conclude that impacts to topography along the Warm Creek/Benchtop Road with construction and reclamation activities would range from minor to moderate over both the short and long terms.

4.2.2 Paleontology

4.2.2.1 Impacts to Paleontological Resources in the Smoky Mountain Area with Mining-Related Activities

Construction of Project components and mining-related activities have the potential to cause the loss of paleontological resources. Excavation and construction related to Project components would occur on or disturb geologic formations that may contain fossil resources. If sensitive or important resources, particularly previously unidentified fossil deposits, are disturbed as a result of mining-related activities, the scientific value of those resources could be lost. Construction of the proposed Warm Creek/Benchtop Road would allow greater access to areas that are relatively inaccessible at present. Increased access and the resulting increase in people, including mine workers, in the area could result in ORV damage, vandalism, and unauthorized collecting of important fossils. Fossil collection by amateurs could result in the loss of valuable scientific information. Paleontological deposits potentially located under the proposed Warm Creek/Benchtop Road would be made permanently inaccessible by construction of the road.

Construction of Project facilities and operation of the mine may result in the discovery of fossil resources not known at present. Excavation for the construction of the surface facilities complex and other components of the proposed Project might uncover important fossils that are not readily apparent because of their placement under surficial deposits. Because of their previously unidentified nature, however, these resources could also be damaged by mining-related activities.

Coal extraction may result in the discovery of fossils associated with the Cretaceous environment during which the coal was deposited. Other Cretaceous coal-bearing strata in Utah, similar to that located at the proposed Smoky Hollow Mine, have yielded dinosaur tracks and bones (Lockley and Jennings 1987). Such fossils would not be apparent until the coal is actually mined. Additional scientific study of paleontologic resources would help to more accurately define the area's potential for important fossil resources. The original position of the proposed Benchtop Road was also located near fossil localities, including one important pelecypod deposit identified during paleontological surveys along the route (Madsen 1994b, d). The road, as currently proposed, has been rerouted to avoid as many of these sensitive fossil localities as possible. The 138-kV power transmission line is located near the formation in which pelecypod deposits were found; however, the line would span the area but would not disturb the formation.

Although the Warm Creek Road crosses fossil-bearing formations considered to have important sensitivity, no fossils have been identified along the road or in areas of realignment (Madsen 1994c). The road is located near previously identified fossil localities, but proposed construction activities would not interfere with these localities.

Monitoring during construction activities, agency notification of potential disturbance areas, and mitigation of paleontological resources would help prevent the loss of previously unidentified and scientifically valuable fossils during construction (Chapter 2, Section 2.1.1, Alternative 1: Approval of the Applicants' Proposals, with Conditions (the Preferred Alternative)). After cessation of mining, there would continue to be impacts to paleontological resources resulting from ORV traffic, vandalism, and natural erosional processes.

The Agencies conclude that impacts to paleontological resources in the Smoky Mountain area with mining-related activities would be minor over the short term and negligible over the long term, with the potential to become significant if important fossil deposits are discovered during Project construction and operation, or if vandalism, collection, or destruction of potentially important fossil deposits occur. Loss of paleontological resources would be irretrievable.

4.2.2.2 Impacts to Paleontological Resources in the Iron Springs and Moapa Areas with Mining-Related Activities

Construction of the proposed Iron Springs and Moapa unit-train loadouts may cause the loss of paleontological resources. The Iron Springs and Muddy Creek Formations have the potential to contain important fossils that are not readily observable now (Madsen 1994f; Reynolds and Scott 1992). Excavation and construction could cause impacts because of the potential loss of scientific data. If sensitive or important resources, particularly previously unidentified fossil deposits, are disturbed as a result of mining-related activities, the scientific value of those resources could be lost. The increase in people in the areas as a result of loadout operation activities could result in unauthorized important fossil collecting and vandalism. Fossil collection by amateurs could result in the loss of valuable scientific information. Once mining ceased, the loadout facilities would be dismantled, and no further mining-related effects would be expected to occur; however, ORV traffic, amateur collecting, vandalism, and natural erosional processes could continue to have impacts.

Construction of mine facilities and operation of the mine may result in the discovery of fossil resources not known at present. Excavation for the construction of loadout facilities may uncover important fossils that are not readily apparent because of their placement under surficial deposits. Because of their previously unidentified nature, however, these resources could also be damaged by mining-related activities.

No important fossils have been found at the Iron Springs loadout site (Madsen 1994e). Four fossil localities have been identified within the boundaries of the Moapa unit-train loadout site, some of which may be important since they contain vertebrate fossils (Reynolds and Scott 1992). Agency notification of potential disturbance areas and mitigation of important paleontological deposits would prevent the loss of scientifically important data. Construction activities would be monitored to ensure that important paleontologic localities are not disturbed and, where feasible, facilities within the site would be located to avoid disturbance of identified localities (Appendix A, Section A.3.5.5, Archaeological and Paleontological Conservation). If facilities cannot be located to avoid sensitive sites, appropriate mitigation measures would be taken to ensure that scientific data are not lost. Identified localities near the loadout facilities would be protected from vandalism and unauthorized collection while the facility is in operation.

The Agencies conclude that impacts to paleontological resources in the Iron Springs and Moapa areas with mining-related activities would be negligible over both the short and long terms, with the potential to become significant if important discoveries of previously unidentified fossil deposits are made during construction, or if unauthorized collecting or vandalism occurs. Any loss of paleontological resources would be irretrievable.

4.2.3 Hydrology

4.2.3.1 Impacts to Water Quality and Quantity in the Smoky Mountain Area with Mining-Related Construction, Operation, and Abandonment

Construction of the surface facilities complex and other operations within the life-of-mine area could impact surface water and groundwater quality and supplies by: altering surface drainages; increasing sediment loads in surface waters; and increasing the potential for the accidental release of hazardous materials, such as diesel fuel, into surface water and groundwater. Operation of mine facilities could divert surface flow through the surface facilities complex, lead to the potential formation of acidic mine drainage, allow infiltration of sewage into the groundwater from the septic system, and lead to the potential for fuel spills into surface water. Mine closure and reclamation could result in increased sediment loads to surface water in reclaimed areas prior to the reestablishment of vegetative cover. Construction of the proposed Warm

Creek/Benchtop Road could temporarily increase suspended solids in runoff in the vicinity of the route. Up to 180 acre-feet of water for road construction purposes would be obtained each year over a period of 1 to 2 years from the subsurface gravels (alluvium) of Wahweap Creek by pumping water from sumps excavated in the alluvium (Appendix A, Sections A.2.4.2, Warm Creek Road, and A.2.4.3, Benchtop Road).

During construction and reclamation of the surface facilities complex area, sediment control structures (straw bales and/or silt fences) would be placed in strategic areas, such as in drainage ditches and at the base of reclaimed slopes, to contain sediment materials. Topsoil storage piles would be seeded and bermed to reduce erosion during mine construction and operation.

Given the elevated amounts of total suspended solids already present in surface runoff in the area, particularly during flood events, construction activities are expected to have a minimal effect on sediment quantities in surface runoff. The surface drainages in the surface facilities complex area would be routed to divert natural drainage under the complex. Culverts would be installed underneath the facilities to divert drainage from Smoky Hollow, as well as side drainages. The culverts would be designed to accommodate a 100-year, 6-hour precipitation event. During mine closure reclamation, these culverts would be removed and the drainages regraded and restored. Internal drainage within the surface facilities complex area would be separate from the natural drainage system. (See Appendix A, Section A.3.4.3, Backfilling and Grading.)

Surface runoff within the surface facilities complex would be diverted and routed to a sedimentation pond (Appendix A). Water that collects in the impoundment would be released after suspended material had settled. Controlled release of impoundment water would be permitted and conducted in accordance with applicable Federal and State regulations governing the surface discharge of water.

Fuel storage and handling during mine operation would be conducted according to the Spill Prevention Control and Countermeasure (SPCC) Plan for the mine. The SPCC Plan provides for secondary containment for the aboveground fuel storage tanks and proper handling of smaller storage containers. Underground storage tanks would not be used to store fuel. The onsite sedimentation pond would also help prevent the accidental discharge of spilled hazardous materials (such as fuel) into the surface drainages.

Septic systems would be designed, installed, and operated according to applicable rules and regulations. Septic systems are not expected to have an impact on groundwater, owing to the lack of groundwater in the alluvium underlying the surface facilities.

Increased acidity of surface and groundwater as a result of acid mine drainage and acidic leachate from the coal stockpile is not expected to be a problem because of the coal's low sulfur content, the region's low precipitation levels, the carbonate content of the coal and overburden, and the limited availability of groundwater in the strata that would be affected by mining (Andalex Resources, Inc. 1994a).

Following mine closure, all structures at the surface facilities complex would be removed, drainages would be returned to their natural channels, and reclamation would be completed. Kane County would retain the Warm Creek/Benchtop Road as permanent access into the Smoky Mountain area. Surface and groundwater quality and quantities are expected to return to premining conditions.

Construction of the paved Warm Creek/Benchtop Road would reduce erosion in the Warm Creek drainage and consequently reduce the amount of sediment available for erosion. The use of silt fences and placement of riprap would minimize the amount of sediment eroded into surface water. Reclamation and revegetation after construction would also minimize erosion (Appendix A, Section A.2.4.2, Warm Creek Road). Given the elevated amounts of total suspended solids already present in surface runoff in the area, construction activities are expected to have a minimal effect on sediment quantities in surface runoff. The use of water from Wahweap Creek would require the regular withdrawal of small quantities during the 1 to 2 years of road construction but should not create any shortages of water in this perennial stream. All applicable water rights and permits have been obtained.

The Agencies conclude that impacts to water quality and quantity in the Smoky Mountain area with mining-related construction, operation, and abandonment would be minor over both the short and long terms.

4.2.3.2 Impacts to Water Quality and Quantity in and Around the Warm Creek Drainage System

Subsidence resulting from coal mining has the potential to alter the flow of groundwater, disrupt the flow of seeps and springs in the life-of-mine area, and change the pattern of surface runoff, which could, in turn, affect the infiltration of water into the ground (Price et al. 1987). Temporary seeps or springs could be created until subsidence cracks heal. Subsidence also has the potential to affect the quality of water by diverting subsurface flow and allowing groundwater to come into contact with strata, such as Tropic Shale, which could leach constituents and cause an increase in TDS and acidity (Dunrud 1984). Permeability increases may be experienced as tensional stresses open cracks and fractures and accentuate the flow of water. Once subsidence cracks have weathered over, this effect should be minimal and would be of relatively short duration. Some changes in recharge and flow characteristics would be permanent. Because subsidence has the potential to alter surface drainage patterns, it could indirectly increase erosion in canyon walls. The effects of subsidence would generally be limited to strata above mined-out areas. Subsidence resulting from mining has the potential to disrupt perched groundwater that may be present in the strata above the coal.

Perched groundwater present in the life-of-mine area has generally not been found in large enough quantities to be usable for drinking water or livestock watering (Andalex Resources, Inc. 1994d, 1995). Of the nine seeps located within the life-of-mine area, Seeps S-1 through S-8 are fed by the Drip Tank Member, whereas the Upper Wesses Seep is fed by the Wahweap Formation. Only four of these seeps have been observed to be potential sources for wildlife use (Andalex Resources, Inc. 1994d, 1995). Given the limited flow, the seeps do not appear to be very usable as sources of water and do not appear to contribute measurably to regional tributary flows. The only spring located within the life-of-mine area, Wesses Spring, is also fed by the Drip Tank Member and has been identified as a source of water for both livestock and wildlife (Andalex Resources, Inc. 1994d).

Mining-related subsidence has the potential to disrupt the rock continuity and divert the water flow associated with Wesses Spring and the nine seeps. Tensional stresses could open cracks and fractures that would affect the flow of water. However, the discharge from these water sources is low, and, if they were to be disrupted of diverted, the effects would be limited to the immediate area adjacent to the source. The depth of overburden in the areas where the seeps and spring are located is such that the subsidence effects should be minimal. Following the initial deformation of subsidence, ultimate settlement would tend to compress tensile fracture widths to some extent, and partial recovery of premining conditions could be anticipated.

The Drip Tank and Needle Eye Water Springs are located outside the proposed life-of-mine area on the eastern flank of the Smoky Mountain Anticline. Although the Drip Tank Spring is also fed by the Drip Tank Member, it lies more than a mile to the north of the proposed subsidence area and is on the opposite flank of the anticline from the nearest subsidence activity. It should not be affected by mining operations. The Needle Eye Water Spring, however, lies less than a quarter of a mile east of the proposed subsidence area and is fed by parts of the Drip Tank strata and the drainage basin that could potentially be affected by subsidence. As with Wesses Spring, above, tensional stresses could open cracks and fractures that would affect the flow of water at this spring. However, the depth of overburden in the area should ensure that subsidence effects would be minimal.

The 14 North and 14 South Springs and the Tibbet Canyon Sandstone Seep, which are sourced by the Tibbet Canyon Member, are located stratigraphically below the coal seams to be mined. They lie outside the subsidence area; therefore, no effects from subsidence on these sources of water are expected to occur. The Section 10 Seep that emanates from the John Henry Member is not expected to be affected by proposed mining activities, as it lies south of John Henry Canyon and is therefore hydrologically separate from the John Henry Member strata that could be affected by mining.

Five other springs and seeps of interest have been identified in the Smoky Mountain area outside the proposed life-of-mine area. Most lie on the southwestern flank of the Smoky Mountain Anticline, are hydrologically isolated from the proposed subsidence area by topography and intervening drainages, and would not be affected by mining-related subsidence activity (Chapter 3, Figure 3-6).

Although the springs and seeps located above or near the subsidence area are not believed to be at substantial risk, they would be monitored to determine what, if any, effects occur as a result of mining and subsidence. Alternate water sources would be provided for wildlife if mining activities result in the disruption of any water sources used by wildlife (Appendix A, Section A.3.5.3, Wildlife Enhancement).

Subsidence would continue to affect the life-of-mine area for several years after the cessation of mining. After the support pillar areas have subsided, subsidence effects on surface and groundwater would be reduced. If subsidence has caused any change in surface drainage patterns, these patterns may remain. The topography of the area may be permanently changed by subsidence. Over time, settling would compress fracture widths, and partial recovery of premining hydrologic conditions would be anticipated.

The Agencies conclude that impacts to water quality and quantity in and around the Warm Creek drainage system with mining-related subsidence would be minor over both the short and long terms.

4.2.3.3 Impacts to the Navajo Aquifer in the Smoky Mountain Area with Mining-Related Activities

The Navajo Aquifer would be tapped as a water source for the proposed mine, with the well expected to provide 550 acre-feet per year during the life of the mine. Use of the water supply well would reduce the amount of water available in the aquifer and would cause a lowering of the potentiometric surface of the aquifer in the vicinity of the well. This lowering of the potentiometric surface would be at a maximum at the well and would decrease away from the well in a radial zone of drawdown until, at some distance from the well (about 8 miles), there would be no effect (Appendix E, Section E.2, Hydrology Drawdown Calculations).

The amount of recoverable water in the Navajo Aquifer in the area is estimated at 140 million acre-feet, with annual discharge from wells south and west of the Kaiparowits Plateau at 1,500 to 1,700 acre-feet (Blanchard 1986). Given that the nearest water supply wells in the Navajo Aquifer are 12 to 15 miles from the proposed surface facilities complex, the proposed withdrawal of water from the aquifer should have minimal effect on these wells or on the total amount of recoverable water in the Navajo Aquifier. Since the Navajo Sandstone, in which the aquifer is found, does not crop out within 8 miles of the proposed surface facilities complex, the well should have little effect on natural discharge (seeps and springs) from the aquifer. None of the surrounding surface drainages are sourced by the aquifer. Andalex has received all necessary water rights and permits for construction and use of the well. The Navajo Aquifer lies at least 2,000 feet below the coal to be mined. Because of the depth to the aquifer, extraction of coal and related surface operations should not have a direct effect on water quality in the aquifer. Following mine closure, use of the well would cease, and potentiometric surface levels and water quantities available for use in the area should gradually return to premining levels.

The Agencies conclude that impacts to the Navajo Aquifer in the Smoky Mountain area with mining-related activities would be minor over both the short and long terms.

4.2.3.4 Impacts to Water Quality and Quantity in and Around the Iron Springs and Moapa Areas with Mining-Related Activities

The proposed unit-train loadouts in Iron Springs and Moapa would obtain water from public offsite sources and would haul water into the sites (Appendix A, Section A.2.5.2, Loadout Facilities). Construction activities at the unit-train loadouts could alter drainage flow, increase sediment loads in surface waters, and increase the potential for fuel spills. Operation of mine facilities could divert surface flow through the unit-train loadout facilities, lead to the potential formation of acidic drainage from the coal stockpiles, allow infiltration of sewage into the groundwater from the septic tank system, and lead to the potential for fuel spills into surface water. Mine closure and reclamation could result in increased sediment loads to surface water in reclaimed areas prior to the reestablishment of vegetative cover.

During construction and reclamation of the unit-train loadout facilities, sediment control structures (straw bales and/or silt fences) would be placed in strategic areas, such as in drainage ditches and at the base of reclaimed slopes, to contain sediment materials. All runoff onsite would be diverted into sedimentation ponds to prevent sediment and coal fines from entering the watershed during operation of the loadouts. Topsoil storage piles would be seeded and bermed to reduce erosion during mine construction and operation (Appendix A, Section A.2.1.2.3, Ancillary Facilities).

The low sulfur content of the coal and its low acid-generating potential reduces the possibility of acidic drainage from the coal storage pile that could potentially impact surface water or groundwater quality. Fuel would be stored in aboveground tanks with secondary containment to prevent spilled fuel from entering the watershed. Septic systems would be designed, installed, and operated according to applicable regulations. Following completion of mining operations, all structures at the unit-train loadouts would be removed, and the areas would be reclaimed. (See Appendix A, Section A.3.4, Reclamation Activities, for a complete discussion on loadout closure.) Surface flow is expected to return to premining conditions.

The Agencies conclude that impacts to water quality and quantity in and around the Moapa and Iron Springs areas with mining-related activities would be negligible to minor over both the short and long terms.

4.2.4 Soils

4.2.4.1 Impacts to Soil Productivity in the Warm Springs Project Area with Mining-Related Surface Disturbance

Development activities associated with the Warm Springs Project would result in the disturbance and alteration of in-place, previously undisturbed, native soils from clearing and construction activities; excavating, salvaging, and storing growth medium; cut and fill/grading preceding construction of roads; development of storage areas and facilities; and initiation of exploration drilling programs.

Surface disturbances related to construction, operation, and reclamation have the potential to affect the productivity of soils throughout the project area. Soil structure, including the character and texture of the soil, would be permanently altered as a result of soil salvage, stockpiling, and redistribution activities. Soil textures and organic matter and chemical concentrations in soils would be altered during soil salvage operations and reclamation by the mixing of surface and subsurface soil layers. Soil development, including soil structure and profile development, would be temporarily impeded during construction and operation.

Stockpiling of soil materials would temporarily reduce soil micro-organism populations, soil fertility, seed viability, nutrient levels, and soil development. Soil biological activity could be substantially reduced or eliminated during stockpiling as a result of anaerobic conditions created in deeper parts of the stockpiles depending upon the length of time that the soil is stockpiled. After soil redistribution, biological activity would slowly increase and eventually reach presalvage levels.

Wind and water erosion of exposed and disturbed soils may be accelerated during construction and operation activities and would continue into reclamation until vegetation became reestablished. Excavation, transportation, and placement of growth medium could also promote the breakdown of soil aggregates into loose soil particles and increase the potential for wind and water erosion on topsoil stockpiles. Blading and/or excavation of remaining subsoil materials to achieve desired grades and soil conditions for the surface facilities complex area could result in steeper slopes on some exposed soils, mixing of soil materials, and the additional breakdown of subsoil aggregates. Soil compaction may result from vehicle and equipment traffic during construction, operation, and reclamation.

Construction of the proposed Warm Creek/Benchtop Road would also create improved access into the area and, as a result, recreational off-road vehicle (ORV) travel could increase in the area. ORV traffic would result in additional erosion and compaction of soils, leading to losses in soil productivity. Recovery of soil productivity along power transmission line access roads may be hindered, depending on the frequency of use for maintenance or upgrade of the powerline during the period of time the powerline is in use. Also, recovery may be impaired by the unauthorized use of the access roads for recreation.

Erosion control and reclamation of disturbed areas would occur throughout the Project area (Appendix A, Section A.3.4, Reclamation Activities). Reclamation would include those areas previously disturbed by past road building and facility construction, as well as areas of new disturbance. Currently unreclaimed soils disturbed during past mining operations in the surface facilities complex area would be reclaimed (Appendix B, Section B.2.12, Missing Canyon Coal Mine).

Erosion problems currently associated with segments of the existing Warm Creek Road underlain by Tropic Shale should be alleviated by the construction of a permanent road. The installation of culverts to direct runoff and the cutting back of slopes to lessen gradients to slow runoff would help reduce erosive effects of water in these areas. Reseeding of disturbed sites in these areas would also enhance erosion control.

At the onset of construction, topsoil at the sites would be salvaged and stockpiled. During construction, sediment impoundments and other erosion and sediment control measures, such as silt fences and straw bales, would be put in place to reduce soil erosion (Appendix A, Section A.2.1.2.4, Stormwater and Sediment Control Facilities). Work areas would be treated with dust suppressants to control wind erosion of disturbed soils (Appendix A, Section A.2.1.2.2, Coal Handling Facilities). At the completion of construction, areas disturbed but not utilized would be reclaimed. At the cessation of mining, all facilities would be removed except for the 12.5-kV power distribution line at the Iron Springs loadout, the Warm Creek/Benchtop Road, and the truck maintenance facility. In these areas some soil material could be permanently buried and removed from use.

Measures, such as seeding, to stabilize and protect growth-medium stockpiles, disturbed areas not in use, and embankments would be implemented to minimize soil loss and additional disturbance (Appendix A, Section A.3.4, Reclamation Activities). Tilling, proper seedbed preparation, erosion control, and revegetation should reduce the effects of stockpiling, and soil profiles would eventually redevelop in disturbed soils. However, the losses in soil productivity resulting from stockpiling cannot be entirely replaced, and these soils may have reduced productivity into the long term, until natural processes allow the soil to recover. Ripping or loosening of compacted soil would take place prior to placement of growth medium and seeding.

During reclamation, stockpiled topsoil would be spread onto all disturbed areas. It is expected that most of the soil for reclamation would be obtained from topsoil stockpiled at the beginning of mine facilities construction. In the surface facilities complex area, most of the soils present are suitable for reclamation, with the primary limitation being the abundance of gravel and rock fragments (Andalex Resources, Inc. 1994). Rock fragments may be beneficial, however, in holding soil for the use of plants. The soils rate either good to fair suitability for effective rooting of plants (Andalex Resources, Inc. 1994). If not enough reclaimable soil is available at the surface facilities complex area, then a topsoil borrow area on Smoky Mountain would be utilized (Appendix A, Section A.2.1.3.2, Topsoil Borrow Area). The borrow area, if excavated to a depth of 6 inches, would provide nearly 38,000 cubic yards of soil for use in reclamation at the surface facilities complex and still allow for reclamation at the borrow area.

Monitoring of topsoil stability and suitability in all mine component areas would be conducted throughout the life of the mine and, if needed, appropriate changes to reclamation would be made (Appendix A, Section A.3.5.6, Environmental Monitoring). Over the long term, ORV use, grazing, and natural erosional processes would continue to have impacts on soil productivity.

The Agencies conclude that impacts to soil productivity in the proposed Warm Springs Project area with mining-related surface disturbance would be minor to moderate over the short term and minor over the long term. The permanent loss of soil productivity underneath the running surface of the proposed Warm Creek/Benchtop Road and at the truck maintenance facility and the loss of soil development during stockpiling would be irretrievable.

4.2.4.2 Impacts to Soils in the Smoky Mountain Area with Mining-Related Subsidence

Subsurface stresses caused by subsidence may induce cracks, fissures, and bulges in surficial soil materials. The surface effects of subsidence could result in the disruption of soil horizons or layers. Where soil cover is thin over bedrock, subsidence effects may result in a temporary increase in erosion and the uprooting of plants. In thicker soils, the effects would not be as pronounced, as thicker unconsolidated materials would deform, rather than crack. Cracks and fissures created by subsidence could temporarily channel surface run-off and potentially increase erosion within the subsidence area. The effects of subsidence would occur during the period of active mining of any given longwall panel. Most subsidence effects would occur over a period of 2 to 3 years. Impacts are not expected to continue once subsidence in each particular area is complete.

The soils of the benchtops over the expected subsidence areas are generally deep to moderately deep and have slight water erosion hazard, moderate wind erosion hazard, and a low sediment yield. Formation of cracks or fissures in these soils not expected to constitute a serious loss of productivity. The surface cracks in unconsolidated soils would close over in a relatively short period of time. Monitoring of subsidence areas would be conducted and repairs would be initiated if necessary (Appendix A, Section A.3.5.6.4, Subsidence). Over the long term, after subsidence has ceased, ORV use, grazing, and natural erosional processes would continue to impact soil productivity.

The Agencies conclude that impacts to soils in the Smoky Mountain area with mining-related subsidence would be negligible to minor over the short term and negligible over the long term.

4.2.4.3 Impacts to Cryptogamic Soils in the Smoky Mountain Area with Mining-Related Activities

Cryptogamic soils, which comprise a minor component of the soils in the Smoky Mountain area, may be disturbed by mining activities. The erosion control and nitrogen-fixing aspects of cryptogamic soils would be lost for a number of years, inasmuch as reestablishment of cryptogamic soils is a slow process and would not occur for some time following reclamation. There is a potential that cryptogamic soils may not reestablish in the disturbed areas, owing to the difficulty these soils have in forming.

Only small areas of cryptogamic soils are present in the proposed disturbance area. Extensive areas have not been identified anywhere in the Smoky Mountain area.

After the cessation of mining activities, ORV use, grazing, and natural erosional processes would continue to impact cryptogamic soils in the area. Improved access into the area provided by the Warm Creek/Benchtop Road and increases in regional population could increase the number of ORV users in the area and could lead to increased disturbance of cryptogamic soils.

The Agencies conclude that impacts to cryptogamic soils in the Smoky Mountain area with mining-related activities would be minor over both the short and long terms.

4.2.5 Vegetation

4.2.5.1 Impacts to Vegetative Productivity and Community Stability in the Warm Springs Project Area with Mining-Related Activities

Impacts to vegetative productivity, vegetative cover, species diversity, and forage availability would result from disturbance of vegetation during construction and operation activities. Impacts would also result from increased ORV use and plant collecting activities that may occur as a result of the increased access into the area provided by construction of the proposed Warm Creek/Benchtop Road. Native vegetation would be permanently removed beneath the running surface of the proposed Warm Creek/Benchtop Road and the buildings and work areas at the truck maintenance facility. Weedy species may invade disturbed areas and replace native species, temporarily causing localized plant community instability. Plant community stability is related to species diversity present within a plant community and to the native species composition within that plant community.

Vegetative productivity (i.e., forage production) would decrease during the construction phases of the proposed Project, owing to the disturbance and loss of vegetation. Construction and topsoil salvage operations could also alter existing soil profiles and composition and could change the floristic composition of existing plant communities. Most native vegetation is adapted to particular soil types and any alteration of the soil character may affect the type of vegetation that would reestablish on the disturbed soil. The low productive potential of some soils in the Project area, including soils found at the proposed Moapa unit-train loadout, along segments of the proposed Warm Creek/Benchtop Road, along segments of the proposed 138-kV power transmission line, and at the proposed surface facilities complex, could also limit reclamation success (Appendix E, Table E-1).

Construction activities, including sidecasting during road construction activities, road and bridge construction, leveling of soil for facilities foundations, and rail spur and power transmission line construction activities, would result in the disturbance of vegetation. Vegetation could be partially or fully buried by soil as a result of subsidence. Plant roots could also be disturbed.

ORV use of lands adjacent to the various project components (e.g., Warm Creek/Benchtop Road) would increase the potential for physical damage of vegetation, disturbance and compaction of soil, soil erosion, and soil sedimentation impacts to vegetation. In addition, the increase in accessibility to these areas could increase the probability that native plants, especially cacti, would be illegally removed from these areas. Plant roots may be exposed, owing to soil erosion, and vegetation may be partially covered or buried as a result of sedimentation effects.

Interim reclamation activities would be implemented immediately after the construction and development of each facility had been completed (Appendix A, Section A.3.4, Reclamation Activities). Revegetation activities would provide plant cover in a relatively short period of time and reduce the rate of soil erosion on previously disturbed land. The implementation of these reclamation measures would sustain the floral diversity in the proposed disturbance areas and would reduce the amount of soil erosion. Successful reclamation of the proposed disturbance areas would replace vegetation removed during construction activities and reduce erosion and sedimentation rates. Successful reclamation also would ensure that species diversity, vegetative cover, and vegetative productivity present in natural plant communities prior to construction would be present in the reclaimed plant communities.

Vegetative productivity would increase after the completion of construction and reclamation activities. Weedy species would predominate, produce the majority of forage, and provide the majority of plant cover during the first 1 to 2 years following initial reclamation. This forage could be considered less desirable for use by some wildlife species since the plant community would primarily consist of weedy species. Weeds would be controlled wherever they become a problem (Appendix A, Section A.3.5.1, Vegetation Enhancement).

Native species and weedy species should equally contribute to vegetative productivity and plant cover in the first 2 to 3 years after the completion of reclamation activities. Native species should predominate in the reclaimed plant communities and contribute the majority of forage to vegetative productivity and plant cover 4 to 5 years after the completion of reclamation activities. Plant community stability and species diversity would be low during the construction and initial reclamation phases because weedy species would predominate these areas. After these disturbed areas have been reclaimed and the native plant seedlings have become established, community stability and species diversity would increase.

Species used in the reclamation seed mixtures have been developed to be representative of the species composition currently present at the various sites (Appendix A, Section A.3.5.1, Vegetation Enhancement). Seeds used during reclamation would be collected and/or purchased in the local area to promote genetic uniformity and increase revegetation success. Reclamation areas would be prepared prior to seeding.

Subsidence impacts would be temporary and localized. Seeds present in the surface soil horizon would enhance the reestablishment of plants in areas disturbed by subsidence activities.

Mining-related traffic would be limited to areas previously designated for vehicle use. Undisturbed areas and reclaimed areas would be considered off-limits to avoid the degradation of existing vegetation and revegetated areas.

Previously disturbed land would be reclaimed and returned to production. Release of the final reclamation bond and liability for each Project component would not be approved by the applicable regulatory agency until reclamation had been deemed successful (Appendix A, Section A.3.4, Reclamation Activities). Revegetation success would be monitored on all disturbed areas associated with the Project and evaluated for cover, density, and productivity following seeding or planting. If monitoring indicated that further work was needed, corrective action would be taken. Revegetation test plots would also be used to determine the most effective reclamation procedure (Appendix A, Section A.3.5.6.2, Vegetation).

The Agencies conclude that impacts to vegetative productivity and community stability in the proposed Warm Springs Project area with mining-related activities would be minor over the short term and negligible to minor over the long term. The permanent loss of vegetation under the running surface of the proposed Warm Creek/Benchtop Road and at the hypothetical Fredonia/Hurricane truck maintenance facility and the temporary loss of vegetative productivity in areas disturbed during construction would constitute an irretrievable commitment of the resource.

4.2.5.2 Impacts to Wetland and Riparian Communities in the Smoky Mountain Area with Mining-Related Activities

Existing, low-value wetland and riparian communities in the Smoky Mountain area, predominantly nonnative tamarisks, would be impacted by Project-related construction activities. A total of 5.7 acres of riparian vegetation would be impacted by the proposed construction of the Benchtop Road. About 1 acre of riparian vegetation would be permanently removed by bridge, riprap barrier, and road construction activities at the proposed Benchtop Road crossing of Wahweap Creek. In addition, about 4.7 acres of riparian vegetation would be temporarily disturbed during Benchtop Road construction activities at Wahweap Creek (3.6 acres) and along Warm Creek in John Henry Canyon (1.1 acres).

A total of 6.7 acres of riparian vegetation would be impacted by the proposed reconstruction of the Warm Creek Road. About 0.5 acre of riparian vegetation would be permanently removed by construction activities at the proposed Warm Creek Road crossing of Wahweap Creek. In addition, about 6.2 acres of riparian vegetation would be temporarily disturbed during bridge and road construction activities in Warm Creek Canyon.

Infrequent flash-flooding may continue to periodically disrupt riparian communities and periods of drought may reduce seep and spring flows. Recreational use of the area would gradually increase in response to population increases in the area and may result in an increase in impacts from ORV use and riparian plant collecting.

Water from the Wahweap Creek would be used during the construction of the Warm Creek/Benchtop Road (a period of 1 to 2 years). This would not likely affect riparian and wetland vegetation, inasmuch as the amount of water used during construction would be minimal relative to the total amount of water available for use by the riparian vegetation.

The limited riparian communities located at nine seeps and one spring within the life-of-mine area may be temporarily lost as a result of mining-related subsidence. If the seeps and the spring are impacted, they would be replaced by developing other water sources (i.e., guzzlers) and the related riparian community in the vicinity. It is unlikely that the riparian communities at the other 11 seeps and springs outside the life-of-mine area would be impacted, as mining would not occur in the geologic formation that feeds the springs, and most springs are separated by canyons (Section 4.2.3.2, Impacts to Water Quality and Quantity In and Around the Warm Creek Drainage System with Mining-Related Subsidence).

Riparian areas and springs temporarily impacted by creek crossing construction would be reclaimed, and a program to monitor the seeps and springs in the Project area during mining construction, operation, and reclamation would be implemented (Appendix A, Sectin A.3.5.6.5, Hydrologic Monitoring). Reclamation of disturbed wetland and riparian communities would occur immediately after construction activities are completed. The seed mixture developed for reclamation of disturbed riparian areas includes a greater species diversity than that currently present in the riparian areas (Appendix A, Section A.3.5.1, Vegetation Enhancement). Successful reclamation of these areas should increase species and vegetative structural diversity (i.e., tree, shrub, and herbaceous layer) within the reclaimed areas.

After bridge and road construction activities have been completed for the Benchtop Road, reclamation activities would be completed for about 9.5 acres adjacent to the Wahweap Creek crossing and along those segments of Warm Creek affected by sidecasting operations. About 5.7 acres of the reclaimable floodplain area at the proposed Benchtop Road crossing of Wahweap Creek currently consist of barren, exposed floodplain. Successful reclamation of the 9.5-acre reclaimable floodplain area adjacent to Wahweap Creek and areas along the new stream channel areas of Warm Creek would replace and potentially exceed the 5.7 acres of riparian vegetation impacted during Benchtop Road construction and operation activities.

After construction activities have been completed for the Warm Creek Road, reclamation activities would be completed for about 11.8 acres adjacent to the Wahweap Creek crossing. Roughly 5.0 acres of the reclaimable floodplain area at the proposed Warm Creek Road crossing of Wahweap currently consists of barren, exposed floodplain and disturbed areas. Successful reclamation of the 11.8-acre reclaimable floodplain area adjacent to Wahweap Creek would replace and potentially exceed the 6.7 acres of riparian vegetation impacted during Warm Creek Road construction and operation activities.

The Agencies conclude that the impacts to wetland and riparian communities in the Smoky Mountain area with mining-related activities would be negligible to minor over the short term and negligible over the long term. The temporary loss of riparian productivity would be irretrievable.

4.2.5.3 Impacts to the Smoky Mountain Evening Primrose and Higgins Biscuitroot with Mining-Related Activities

The annual, herbaceous Smoky Mountain evening primrose is a Federal candidate, category 2, species. The proposed alignment for the Benchtop Road indicates that individuals of the Smoky Mountain evening primrose should not be directly impacted during construction, although records indicate that one population exists near the proposed crossing of John Henry Canyon (Holland 1994). A survey for Smoky Mountain evening primrose would be conducted in this area prior to construction to determine the presence or absence of individuals in the construction ROW and proposed sidecast areas. Adequate mitigation would be applied if necessary.

The perennial, herbaceous Higgins biscuitroot is also a Federal candidate, category 2, species. One historically documented population of Higgins biscuitroot could be affected by reconstruction activities associated with the Warm Creek Road (NPS 1991). A survey for Higgins biscuitroot would be conducted in potential habitat along the route alignment prior to construction to ascertain the presence or absence of individuals in the construction ROW. If individuals are located within the construction ROW, additional inventory, evaluation and mitigation measures would be identified by the Agencies (Appendix A, Section A.3.5.1, Vegetation Enhancement).

Regional increases in population, increased ORV use, and improved access created by the paved Warm Creek/Benchtop Road could lead to increased impacts to the Smoky Mountain evening primrose and Higgins biscuitroot through habitat disturbance and collecting.

The Agencies conclude that the impact to the Smoky Mountain evening primrose and Higgins biscuitroot with mining-related activities would be negligible to minor over both the short and long terms.

4.2.6 Wildlife

4.2.6.1 Impacts to Mule Deer Movement During Migrational Periods Along Interstate-15 and U.S. Highway 89 with Mining-Related Traffic

Deer are the primary big game animal affected by highway traffic within the United States. The availability of succulent green forage along open roadways and the crossing of highways during daily or seasonal movements contribute to deer mortalities along highways and roads, (USDOT 1975). Studies conducted on deer-vehicle collisions (USDOT 1975) suggest that patterns can be established in certain areas, such as seasonal increases in mortalities of adult males during the fall rut and increases in mortalities of adult females in the spring as they disperse from winter ranges (Jahn 1959). Daily patterns also become apparent, particularly during crepuscular (twilight and dawn) and nocturnal (nighttime) periods when deer are the most active (USDOT 1975). Important habitat factors include forage availability, cover proximity, topography, and weather (Dickerson 1939; USDOT 1975).

The incidence of deer mortalities along U.S. Hwy. 89 and Interstate-15 could increase with the addition of mining-related traffic, particularly during the migrational periods. Slight disruption of seasonal migratory routes could also occur.

The Paunsaugunt Mule Deer Herd crosses U.S. Hwy. 89 during its seasonal movements between summer range on the Paunsaugunt Plateau and winter range in the Buckskin Mountains. Migration between these two seasonal ranges is typically concentrated during April/May and October/November (Messmer 1994), with the migration route primarily crossing U.S. Hwy. 89 between Big Water and Kanab, Utah.

This section of highway has exhibited deer mortalities in recent years, particularly during the migrational periods. Records indicate that 39 deer were killed in this section between 1984 and 1987, 28 mortalities were recorded from 1989 to 1990, 32 mortalities between 1990 and 1991, and 18 mortalities from 1991 to 1992 (Lamb 1993). The majority of these mortalities occurred between mile posts 41 and 51 east of Kanab (Utah DWR 1992). Utah DWR, in cooperation with BLM, recently removed all the tree cover within the 400-foot highway ROW to improve visibility for both deer and motorists in an effort to reduce deer mortality in the area.

Other observers have recorded deer mortalities along U.S. Hwy. 89 between Kanab and Big Water, with 10 deer struck in 1991, 15 in 1992, and 32 in 1993 (Utah Highway Patrol 1994, unpublished data). Of the total reported deer/vehicle accidents, nearly 97 percent involved automobiles, while only 3 percent involved large trucks; trucks accounted for less than half of the reported strikes that would be expected on the basis of their proportionate traffic volume.

Traffic projections along this segment of highway indicate an increase in average daily traffic volume during Project construction and production when compared to estimated future traffic without the Project (Section 4.2.7, Transportation). Typical traffic levels on a two-lane road such as U.S. Hwy. 89 tend to be very light during the nighttime hours, a period when most deer movement occurs. Because coal hauling during full production would occur 24 hours per day, the percentage increase in truck traffic at night is expected to be even higher than the average daily traffic volume increases would indicate.

The segment of Interstate-15 between Utah Route 17 and exit 59 in Cedar City, which would serve the Iron Springs unit-train loadout, passes directly through designated mule deer critical winter habitat. Because of past deer mortality problems along Interstate-15 south of Ash Creek Reservoir, a segment of this highway has been fenced to restrict mule deer access to the roadway. North of the reservoir, the unfenced segment of the haul route to the proposed Iron Springs unit-train loadout has not exhibited this same problem with deer kills. Traffic projections for this segment of Interstate-15 indicate a small increase in average daily traffic volume during construction and production, when compared to estimated future traffic without the project (Section 4.2.7, Transportation).

The anticipated incidence of vehicle-related mortalities for mule deer along the proposed haul route would be proportional to the amount, speed, and timing of traffic relative to deer movements and concentrations, with the greatest potential for mortality to occur during the spring and fall migration periods and at night. The gradual increase in regional population and in tourist traffic projected for the future would add to deer mortalities and migration route disruption along U.S. Hwy. 89 and Interstate-15. As recreational and other traffic increases in the area, the percentage of mining-related traffic on these roads would decrease proportionally.

In an effort to determine whether increased truck traffic along U.S. Hwy. 89 between Kanab and Big Water would adversely affect the Paunsaugunt Mule Deer Herd, the Applicants have committed to providing assistance to the Utah DWR for the evaluation of existing deer populations. If the studies indicate the need, the Applicants would also participate in the development of appropriate mitigation measures to minimize impacts to the seasonal deer migration (Appendix A, Section A.3.5.3.4, Other Enhancements).

Following mine closure, mining-related traffic on U.S. Hwy. 89 and Interstate-15 would be discontinued, and impacts to deer from mining-related traffic would end. Regional traffic levels would continue to gradually increase with increased regional population and would continue the effects on deer.

The Agencies conclude that impacts to mule deer movement during migrational periods along Interstate-15 and U.S. Hwy. 89 with mining-related traffic would range from negligible to minor over both the short and long terms. Highway deer mortalities would constitute an irretrievable commitment of the resource.

4.2.6.2 Impacts to Wildlife Habitat and Productivity in the Smoky Mountain Area with Project-Related Activities

Project construction and mining-related subsidence within the Smoky Mountain area could result in both adverse and beneficial impacts to area wildlife species. Direct adverse effects to wildlife could include disturbance to underground den sites, hibernacula, nest sites, and communal roosting areas and a resultant potential reduction in species productivity or the loss of adults or young (e.g., bats, birds, reptiles). Subsidence could benefit wildlife habitat by changing topographic conditions and creating cover or den sites for animals. Because topography influences the individual microclimate and microhabitats, variations in the ground surface could result in a greater diversity of habitat types.

Disturbance of native habitats along both the Warm Creek Road and the Benchtop Road could result in the direct loss of less mobile species (e.g., small mammals, bird nestlings, reptiles) and the displacement of more mobile species (e.g., medium-sized mammals, adult birds, and big game animals). The greatest direct impact of habitat removal and disturbance to wildlife along either of the two roads would be (1) the loss of nesting or breeding habitat, (2) disturbance to foraging territories, (3) loss of cover, and (4) disturbance to important habitat features (e.g., hibernacula, communal den sites). Direct effects to important habitat would result in displacing animals, increasing competition, and reducing the available carrying capacity within the adjacent habitats. Displaced individuals may or may not be able to establish new territories, depending on such variables as the species' behavior, density, and individual habitat requirements and availability.

Construction of the Warm Creek Road would involve realignment of the right-of-way out of the creek channel, resulting in beneficial impacts to wildlife resources. With this realignment, the damage to the Warm Creek and Wahweap Creek drainages from existing traffic use (Utah DWR 1992) would be expected to decrease. Therefore, the ongoing disturbances to riparian vegetation and associated water quality from public use would decline.

Gradual increases in regional population and recreational uses in the Project area may also add to minor changes in wildlife habitat and productivity from such activities as ORV use and collecting.

Intensive field inventories would be conducted to determine important habitat for wildlife species (e.g., raptors, reptiles, amphibians, bats) in the Smoky Mountain area that may be disturbed by construction and operation activities. These surveys would be conducted within 1 year prior to disturbance. If these surveys identify important habitat (e.g., high-priority chukar winter habitat, bat hibernacula, raptor nest sites), additional inventory, evaluation, and mitigation measures would be coordinated with the agencies involved, if necessary (Appendix A, Section A.3.5.3.4, Other Enhancements).

Since available water is the limiting factor in the Smoky Mountain area, riparian habitats support a greater population diversity and density of wildlife species per acre than any other habitat type occurring in the region. Nine seeps and one spring (Wesses Spring) occur in the proposed life-of-mine area and could be impacted by mining-related subsidence (Section 4.2.3.2, Impacts to Water Quality and Quantity in and Around the Warm Creek Drainage System with Mining-Related Subsidence). Water availability, forage, and cover for area wildlife could be affected. Because of the sensitivity of this issue, a monitoring program for the natural seeps and springs within the area would be implemented during the life-of-mine operations. In the event that adverse effects do occur from ground subsidence, appropriate mitigation measures would be developed, such as providing alternative sources of water for wildlife use (Appendix A, Section A.3.5.3.4, Other Enhancements).

Available habitat in areas of projected disturbance would be lost during the life of the Project. Interim reclamation measures would help reduce the impacts from habitat lost during construction and operation. After mine closure, reclamation measures would aid in replacing the majority of habitat disturbed during construction and operation (Appendix A, Section A.3.4, Reclamation Activities, and Section A.3.5, Enhancement Activities).

The proposed Warm Creek/Benchtop Road would continue to provide public access into the area after mine closure. Use would gradually increase over time as the regional population increases. Impacts to wildlife productivity and habitat from public use of the area would continue over time and would increase as the population increases.

The Agencies conclude that the impacts to wildlife habitat and productivity in the Smoky Mountain area with Project-related activities would be minor over the short term and negligible over the long term. Temporary habitat loss and potential reduction in wildlife productivity could constitute an irretrievable commitment of the resource.

4.2.6.3 Impacts to Wildlife in the Smoky Mountain Area from Increased Human Presence with Project-Related Activities

Impacts to highly visible wildlife species in the Smoky Mountain area is proportional to the size of the construction force, number of employees, transportation options, land use and recreation demands, and other associated development and activities in the region. Construction and/or improvement of the proposed Warm Creek/Benchtop Road would allow additional public access into the Smoky Mountain area, resulting in increased human effects (e.g., vehicle/wildlife mortalities, harassment, poaching, increased hunting pressure, noise, ORV use).

The peak construction and operational workforces are estimated to be 50 and 150 for the Smoky Hollow Mine, respectively (Chapter 1, Figure 1-2). Personnel commuting to and from the mine would increase the potential for vehicle-related mortalities of big game species, particularly mule deer. The use of ORVs during recreational activities could result in increased wildlife harassment and physiological stress, breeding disturbance, and habitat degradation for resident and migratory species. Additional hunting pressure would occur, and poaching or illegal shooting could increase in the area. Poaching is often the greatest adverse impact to wildlife from increased human presence (Streeter et al. 1979), particularly for big game species. However, other wildlife species are often harassed, including large raptors (e.g., eagles and hawks) and predators (e.g., coyote), because of their high visibility and how they are typically perceived by humans. Any increase in either legal or illegal hunting could result in increased law enforcement needs and responsibilities for Utah DWR.

Noise generated during Project development and operation (Section 4.8, Noise) would result in varying impacts to area wildlife species. Common responses of animals to noise disturbances are either avoidance or accommodation. Except at extreme levels, the more secretive and smaller animals would coexist with the noise sources. Other animals, particularly those that rely most on vocal or auditory cues for communication and orientation, would avoid the vicinity of a noise source, moving out of the area until the source dropped to an acceptable background level for that species. After initial avoidance of human activity and noise-producing areas, some wildlife species may acclimate and begin to reinhabit adjacent areas formerly vacated. Abrupt and intermittent noises (e.g., blasting) are less likely to be accommodated than are the more steady continuous noises (e.g., truck traffic).

The predominant cumulative effects of increasing human presence would be the additional public use of recreational areas surrounding the Smoky Mountain area that are currently used on a limited basis. The development of the proposed Warm Creek/Benchtop Road would provide additional access into the Burning Hills WSA, Paria-Hackberry WSA, and Wahweap WSA. Modifications to the Warm Creek Road would also provide improved access into the Glen Canyon National Recreational Area.

All construction and operational personnel would be informed about the appropriate Utah game laws and cautioned not to harass or poach game and nongame animals (Appendix A, Section A.3.5.3.4, Other Enhancements). Employees would also maintain records of wildlife observed in the Project area and any highway mortalities. The employees would receive annual training to develop an awareness of and sensitivity to wildlife issues and concerns specific to the area. Speed limits of 25 mph would be established for Project personnel on unpaved access roads through the area to reduce wildlife/vehicle collisions (Appendix A, Section A.3.5.3.1, Wildlife Habitat).

Following mine closure, mining-related traffic and mine employee presence would cease. The proposed Warm Creek/Benchtop Road would remain permanently open and available for public access into the area.

Use of the area and the road would gradually increase, owing to increasing regional population, with resultant increases in wildlife disturbance.

The Agencies conclude that the impacts to wildlife in the Smoky Mountain area from increased human presence with Project-related activities would be minor to moderate over the short term and minor over the long term. Wildlife mortalities and reduced productivity would constitute an irretrievable commitment of the resources.

4.2.6.4 Impacts to the Ferruginous Hawk, Golden Eagle, Peregrine Falcon, and Other Raptors in the Warm Springs Project Area with Project-Related Activities

Raptor mortality could increase along the haul routes from mining-related traffic collisions with scavenging birds. Construction of transmission and lines in the Smoky Mountain area and at the Moapa and Iron Springs unit-train loadouts could increase raptor electrocution hazards. Construction disturbance could also affect raptor breeding and nesting in proposed Project areas. Disturbance from the construction of Project components could adversely impact breeding birds, potentially resulting in nest abandonment and loss of productivity for that breeding season. Impacts to nesting birds would depend on the nest location relative to the construction activities, the phase of the breeding period, and the duration of the disturbance.

An average of three to five dead or injured golden eagles have been documented per year along Utah Route 56 west of Cedar City, from injuries received during scavenging along the road (McDonald 1994). Traffic projections along this segment of highway indicate an increase in average daily traffic volume during construction and production, when compared to estimated future traffic without the project (Section 4.2.7, Transportation). Projected traffic from construction would not likely result in increased golden eagle kills; however, the increase in traffic during the years of Project operation may result in an increase in mortality potential. Additional projects that may cumulatively affect traffic and eagle mortality along Utah Route 56 would include the WECCO facilities and the Cedar City Industrial Park (Appendix B).

The proposed 138-kV power transmission line across Tibbet Canyon would span the canyon width. This 1,500-foot span could increase the risk of birds colliding with the transmission line conductors and static wires. Raptor use of proposed distribution lines in the surface facilities complex area, at the Iron Springs unit-train loadout, and at the Moapa unit-train loadout could result in direct impacts to individual birds from electrocution hazards.

Intensive field inventories would be conducted to determine the presence or absence of breeding raptors, including the golden eagle, peregrine falcon, and ferruginous hawk, in and around proposed Project-related construction and/or subsidence activities. These surveys would be conducted within 1 year prior to potential disturbance activities and would follow the agency-approved protocol for nesting raptors. The presence or absence of breeding raptors would be monitored on a regular basis throughout the life of the

Project. Additional inventory, evaluation, and mitigation measures, if necessary, would be coordinated with the agencies involved (Appendix A, Section A.3.5.3.4, Other Enhancements).

Powerline markers would be installed on the overhead static wires of the proposed 138-kV power transmission line across Tibbet Canyon in order to increase the line's visibility and minimize avian strikes (Appendix A, Section A.3.5.3.4, Other Enhancements). Marking the static wires at the canyon crossing may reduce bird collision rates as much as 45 percent (Beaulaurier et al. 1982). To prevent electrocution hazards, smaller powerlines (less than 69-kV) would be constructed in accordance with Rural Utility Service standards and other suggested design recommendations (Appendix A, Section A.2.2, 138-kV Power Transmission Line). No electrocution impacts to raptor species are anticipated from operation of either the 69-kV or the 138-kV power transmission lines. Electrocution of raptors is not considered to be a problem with powerlines of these sizes. The physical dimensions and configuration of the structures and conductors would meet or exceed design recommendations for raptor protection and would not introduce an electrocution hazard (Ollendorf et al. 1981).

Following mine closure, mining-related traffic would cease, and the transmission powerlines and most of the distribution powerlines would be removed. Potential impacts to raptors from mining-related activities would cease. Increased regional traffic on area highways would continue to impact raptors from traffic accidents over time.

The Agencies conclude that impacts to the ferruginous hawk, golden eagle, peregrine falcon, and other raptors in the Warm Springs Project area with Project-related activities would be minor over both the short and long terms. Any raptor mortalities would be an irretrievable commitment of the resource.

4.2.6.5 Impacts to the Mexican Spotted Owl in the Smoky Mountain Area with Project-Related Activities

John Henry and Wesses Canyons have been identified as containing potential suitable habitat for the Mexican spotted owl during habitat surveys in and around the life-of-mine area (Chapter 3, Section 3.7.5, Wildlife). No Mexican spotted owls, nests, or other indication of the species' presence has ever been found in the area, however. Construction and operation of the Benchtop Road into John Henry Canyon may disturb nesting spotted owls, if present within the canyon. The degree of impacts to breeding birds would depend on the location of nesting sites relative to the road right-of-way. These impacts could include the loss of nesting and foraging habitat, disturbance of adults resulting in nest abandonment, and displacement of roosting owls. Indirect effects could encompass impacts from construction and operational noise and increased public access into the Smoky Mountain area. Increased human presence and disturbances could result in nest abandonment and/or reduced productivity (Utah Mexican Spotted Owl Technical Team 1994).

Mining-related subsidence could result in topographic elevation changes (Section 4.2.1, Geology and Topography) and cause rock cliffs to collapse. Loss of nest sites, eggs, or nestlings could occur. Subsidence, however, would be more likely to create rather than destroy rock outcrop cavities, which could increase nesting sites for spotted owls.

An intensive field inventory would be conducted for the presence or absence of the Mexican spotted owl in and around the parts of Wesses Canyon that could experience mining-related subsidence effects. An inventory would also be conducted in and around the part of John Henry Canyon that could be affected by the construction of the proposed Benchtop Road. These inventories would be conducted for 2 years prior to any potential disturbance activities and would follow the agency-approved protocol for the Mexican spotted owl, documenting the presence, if any, of spotted owls, and recording the associated habitat quality of the canyon systems that would be impacted. Additional inventory, evaluation, and mitigation measures, if necessary, would be coordinated with the agencies involved (Appendix A, Section A.3.5.3.4, Other Enhancements).

The field inventory and mitigation program would (1) identify the presence or absence of the Mexican spotted owl in these canyon systems; (2) establish the appropriate Core Area or Management Territory, if Mexican spotted owls are present; (3) initiate formal Section 7 consultation with the USFWS, if applicable; and (4) protect individual owls from the potential mining effects. This would avoid jeopardizing the continued existence of any populations that may be present. If inventories confirm that no Mexican spotted owls occupy the John Henry and Wesses Canyon systems, no impacts to this species would be anticipated as a result of Project-related activities.

Within its range, the Mexican spotted owl is experiencing cumulative pressure from a variety of activities, such as outdoor recreation, tourism, mineral exploration, and residential development. If owls are present in the Smoky Mountain area, the increased human presence, disturbances from Project construction and operation, and public use of the area would result in greater cumulative impacts to the Mexican spotted owl in southern Utah. Continued public use of the proposed Warm Creek/Benchtop Road following mine closure could increase human presence in the area gradually over time and, if spotted owls are present, could result in increased disturbance to breeding owls.

The Agencies conclude that impacts to the Mexican spotted owl in the Smoky Mountain area with Project-related activities would be none to minor over both the short and long terms.

4.2.6.6 Impacts to the Desert Tortoise in the Moapa and Hurricane Areas with Project-Related Activities

Construction and operation of the proposed Moapa unit-train loadout and the Hurricane truck maintenance facility could result in direct physical disturbance of desert tortoise habitat. Desert tortoise surveys conducted at the proposed Moapa unit-train loadout discovered 63 tortoise burrows and 3 tortoise remains in 1990, and 40 usable burrows, 9 collapsed burrows, 2 tortoise remains, and 1 live tortoise in 1992 (Global Research Corporation 1990; Harry Reid Center for Environmental Studies 1992). Suitable tortoise habitat in the Hurricane area is currently being evaluated in a countywide Habitat Conservation Plan (HCP) (Mader 1994). Desert tortoises may be killed or injured by vehicles or heavy equipment during construction or by coal truck traffic during operation. The elevated railroad bed at the Moapa site for the loop railroad track may impair the movement of, and possibly entrap, desert tortoises. Additional impacts to the tortoise could occur from increased levels of human activity, noise, and ground vibrations; attraction of ravens to the area, if all trash is not removed immediately; and capture of tortoises by construction and maintenance crews for pets (USFWS 1992).

The Agencies have determined that activities at the Moapa unit-train loadout "may affect" the desert tortoise or its habitat in that area and entered into formal consultation with USFWS as required under Section 7 of the Endangered Species Act of 1973, as amended. Activities at the hypothetical location selected for the Hurricane truck maintenance facility could affect the desert tortoise or its habitat if the facility were located in desert tortoise habitat. (See Chapter 5, Section 5.3.1, Issues Concerning Threatened or Endangered Wildlife or Plant Species Protected by the Endangered Species Act, for a complete description of the Agencies' efforts to comply with the Act.) With the cooperation of USFWS, Andalex committed to a series of measures to protect the desert tortoise and its habitat during the construction and operation of these facilities. These include thorough tortoise surveys of all construction areas, ensuring tortoise passage under road and railroad beds, installation of tortoise-proof fencing and trenches in high traffic areas, an active litter-control program, and worker awareness training, (Appendix A, Section A.3.5.3.2, Desert Tortoise Habitat). At the conclusion of the formal Section 7 consultation, USFWS concurred with the Agencies' "may affect" finding in the Moapa area but determined that the proposed operation and mitigation activities would not likely jeopardize the continued existence of the Mohave population of the desert tortoise. In the Hurricane area, BLM, OSM, and USFWS agreed that informal consultation should continue until such time as the actual location for the truck maintenance facility is selected, the desert tortoise habitat is determined to actually be present, and the countywide HCP is finalized.

The Hurricane truck maintenance facility would be located on private land in Washington County, and the habitat review and the impact assessment are hypothetical for the purpose of this analysis. If constructed, the Hurricane truck maintenance facility could fall under Section 10 of the Endangered Species Act. If the facility were located in desert tortoise habitat, the private bulk carrier transport company would be responsible for compliance with either Section 7 or Section 10 of the Act. Development of the proposed Hurricane truck maintenance facility would be in accordance with applicable Federal and State regulations, and the applicable permitting and compliance regulations would be addressed in the HCP process.

Cumulatively, the proposed Project would contribute to an overall decrease in available desert tortoise habitat in the Moapa area, in association with a number of other existing and proposed projects, including the Los Angeles Department of Water and Power Intermountain and Navaho-McCullough 500-kV power transmission lines, Kern River gas transmission pipeline, Reid Gardener Powerplant, and the Moapa area Overton to Las Vegas fiber optic communication line (Appendix B). Cumulative effects to tortoise habitat in the Hurricane area would occur from such projects as the proposed Hurricane Industrial Park, the Wal-Mart Regional Distribution Center, and the Gateway Center Planned Unit Development. However, all existing projects have had to comply with either Section 7 or Section 10 of the Endangered Species Act to minimize impacts to tortoises and to mitigate individual "takes" (tortoise mortalities or harassment). Future projects also would fall under the regulations of the Act. The Clark County Desert Tortoise Habitat Conservation Fund has been established to secure tortoise management areas, enhance available habitat, and contribute to tortoise research. Similar conservation funds would be anticipated for the Hurricane area under the future HCP in Washington County. The implementation of enhancement measures, such as those presented in Appendix A and requirements for compliance with the HCP and Sections 7 and/or 10 of the Endangered Species Act, would minimize the effects to the tortoise population at the proposed Moapa unit-train loadout and the Hurricane truck maintenance facility if it were constructed.

Following mine closure, the Moapa unit-train loadout would be reclaimed and native vegetation and tortoise habitat would be expected to reestablish over time. The proposed Hurricane truck maintenance facility, however, would remain in place, and tortoise habitat in the facility area could be permanently lost.

The Agencies conclude that impacts to the desert tortoise in the Moapa and Hurricane areas with Project-related activities would be minor over the short term and negligible to minor over the long term. Any tortoise mortality would be an irretrievable commitment of the resource.

4.2.7 Transportation

4.2.7.1 Impacts to Open Road Traffic Flow in the Warm Springs Project Area with Mining-Related Traffic

Traffic in the proposed Warm Springs Project area will gradually increase over time to projected future background traffic levels (Table 4-1). These increases in traffic volume, unrelated to the proposed Project, would affect the levels of service (LOS) along area roadways. With the addition of Project-related construction, production, and reclamation activities, traffic levels in the study area would increase further.

Construction of the proposed mine surface facilities complex, the loadout facilities, the truck maintenance facilities, and the Warm Creek/Benchtop Road would occur over a 2-year period, during which time the construction-related employee, truck, and vendor traffic would add to existing traffic on the public roadway systems directly adjacent to the construction sites in Utah, Arizona, and Nevada. Because these traffic increases would be minimal and generally localized to the construction areas and their immediate associated

Table 4-1 — Future[1] Average Daily Traffic Volume Projections on Selected Area Roads

Roadway	Section	Without Proposed Project (Future) ADT[2]	Without Proposed Project (Future) Percent Trucks	Without Proposed Project (Future) LOS[3]	With Proposed Project (Future) ADT[2]	With Proposed Project (Future) Percent Trucks	With Proposed Project (Future) LOS[3]
COMMON ROUTE TO HURRICANE							
Warm Creek Road	All.	20	5.0	A;A	592	59.3	A;A
U.S. Hwy. 89	Big Water to Kanab.	2,980	8.0	A;B	3,472	16.9	B;B-C
Utah Route 11	Kanab to Arizona State line.	3,990	7.6	A;B	4,340	15.0	A;B
U.S. Hwy. 89A	Utah State line to Fredonia.	6,600	11.0	B;C	7,230	14.9	B;C
Arizona Route 389	Fredonia to Colorado City/Utah State line.	7,000	11.0	B;C	7,350	15.2	B;C
Utah Route 59	Hildale/Arizone State line to Hurricane.	3,420	11.4	B;C	3,770	19.6	C;D
ROUTE TO MOAPA							
Utah Route 9	Hurricane to Interstate-15.	20,180	5.0	A;A	20,765	6.5	A;A
Interstate-15	Utah Route 9 to Arizona State line.	25,990	25.0	A;A	26,340	26.0	A;A
Interstate-15	Utah/Arizona State line to Arizona/Nevada State line.	23,800	25.0	A;B	24,150	26.1	A;B
Interstate-15	Nevada/Arizona State line to Exit 88 in Nevada.	15,500	25.0	A;A	15,860	26.6	A;A
Hidden Valley Road	Interstate-15 to Moapa.	400	25.0	A;A	770	58.4	A;A
ROUTE TO IRON SPRINGS							
Utah Route 9	Hurricane to La Verkin.	21,475	2.3	A;A	21,825	3.9	A;A
Utah Route 17	La Verkin to Interstate-15.	2,640	9.3	B-C;C	2,990	19.9	C-D;D
Interstate-15	Route 17 to Exit 59.	22,300	25.0	A;B	22,650	26.2	A;B
Utah Route 56	Interstate-15 to Iron Springs Road.	3,800	8.0	A;B	4,190	15.6	A;B
Iron Springs Road	Utah Route 56 to Iron Springs.	1,615	5.0	A-B;B	2,005	37.6	B;B

Source: Jager 1993.
JHK & Associates 1993.
Berger 1993.

[1]Future volumes are based on 15-year projections for Utah and Nevada and 25-year projections for Arizona.
[2]ADT = Average daily traffic.
[3]LOS = LOS "A" is highest level of service, LOS "F" is the lowest, or worst level of service. Two letters with a semicolon indicate level of service in morning (7 a.m. to 8 a.m.);afternoon (5 p.m. to 6 p.m.) peak times. Two letters separated by a dash indicates that the level of services is close to the dividing line between the two ranges.

roadways, no decrease in LOS is projected; however, some brief periods of delay due to construction at site access points could be anticipated.

Construction of the proposed Moapa unit-train loadout would add a maximum of 50 vehicle trips per day to Interstate-15 beyond projected future traffic levels, with as many as 90 additional vehicle trips per day on the Hidden Valley Road. On the average, two of these construction-related trips per day would be truck trips. The proposed Iron Springs unit-train loadout construction would add 70 to 80 vehicle trips per day to Utah Route 56 and Iron Springs Road near Cedar City; 2 of the trips would be truck trips. Construction of the proposed Hurricane/Fredonia truck maintenance facilities would add 8 to 10 vehicle trips per day to the roadways adjacent to each site. On the average, two of those trips per day would be truck trips. Construction of the mine and the Warm Creek/Benchtop Road would add about 156 vehicle trips per day to future traffic levels expected for the existing Warm Creek Road; 16 of these trips would be truck trips. About 70 vehicle trips per day would be added to future projected traffic levels on U.S. Hwy. 89 in the vicinity of Big Water.

Baseline traffic and truck volumes on regional highways would continually increase, during the period of full mine production until beginning of reclamation. (Table 4-1 outlines future projected baseline traffic and truck volumes with and without the proposed Project during the expected period of mine production.) During full production, mine workers, loadout employees, and truck maintenance facility employees would commute between home and work. Trucks would haul coal to the Moapa and Iron Springs unit-train loadouts, and service-related vehicles would travel to and from these facilities to deliver supplies and perform construction and maintenance operations. Trucks hauling coal from the mine and returning to reload would add to the number of trucks travelling along the haul route. The haul trucks would operate 24 hours a day, 365 days a year, with loaded trucks being dispatched from the mine at 8- to 10-minute intervals (Appendix A, Section A.2.7.6, Truck Haul). This schedule would add a maximum of 175 mine-related truck round-trips daily to the truck haul routes. This amount of truck traffic would increase the percentage of projected future truck traffic along the haul routes during the full mine production period, ranging from 1 percent along Interstate-15 between Utah Route 9 and the Arizona State line to about 54 percent along the Warm Creek/Benchtop Road (Table 4-1).

Mining-related impacts would be constant with very little fluctuation during the 40-year period of active coal mining. General traffic, however, is expected to gradually increase throughout this period as a result of increases in the regional population. The actual percentage of mine-related truck traffic along the haul routes and at intersections would decrease over time as regional traffic increases.

Rural two-lane highway LOS is a function of the traffic volume and vehicle composition, the directional split of the traffic, the terrain, and the number of no-passing zones. Because any passing maneuvers must occur in the opposing lane, the opposing traffic volume has an effect on capacity. As traffic volumes increase, the demand for passing increases and the passing capacity of the opposing lane decreases. Heavy vehicles within the traffic stream tend to increase the demand for passing, particularly in rougher terrain, where steeper grades can cause heavy vehicles to slow considerably. The difficulty of the passing maneuver is also increased owing to the longer vehicle length of those vehicles and associated passing distance and to the increased difficulty in seeing around a heavy vehicle.

Small traffic increases due to the proposed Project (such as 15 trucks per hour in each direction) could affect the LOS sufficiently to lower it one level, or letter designation, on some roads. Each LOS designation covers a range of traffic volumes, specific to the number of heavy vehicles, type of terrain, and number of no-passing zones. As increasing traffic volumes approach the threshold between two levels, small increases in the number of heavy trucks could decrease the level of service by one letter designation.

For the purpose of this analysis, impacts to LOS are evaluated on various roadway segments in the proposed Warm Springs Project area during morning and afternoon peak traffic hours (7 a.m. to 8 a.m. and 5 p.m. to 6 p.m.). Peak traffic hours are used to help determine the effects of increased traffic on traffic flows and LOS during high-use periods. In general, LOS "A" represents free-flow conditions and LOS "F" represents congested, or forced-flow, conditions. LOS "D" is considered to be acceptable during periods of peak usage (Chapter 3, Section 3.7, Transportation). Coal trucks would add 15 vehicles to any hour (peak or off-peak) on all roadway segments, whereas other mine-related traffic would add vehicles to certain roadway segments only.

With approval of the proposed Project, either a new road, the Benchtop Road, would be constructed or the existing Warm Creek Road would undergo reconstruction. Traffic flow capabilities and road quality would improve. Traffic volumes along the Warm Creek/Benchtop Road are projected to increase from the existing 20 vehicles per day (vpd) to 592 vpd; 350 of these trips would be mine-related coal trucks, and 222 trips would be mine employee and other traffic. The employee trips would occur throughout the day, with peak traffic at times when work-shift changes occurred. It is anticipated that there would be a small number of mine service-related vehicle trips during daytime hours. The current and projected LOS "A" during both peak traffic periods should be maintained under this volume of traffic.

Increased traffic along U.S. Hwy. 89 between Big Water and Kanab could result in a projected future average daily traffic (ADT) of 3,472 vpd, 350 of which would be mine-related coal trucks and 142 of which would be mine employee traffic. LOS during morning hours is currently "A" and during afternoon hours is currently "B"; future traffic increases would maintain the afternoon peak-hour level of service. Project-related traffic could contribute to a lowering of the projected level of service for the morning peak hour to LOS "B" and the projected afternoon to a LOS of "C."

On Utah Route 11 between Kanab and the Arizona State line, LOS is currently "A" at the morning peak traffic hour and "B" at the afternoon peak traffic hour. Future traffic increases would not reduce the LOS at either peak. Project-related traffic should not be sufficient to further decrease the level of service from the projected morning and afternoon peak hour LOS of "A" and LOS of "B," respectively.

On U.S. Hwy. 89A in Arizona between the Utah State line and Fredonia, the future ADT is projected to be 7,230 vpd, 350 of which would be mine-related coal truck traffic and 280 of which would be Fredonia truck maintenance facility employee traffic. Non-Project traffic would reduce morning and afternoon peak-hour LOS from LOS "A" to LOS "B" and LOS "B" to LOS "C," respectively. Project-related traffic volumes should not decrease the level of service for this segment from its projected future levels.

On Arizona Route 389 between Fredonia and the Utah State ine, future traffic increases would reduce morning peak-hour LOS from "A" to "B" and afternoon peak-hour LOS from "B" to "C." The volume of Project-related traffic should not decrease the projected level of service further.

On Utah Route 59 between the Arizona State line and Hurricane, a decrease in future LOS for morning and afternoon peak hours is not projected. However, in this area, Project-related traffic could contribute to a decrease from the projected morning peak-hour LOS of "B" and the afternoon peak-hour LOS of "C" to LOS "C" and LOS "D," respectively.

The section of Utah Route 9 between Hurricane and Interstate-15 is projected to experience a future traffic volume of 20,765 vpd with the inclusion of mine-related traffic; 350 of these trips would be coal haul trucks and 235 trips would be related to the Hurricane truck maintenance facility component of the proposed Project. Improvements to widen Utah Route 9 to four lanes (scheduled for 1996) should improve the LOS levels in the area throughout the 20-year planning horizon. Future traffic volumes without the proposed Project would be at LOS "A" for all periods. Traffic associated with the Project should not reduce the level of service below LOS "A" for either peak period.

The section of Interstate-15 between Utah Route 9 and the Arizona/Nevada State line is not projected to experience future LOS reductions from LOS "A" during morning or afternoon peak hours. Mining-related truck traffic in these segments would not be expected to affect the projected baseline morning and afternoon peak-hour levels of service.

In Nevada, traffic volumes on Interstate-15 between the Arizona/Nevada State line and exit 88 at the Hidden Valley Road are not projected to decrease the level of service from LOS "A" during either the morning peak hour or the afternoon peak hour. The addition of Project-related traffic to anticipated future traffic volumes would increase traffic to 15,860 vpd in the future; 350 of these trips would be Project-related trucks, and 10 would be employee traffic. This small volume of mining-related traffic would not contribute to a decrease from either the projected morning peak-hour LOS or the projected afternoon peak-hour LOS.

In Nevada, the Hidden Valley Road has a current and projected LOS "A" during both peak periods, and the volume of traffic associated with the proposed Project should not reduce this level of service.

The section of Utah Route 9 between Hurricane and La Verkin would experience a decrease in the existing morning and afternoon peak-hour levels of service of LOS "C" during morning peak hours and LOS "D" during afternoon peak hours as a result of future traffic. The volume of mining-related traffic would not further affect the projected two-lane morning and afternoon peak hour level of service of LOS "E." Future plans to widen this section of roadway to four lanes should, however, eventually improve the LOS levels to LOS "A" during all periods with or without the addition of Project-related traffic.

On Utah Route 17, between La Verkin and Interstate-15, the addition of mining-related traffic would contribute 15 vehicles to the peak-hour volume and could contribute to the decrease from the projected levels of service of LOS "B" and LOS "C" during the morning and afternoon peak hours to LOS "B-C," and LOS "C-D," respectively.

The section of Interstate-15 between Utah Route 17 and exit 59 in Cedar City is projected to experience a future decrease in level of service for the afternoon peak hour from LOS "A" to LOS "B." The addition of mine-related truck traffic to projected traffic volumes, while only a small percentage of the total, could contribute to this decrease from the projected afternoon peak-hour level of service. Projected morning peak-hour LOS should not be affected.

Future traffic volume on Utah Route 56 between Interstate-15 and Iron Springs Road would decrease the afternoon peak LOS from "A" to "B." Morning peak LOS would remain at "A." Mining-related traffic would not be expected to affect the projected morning or afternoon peak-hour levels of service.

The Iron Springs Road would experience an increase in ADT to 2,005 vpd; 350 of these trips would be Project-related coal truck trips, and 40 trips would be Iron Springs unit-train loadout employee trips. Without the proposed Project, level of service is projected to decrease from LOS "A" to LOS "B" during both peak-hour periods. Mining-related traffic volumes should not result in any further reduction from the projected level of service during either peak hour.

During the final reclamation phase of the proposed Project, when coal production and hauling operations have ended, Project-related traffic would decrease substantially and would be localized to the areas immediate to the mine and loadout facilities. This traffic would be limited to reclamation operations employees and to any heavy trucks or equipment used in the reclamation process. This level of traffic would not be sufficient to affect future area traffic operations.

The Applicants would require coal trucks to stay in radio contact to help maintain adequate spacing between trucks and avoid congestion. Coal trucks would also be required to stay on the identified haul roads and to avoid using other roadways (Appendix A, Section A.2.7.6, Truck Haul).

After mine closure, general traffic levels in the area would drop slightly and then begin to gradually increase in response to continuing increases in regional population. No additional effects from mine traffic are anticipated following mine closure. The Warm Creek/Benchtop Road would be permanently available to the general public. Cumulative effects from other projects (Appendix B), such as the Navajo Generating Station, have been considered in the future baseline LOS ratings and traffic volumes discussed above.

The Agencies conclude that impacts to open road traffic flow in the Warm Springs Project area with mining-related traffic would be minor to moderate over both the short and long terms. Impacts along some segments of U.S. Hwy. 89, Utah Route 59, Utah Route 17, and Interstate-15 would have the potential to become significant.

4.2.7.2 Impacts to Traffic Flow at Intersections in the Warm Springs Project Area with Mining-Related Traffic

Traffic in the Warm Springs Project area will gradually increase over time to projected future background traffic levels (Table 4-1). These increases in traffic volume unrelated to the Project would change LOS ratings at area intersections. With the addition of Project-related construction, production, and reclamation activities, traffic levels in the study area would increase further (Table 4-1). This could lead to an additional increase in traffic at intersections in the study area, with the greatest increase occurring during mine production. Traffic levels during peak traffic hours (7 a.m. to 8 a.m. and 5 p.m. to 6 p.m.) are the most important for determining traffic flow and LOS ratings at intersections.

Employee-, vendor- and construction-related truck traffic generated by construction of the mine, the loadouts, the truck maintenance facilities, and the Warm Creek/Benchtop Road would use intersections immediately adjacent to the construction areas during the 2-year construction phase of the proposed Project. The construction of new access roads to serve the loadouts and maintenance facilities would create new turning movement conflicts at the intersections within the existing roadway system.

Traffic related to the construction of the mine and the Warm Creek/Benchtop Road would add 70 vehicle trips per hour to the projected peak-hour traffic at the U.S. Hwy. 89/Warm Creek Road intersection near Big Water. Construction of the Iron Springs loadout would add 36 vehicle trips per hour to the existing peak-hour traffic at the intersection of Utah Route 56/Iron Springs Road intersection near Cedar City. Construction of this loadout would also create a new access intersection with the Iron Springs Road. Construction-related traffic would add 40 peak-hour turning movements at this new intersection. Construction of the Moapa loadout would add 45 vehicle trips per hour to the projected peak-hour traffic at the Interstate-15/Hidden Valley Road interchange in Nevada. Construction of this loadout would also create a new access intersection with the Hidden Valley Road. Construction-related traffic would add 50 peak-hour turning movements at this new intersection. Because the traffic increases at the intersections are expected to be minimal and generally localized to the construction areas and their immediate associated roadways, no decrease in future LOS would be projected for adjacent intersections; however, some brief periods of delay due to construction at site access points would be anticipated. Construction of the Fredonia or the Hurricane truck maintenance facilities and their associated new access roads would add only minimal amounts of construction-related traffic to the adjacent roadways and should not reduce projected levels of service in these areas.

When the proposed coal mining and hauling operations begin there would be more traffic at public roadway system intersections along the haul routes in Utah, Arizona, and Nevada. In general, coal trucks accelerate and maneuver slowly and require more space and time to make turns at intersections. This may slow traffic flow slightly at intersections along the haul route. Also, coal trucks require more time to accelerate to a normal travel speed from a stopped position. Mine worker, loadout employee, and truck maintenance facility employee traffic increases and coal trucks and their operating characteristics could lower the LOS at these intersections.

Mining-related impacts would be constant with very little fluctuation during the 40-year period of active coal mining. General traffic, however, is expected to gradually increase throughout this period because of increases in the regional population. The actual percentage of mine-related truck traffic along the haul routes and intersections would decrease over time as regional traffic increases.

Mine-related traffic would add a maximum of 104 peak hour vehicle trips (15 of which would be truck trips) to the intersection of Warm Creek/Benchtop Road and U.S. Hwy. 89 in Big Water. Unsignalized traffic operations, currently at LOS "A" during both peak hours, would experience a reduction in traffic operational conditions in the future to LOS "B" during the afternoon peak hour on the Warm Creek Road approach. Addition of Project traffic should not reduce the projected LOS further.

At the signalized intersection of U.S. Hwy. 89/Utah Route 11 in Kanab, mining-related traffic would add 15 truck trips to the existing peak-hour traffic. Under projected future conditions without the proposed Project, the existing signalized intersection operations would be lowered from a current LOS "B" during both peak hours to LOS "C" during the afternoon peak hour. Addition of Project-related traffic should not affect this projected LOS rating.

In Arizona, mine-related traffic would add about 18 peak-hour vehicle trips, 15 of which would be haul truck trips, to the stop-sign-controlled intersection of U.S. Hwy. 89A/Arizona Route 389 in Fredonia. The projected Project-related traffic volumes should not reduce the projected future LOS on the single-lane eastbound approach to this intersection from its projected LOS "C" and LOS "E" during the morning and afternoon peak hours, respectively. Addition of Project-related traffic should not reduce the projected afternoon peak operation LOS of "B" on the single-lane westbound approach to the intersection.

Mine-related traffic would add about 18 peak-hour vehicle trips, 15 of which would be haul truck trips, to the signalized intersection of Utah Route 59/Utah Route 9 in Hurricane. Projected future traffic operations would be reduced from the existing LOS "B" during both peak hours to LOS "C" during the morning peak hour and LOS "E" during the afternoon peak hour. The additional increases from Project-related traffic would not be expected to affect the projected LOS ratings for this intersection.

Mine-related traffic would add 15 peak-hour truck trips through the Interstate-15/Utah Route 9 interchange west of Hurricane. These mining-related traffic increases are not expected to affect the projected LOS at this intersection, which would have decreased over time from the current LOS of "A" to LOSs of "B" and "F" on the right turn of the northbound off-ramp in the morning and afternoon hours, respectively.

In Nevada, mine-related traffic could add as much as 21 peak-hour vehicle trips (15 of which would be truck trips) to future traffic levels through the Interstate-15/Hidden Valley interchange near Moapa. This additional traffic, in combination with projected future increases in general traffic, would not be sufficient to lower the projected LOS of "A" at the two unsignalized intersections at this interchange. At the proposed unsignalized intersection at the proposed Moapa unit-train loadout access road and Hidden Valley Road, mine-related traffic could add up to 29 vehicle trips (15 of which would be truck trips) accessing Hidden Valley Road. This increase in traffic, in combination with projected future increases in general traffic, should not lower the projected LOS of "A" along Hidden Valley Road.

At the unsignalized intersection of Utah Route 9/Utah Route 17 in La Verkin, mine-related traffic could add 15 truck trips to the existing peak-hour traffic. The general increases in traffic levels contained in the future projections excluding project traffic, would lower the westbound left turn operations, currently at LOS "A" and LOS "C" during the morning and afternoon peak hours, to LOS "E" and LOS "F." The eastbound approach to this intersection would also experience a reduction from the current LOS "A" to LOS "C" during the afternoon peak hour. The additional increases associated with mining-related traffic would not be expected to affect these projected levels of service.

Mine-related traffic would add 15 peak hour truck trips through the Interstate-15/Utah Route 17 interchange north of La Verkin. This increase, in combination with the projected future traffic volumes, would not be sufficient to cause a reduction in the projected LOS of "A" at the unsignalized intersections at this interchange.

Mine-related traffic would add 15 peak-hour truck trips to future traffic levels through the two unsignalized intersections which form the Interstate-15/Utah State Route 56 interchange in Cedar City. At the intersections of the Interstate-15 off-ramps and Utah Route 56, LOS is projected to be "F" during both morning and afternoon peak hours. Addition of Project-related truck traffic should not affect this projected LOS rating. Projected LOS for left turns onto Interstate-15 from Utah Route 56 also should not be affected by mining-related traffic.

At the unsignalized intersection of Iron Springs Road/Utah Route 56 west of Cedar City, and at the proposed unsignalized intersection of the Iron Springs loadout access road and Iron Springs Road, mine-related traffic would add up to 29 vehicle trips (15 of which would be truck trips) to the peak-hour traffic. This mining-related traffic, in conjunction with the projected increases in general traffic, should not lower the projected peak-hour LOS "A" of either intersection.

During the final reclamation phase of the proposed Project, when coal production and hauling operations have ended, Project-related traffic would decrease substantially and would be localized to the areas immediate to the mine and loadout facilities. This traffic would be limited to reclamation operations employees and any heavy trucks or equipment used in the reclamation process. This level of traffic should not be sufficient to affect future area traffic operations at intersections.

The Applicants would require coal trucks to stay in radio contact to help maintain adequate spacing between trucks. Coal trucks also would be required to stay on the identified haul roads and to avoid using other intersections (Appendix A, Section A.2.7.6, Truck Haul).

After mine closure, general traffic levels in the area would drop slightly and then would gradually increase because of continuing increases in regional population. No additional effects from mine traffic are anticipated. The Warm Creek/Benchtop Road would be permanently available to the general public. Cumulative effects from other projects (Appendix B), such as the Navajo Generating Station, have been considered in the future baseline LOS ratings and traffic volumes discussed above. All effects on LOS from mining-related traffic are in addition to future cumulative traffic volumes.

The Agencies conclude that impacts to traffic flow at intersections in the Warm Springs Project area with mining-related traffic would be minor to moderate over both the short and long terms. Impacts would have the potential to become significant at the intersections of U.S. Hwy. 89A and Arizona Route 389, Utah Route 59 and Utah Route 9, Utah Route 9 and Interstate-15, Utah Route 9 and Utah Route 17, and Interstate-15 and Utah Route 56.

4.2.7.3 Impacts to Highway Infrastructure in the Warm Springs Project Area with Mining-Related Traffic

Construction, operation, and reclamation of the proposed Warm Springs Project would add mining-related traffic to future projected traffic volumes in the Project area. Owing to the lower mine traffic volumes anticipated during construction and reclamation and to the localized nature of the traffic, mine-related traffic during these periods would not be expected to substantially affect highway infrastructure in the Project area.

During mine production, coal trucks travelling between the mine and the loadouts would carry average loads of 123,500 or 129,000 pounds (Appendix A, Section A.2.7.5, Haul Trucks). The maximum axle loadings for the proposed haul trucks (Appendix A, Figure A-14) would be within all State regulations. For comparison purposes, the maximum-weight conventional "18-wheeler" tractor/trailer has an average tandem axle loading of 34,000 pounds. The maximum tandem axle loading of 31,500 pounds for the proposed coal trucks would be well below the Utah and Nevada limit of 34,000 pounds and the Arizona limit of 46,200. The impact of mine-related heavy truck traffic during mine operation would not be any greater than any other truck legally using area roadways. Coal haul trucks would, however, contribute to any acceleration of the normal rate of damage to the pavement and structure of the roadways along the haul route, thus contributing to any increase in road maintenance requirements and costs. As defined by the Utah, Arizona, and Nevada DOTs, bridges and other structures along the haul route are structurally and geometrically adequate to accommodate the proposed haul trucks and are subject to routine inspection and maintenance. The existing maintenance requirements of bridges and other structures and costs would increase gradually as nonmine traffic increases. They would increase as a result of mining-related traffic as well. Mining-related impacts would be constant with very little fluctuation during the 40-year period of active coal mining. General traffic, however, is expected to gradually increase throughout this period because of increases in the regional population. The actual percentage of mine-related truck traffic along the haul routes and intersections would decrease over time as regional traffic increases.

Utah Routes 17, 56, and 59 are currently structurally inadequate to handle heavy truck loadings (Utah DOT 1993a) and would eventually require reconstruction to accommodate any continuous heavy truck traffic. Hidden Valley Road is also currently inadequate to sustain repeated truck loadings, and about one-quarter mile from the Interstate-15 exit to the entrance to the proposed loadout could require reconstruction to handle mining-related truck traffic (Nevada DOT 1994a). Without reconstruction, the road surfaces along these roadways are expected to deteriorate further. Under heavy truck traffic use they could require maintenance much earlier than currently anticipated. The Warm Creek Road would be improved and paved, or the Benchtop Road would be constructed, as part of the proposed action (Appendix A, Section A.2.4, Smoky Mountain Road System), and traffic flow in this area should improve as a result.

The proposed coal truck configuration would meet all applicable requirements for Utah, Arizona, and Nevada DOT permits and, through the permitting process, would be allowed to operate on any roads in those States, including those along the proposed haul route. State DOTs would continue to routinely repair and upgrade area roadways. Trucking fees and permits generated by the Project would generate revenue that would be used by the individual State DOTs to defray any additional maintenance costs along the haul route that would be incurred as a result of coal truck traffic (Section 4.2.9, Socioeconomics). Required truck inspections and weighing would also help alleviate road damage caused by incorrect weight distribution or overweight trucks.

Non-Project-related traffic volumes, including heavy truck traffic, are anticipated to increase gradually in the region over time because of regional population increases and the influx of business and construction into the area. (See Appendix B for a discussion of future interrelated projects in the area.) These traffic increases (Table 4-1), added to those anticipated for the proposed Warm Springs Project, would further increase highway infrastructure maintenance requirements. The percentage of mining-related traffic to future baseline traffic would decrease over the life of the Project as regional traffic levels gradually increased over time. Toward the end of the life of the Project, mine traffic would be generating a proportionately smaller amount of wear and tear on area highways compared to overall traffic.

After mine closure, the Warm Springs Project-related truck traffic would cease and slightly reduce the levels of heavy truck traffic on area highways, thereby slowing down the rate of highway maintenance repairs needed for area highways until non-Project volumes expand. Collection of trucking fees paid by the trucking contractor would also cease. Non-Project traffic levels would continue to gradually increase over time with resultant wear and tear on area highways.

The Agencies conclude that the impacts to the highway infrastructure in the Warm Springs Project area with mining-related traffic would be minor to moderate over both the short and long terms, with the potential to become significant along segments of Utah Routes 17, 56, and 59 and on the Hidden Valley Road.

4.2.7.4 Impacts to Public Safety in the Warm Springs Project Area with Mining-Related Traffic

The projected increased traffic levels on the roadway systems in Utah, Arizona, and Nevada will have an impact on public safety along the haul route as the regional population increases. The potential for accidents, likewise, will be further increased along all roadway sections and at all intersections.

Employee-, vendor-, and construction-related truck traffic generated by construction of the mine, the loadouts, the truck maintenance facilities, and the Warm Creek/Benchtop Road would use roadways and intersections immediately adjacent to the construction areas during the 2-year construction phase of the proposed Project. Because the traffic increases at the intersections are expected to be minimal and would be generally localized to the construction areas and their immediate associated roadways, little increase in future accident rates resulting from construction traffic would be anticipated.

During mine production, the size, weight, and configuration of the proposed haul trucks could contribute to traffic safety problems along the haul route. The length of the trucks would increase the difficulty of passing maneuvers and might cause motorists to misjudge available passing distances. The haul trucks would require longer stopping distances and more space to make turns than average vehicles. In general, all roadway segments and intersections along the haul route are geometrically adequate to safely accommodate the proposed haul truck configuration. Mining-related impacts would be constant with very little fluctuation during the 40-year period of active coal mining. General traffic, however, is expected to gradually increase throughout this period because of increases in the regional population. The actual percentage of mine-related truck traffic along the haul routes and at intersections would decrease over time as regional traffic increases.

Increased traffic through school zones during mine production would tend to increase potential coal truck conflicts with school buses and pedestrians. All coal haul traffic and some of the Hurricane truck maintenance facility traffic would pass through the school zone and pedestrian crossing on Utah Route 9 in Hurricane. All coal haul traffic destined for the Iron Springs loadout would pass through the school zones on Utah Route 9 in La Verkin and on Utah Route 17 in Toquerville. All the coal haul traffic and some of the Fredonia truck maintenance facility traffic would pass through the school zone on U.S. Hwy. 89A in Fredonia, and all the coal haul traffic and some of the mine employee traffic would pass through the school zone on Utah Route 11 in Kanab. This traffic could increase the potential for conflict with pedestrians and school buses in these areas.

Adverse weather conditions could compound mine-related traffic safety impacts. Ice and snow conditions can exist on Interstate-15 approaching Cedar City and in Arizona through the Virgin River Gorge. Icing can also occur on Utah Route 17 between Hurricane and Toquerville. Such conditions would increase the potential for traffic accidents of all kinds, including mining-related truck accidents.

Traffic accidents in the future should occur at about the existing accident rates along haul route segments and at intersections. Table 4-2 shows the projected number of roadway accidents for the traffic volume increases associated with approval of the proposed Project; also shown are the roadway accident projections associated with disapproval of the proposed Project as a comparison. A comparison of intersection accident projections is shown in Table 4-3. Once full mine production begins, mining-related traffic could be expected to increase accidents along the haul routes by about 5 percent. Most of these accidents would probably involve trucks. About 0.5 to 0.7 additional fatalities (about a 4 percent increase) could occur each year as a result of mining-related traffic, based on the total number of accidents in a year anticipated in the future along the haul route. About 0.1 additional mining-related traffic accidents per year could occur at any given intersection along the haul route. The accident numbers in Table 4-2 are based on the actual accident rates (supplied by the State DOTs) along the various haul route segments for all vehicles and for all trucks. As a point of comparison, Savage Industries, Inc., was contacted regarding their existing coal trucking operation in central Utah. For the period of January 1990 through January 1995, Savage Industries experienced a similar fatal accident rate (3.08 per 100 Mtmt) and a lower overall accident rate (0.25 per Mtmt) when compared to the DOT-supplied rates for the haul routes (Goodman 1995). The majority of the Savage accidents (eight total) were a trailer or tractor rolling over on its side and did not

Table 4-2 — Future Accident Projections on Selected Area Roads

Roadway	Section	Number of Accidents per Year Without Proposed Project			Number of Accidents per Year With Proposed Project		
		Total	Truck	Fatal	Total	Truck	Fatal
SMOKY HOLLOW MINE TO MOAPA LOADOUT[2]							
Warm Creek Road	All.	N/A	N/A	N/A	N/A	N/A	N/A
U.S. Hwy. 89	Big Water to Kanab.	83.7	10.3	1.3	97.5	25.4	1.5
Utah Route 11	Kanab to Arizona State line.	4.4	0.0	0.0	4.8	0.0	0.0
U.S. Hwy. 89A	Utah State line to Fredonia.	2.3	0.0	0.0	2.5	0.0	0.0
Arizona Route 389	Fredonia to Colorado City/Utah State line.	42.5	2.2	2.2	44.6	3.2	2.3
Utah Route 59	Hildale/Arizona State line to Hurricane.	26.7	1.5	0.6	29.5	2.8	0.6
Utah Route 9	Hurricane to Interstate-15.	80.9	6.3	0.0	83.2	8.4	0.0
Interstate-15	Utah Route 9 to Arizona State line.	115.3	20.0	2.2	116.9	21.1	2.3
Interstate-15	Utah/Arizona State line to Arizona/Nevada State line.	137.9	21.7	5.8	139.9	23.0	5.9
Interstate-15	Nevada/Arizona State line to Exit 88 in Nevada.	112.0	13.3	7.9	114.6	14.5	8.1
Hidden Valley Road	Interstate-15 to Moapa.	N/A	N/A	N/A	N/A	N/A	N/A
Total Projected Accidents Per Year Along Haul Route		605.7	75.3	20.0	633.5	98.3	20.7
SMOKY HOLLOW MINE TO IRON SPRINGS LOADOUT[3]							
Warm Creek Road	All.	N/A	N/A	N/A	N/A	N/A	N/A
U.S. Hwy. 89	Big Water to Kanab.	83.7	10.3	1.3	97.5	25.4	1.5
Utah Route 11	Kanab to Arizona State line.	4.4	0.0	0.0	4.8	0.0	0.0
U.S. Hwy. 89A	Utah State line to Fredonia.	2.3	0.0	0.0	2.5	0.0	0.0
Arizona Route 389	Fredonia to Colorado City/Utah State line.	42.5	2.2	2.2	44.6	3.2	2.3
Utah Route 59	Hildale/Arizona State line to Hurricane.	26.7	1.5	0.6	29.5	2.8	0.6
Utah Route 9	Hurricane to La Verkin.	5.6	0.0	0.0	5.7	0.0	0.0

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Table 4-2 — Future Accident Projections on Selected Area Roads (Continued)

Roadway	Section	Number of Accidents per Year Without Proposed Project			Number of Accidents per Year With Proposed Project		
		Total	Truck	Fatal	Total	Truck	Fatal
SMOKY HOLLOW MINE TO IRON SPRINGS LOADOUT (Con.)							
Utah Route 17	La Verkin to Interstate-15.	9.5	0.5	0.5	10.8	1.2	0.5
Interstate-15	Utah Route 17 to Exit 59.	302.2	36.3	6.0	306.9	38.6	6.1
Utah Route 56	Interstate-15 to Iron Springs Road.	3.8	0.5	0.4	4.2	1.2	0.5
Iron Springs Road	Utah Route 56 to Iron Springs.	N/A	N/A	N/A	N/A	N/A	N/A
Total Projected Accidents Per Year Along Haul Route		480.7	51.3	11.0	506.5	72.4	11.5

Source: Utah Department of Transportation 1994.
Jager 1993.
Arizona Department of Transportation 1993b.
Nevada Department of Transportation 1993.
Berger 1993.
JHK & Associates 1993.

[1] Based on existing accident rates and traffic volume projections.
[2] Accident rates are not available for the road segments from Smoky Hollow to Big Water or Exit 88 to the loadout.
[3] Accident rates are not available for the road segments from Smoky Hollow to Big Water or Iron Springs Road to the loadout.
N/A = Data not available.

Table 4-3 — Future Accident Projections at Selected Area Intersections

Intersection	Total Number of Accidents Per Year Without Proposed Project	Total Number of Accidents Per Year With Proposed Project
SMOKY HOLLOW MINE TO MOAPA LOADOUT		
U.S. Hwy. 89 at Warm Creek Road	(2)	(2)
U.S. Hwy. 89 at Utah Route 11	2.9	3.0
U.S. Hwy. 89A at Arizona Route 389	(2)	(2)
Utah Route 59 at Utah Route 9	10.1	10.2
Utah Route 9 at Interstate-15	0.9	0.9
Interstate-15 at Hidden Valley Road	(2)	(2)
Total Projected Accidents Per Year Along Haul Route	13.9	14.1
SMOKY HOLLOW MINE TO IRON SPRINGS LOADOUT		
U.S. Hwy. 89 at Warm Creek Road	(2)	(2)
U.S. Hwy. 89 at Utah Route 11	2.9	3.0
U.S. Hwy. 89A at Arizona Route 389	(2)	(2)
Utah Route 59 at Utah Route 9	10.1	10.2
Utah Route 9 at Utah Route 17	9.7	9.8
Utah Route 17 at Interstate 15	1.6	1.7
Interstate-15 at Utah Route 56	1.5	1.5
Utah Route 56 at Iron Springs Road	(2)	(2)
Total Projected Accidents Per Year Along Haul Route	25.8	26.2

Source: Utah Department of Transportation 1994a.
Jager 1993.
Arizona Department of Transportation 1993b.
Nevada Department of Transportation 1993.
Berger 1993.
JHK & Associates 1993.

1 Based on existing accident rates and traffic volume projection of 15 years for Utah and Nevada and 25 years for Arizona.

2 Intersections at U.S. Hwy. 89/Warm Creek Road, U.S. Hwy. 89A/Arizona Route 389, Interstate-15/Hidden Valley Road, and Utah Route 56/Iron Springs Road have not recorded accidents in the past. Without previous accident rate, future accident numbers could not be projected.

involve another vehicle. One fatal accident was alcohol related and occurred when a car ran into the back of a coal truck that was stopped at a stop sign. If the Savage Industries accident rates were applied to the proposed Warm Springs Project truck haul from the proposed minesite to Moapa, operations would result in about 7.3 truck accidents per year (versus 21.4, using the DOT rates) and about 0.9 fatal accidents per year (versus 0.7, using the DOT rates). Savage Industries trucks in central Utah averaged about 6.5 Mtmt per year over the 5-year reporting period, while Warm Springs Project trucks would average about 29 Mtmt per year. Given the differences in operating conditions between the Project area and central Utah, accident rates for all trucks and for coal trucks only, and the Warm Springs Project truck haul operator and equipment and Savage Industries, Inc., it is felt that the number of accidents based on DOT accident rates and Savage accident rates bracket the actual number of accidents that could result from the Warm Springs Project.

The greatest number of accidents attributable to mining-related traffic would be expected to occur along U.S. Hwy. 89 between Big Water and Kanab, along Utah Route 59 between the Arizona State line and Hurricane, along Utah Route 9 between Hurricane and Interstate-15, and along Interstate-15. Although planned roadway improvements could improve the safety characteristics of sections of Utah Route 9, the existing accident rates were applied to the projected volumes to project future accident frequency. The number of fatalities (about 0.2 per year per segment) should remain fairly constant along these segments of the haul route.

No accidents were recorded during the most recent traffic accident data collection period along the Warm Springs Road, the Iron Springs Road, and the Hidden Valley Road or their related intersections. In addition, no accidents were recorded at the intersection of U.S. Hwy. 89 and Route 11 in Kanab, at the intersection of U.S. Hwy. 89A and Arizona Route 389 in Fredonia, or at other minor intersections in the area. No truck-related or fatal accidents occurred during the reporting period along Utah Route 11 between Kanab and the Arizona State line, along U.S. Hwy. 89A in Arizona near Fredonia, or along Utah Route 9 between Hurricane and La Verkin. The addition of mining-related traffic in these areas could potentially increase the number of accidents occurring in these areas; however, the historic accident rate for the areas has been low and would be expected to continue to be low. Future road improvements along Utah Route 9 between Hurricane and La Verkin should, however, improve the safety characteristics of this section of highway.

During the final reclamation phase of the proposed Project, when coal production and hauling operations have ended, Project-related traffic would decrease substantially and would be localized to the areas immediately adjacent to the mine and loadout facilities. This traffic would be limited to reclamation operations employees and any heavy trucks or equipment used in the reclamation process. This level of traffic should not be sufficient to affect any future area traffic accident levels.

To help reduce the potential for accidents, coal truck drivers would not be allowed to travel in convoys or groups. Using radio contact, coal trucks would maintain a minimum 1-mile spacing to allow safe passing and minimize congestion. Haul drivers would be responsible for obeying posted speed limits and other traffic laws (Appendix A, Section A.2.7.6, Truck Haul). Trucks would undergo safety and maintenance on a regular basis. Trucks would use tarps, mechanical closures, or other effective means to minimize coal dust emissions. All truck axles would be equipped with self-adjusting pneumatic brakes and compression (Jake) brakes to increase their safety on the hills.

After mine closure, general traffic levels in the area would drop slightly from the cessation of coal haul truck traffic and then would gradually increase as a result of increases in regional population. No additional effects from mine traffic would be anticipated. Cumulative effects from other projects (Appendix B), such as the Navajo Generating Station, have been considered in the future baseline accident rates discussed above. All effects on accident frequency from mining-related traffic are in addition to future cumulative traffic volumes.

The Agencies conclude that impacts to public safety in the Warm Springs Project area with mining-related traffic would range from moderate to major over both the short and long terms, with the potential to become significant along Interstate-15, Utah Route 9, Utah Route 59, and U.S. Hwy. 89.

4.2.7.5 Impacts to Structural Integrity and Stability of County Roads in the Smoky Mountain Area with Mining-Related Activities

Mining activities could cause subsidence of both the reconstructed Warm Creek/Benchtop Road and the existing Kelly Grade Branch of the Warm Creek Road where they cross the proposed Smoky Hollow life-of-mine area. Subsidence would cause dips in the roadway and/or a weakened roadway structure and could force slower vehicle travel because of uneven roadway surfaces (Section 4.2.1.1). Heavy vehicles travelling on roadways weakened by subsidence could cause further damage to the road. Poor road surface conditions would increase vehicle operating and maintenance costs. Weaker road surfaces and roadbed structure would accelerate roadway maintenance requirements.

If subsidence cracks or fractures appear on the surface, there would be a potential for damage to occur where roads cross into and over the subsidence trough. At the edges of the trough (between the limit of the mined-out coal and the edge of subsidence effects defined by the angle of draw), the road may drop in elevation and be affected by cracks. In other areas in the trough, buckles in the road surface may develop in sections affected by compressional forces. The severity of cracks and buckles would depend on whether brittle bedrock is at or near the surface in a particular location. The presence of soft, easily deformed, unconsolidated materials at the surface would reduce the severity of surface cracks and resultant damage.

About 1.5 miles of the Warm Creek/Benchtop Road in the upper reaches of the Smoky Hollow Canyon, 1.7 miles of the Kelly Grade Branch of the Warm Creek Road on Smoky Mountain, and 1.7 miles of the

Warm Springs Road on Smoky Mountain would cross over underground mine workings (Appendix A, Figure A-4). The primary north-south main entries to the proposed underground mine workings would lie under the Smoky Hollow drainage. The mining plan calls for barrier pillars to be left in place on either side of these main entries (Appendix A, Figure A-4). Also, in the lower part of Smoky Hollow Canyon, coal directly beneath the base of the canyon drainage would not be mined. Because of the support underneath this area, that part of the proposed Warm Creek/Benchtop Road from the surface facilities complex to the top of Smoky Mountain should experience little effect from subsidence, with the exception of potential sloughing of material from steep canyon slopes caused by the mining of panels adjacent to either side of the main entries. The coal left in barrier pillars would collapse many years after mining has ceased, but the effects are expected to be minimal. The majority of subsidence would be expected to end in this part of the life-of-mine area about 5 to 10 years after mining ceased.

The Kelly Grade Branch and the Warm Creek/Benchtop Road would cross over the easternmost parts of the underground mine workings where thickness of the overburden is 600 feet or greater. The road would be subjected to subsidence effects as described above, but because of the overburden depth and the flat topography at the top of Smoky Mountain, the effects would not be expected to be severe. Monitoring of subsidence (Appendix A) would be conducted to protect the potential users of the road. The mine operator would repair any damage to the Warm Creek/Benchtop Road and the Kelly Grade Branch of the Warm Creek Road resulting from mining-related activities, including damage caused by subsidence, mine vehicle traffic, or other heavy mining equipment traffic. The mine operator would also be responsible for temporary or permanent relocation of any sections of the road which could not be maintained in a satisfactory condition. Monitoring and maintenance of the roads would continue throughout the life of the mine. No long-term effects on the roads from subsidence would be expected.

After mining activity ceases, vehicle use of the county roads in the Smoky Mountain area would continue and is expected to increase in the future because of local and regional population increases. This traffic would continue to cause wear to the surface and structure of the roads in the area. Natural processes would also continue to act upon all roads in the existing county road system, with the structural integrity and stability of the roads subject to the severity of those natural processes.

The Agencies conclude that impacts to the structural integrity and stability of county roads in the Smoky Mountain area with mining-related subsidence would be minor over the short term and negligible over the long term.

4.2.8 Noise

4.2.8.1 Impacts from Noise Generated Along the Roads in the Warm Springs Project Area with Mining-Related Traffic

Traffic in the Warm Springs Project area will increase over time to projected future background levels (Table 4-1). These increases in traffic volume, unrelated to the proposed Project, will increase noise levels along area roadways. Project-related construction, operation, and reclamation would add traffic to area roadways and would contribute to increased noise levels as well.

Additional traffic during construction activities would range from about 8 to 10 vehicle trips per day on the roadways in the vicinity of the proposed Hurricane/Fredonia truck maintenance facility to about 90 vehicle trips per day on the roadways in the vicinity of the Moapa unit-train loadout (Section 4.2.7, Transportation). These vehicles would largely be personal use vehicles and limited to roadways adjacent to the sites. They are not expected to substantially affect current background noise levels (Chapter 3, Table 3-9).

During the period of full mine production, about 175 mine-related truck round-trips daily would be added to future traffic volumes along the haul route. In addition, mine workers, loadout employees, and truck maintenance facility employees would commute between home and work, and service-related vehicles would travel to the various mine facilities to deliver supplies. Coal haul trucks and other mining-related traffic would increase noise levels along the haul routes as single events and on a cumulative average level, with coal haul trucks initiating the highest noise level changes. Single-event noise level increases along the haul routes are expected to be localized and generally confined to the areas immediately adjacent to the road. Average single-event dBA levels (Maximum Noise Level) for coal haul trucks can range from about 75 dBA at 55 feet from a loaded coal haul truck travelling 55 mph to about 91 dBA at 30 feet from an empty haul truck traveling down a hill with a 5 percent grade (Andalex Resources, Inc. 1993). Time exposure during the maximum single-noise event would be about 10 to 15 seconds. Although the perception of what constitutes noise and what doesn't is extremely subjective, audible noise values higher than 80 dBA have been known to elicit widespread community complaints (EPA 1974). Single coal haul truck noise events during the night could be more noticeable, since overall background noise levels are generally lower at night (45 to 50 dBA). When a coal haul truck passes by a residential area during the night, ambient noise levels of about 45 to 50 dBA could be temporarily increased to about 70 to 90 dBA, depending upon the distance from the road and the terrain being traversed. Distance from the road to a residence, screening (such as trees and walls), and weather would all affect the dBA levels. Acclimation to the noise over time could reduce perceived noise effects. With the intermittent coal haul truck noise increases occurring about every 4 to 5 minutes, some community complaints could be elicited, particularly in the early stages of mine production (Chapter 3, Tables 3-8 and 3-9).

Haul truck noise could also illicit more reaction in communities than in rural areas because of the larger numbers of people. Some of the sections along the haul route, including roadways through Kanab, Fredonia, Hurricane, La Verkin, and Cedar City, already appear to have a background noise level that may be eliciting some complaints (Chapter 3, Tables 3-8 and 3-9). Over the 40-year operation life of the mine, background traffic levels would continue to increase because of regional population increases, and the area should experience gradual increases in noise levels. Mine-related traffic noise would account for a smaller percentage of the ambient noise levels as these volumes increase. Table 4-4 outlines projected peak hour traffic noise levels along selected segments of the haul route about 15 to 20 years in the future, both with and without the proposed Project. (See Appendix E, Section E.6, Noise Level Calculations.) Rural areas would experience the greatest increase in traffic noise since their background levels are generally lower overall. Decibel increases of 5 to 6 are generally identified as moderate noise level increases; increases of 10 dBA or more are identified as severe increases (EPA 1977). Most parts of the haul route between Big Water and the loadouts should experience relatively low dBA increases of 0.2 to 3.3. The Iron Springs Road leading to the unit-train loadout would experience an increase in noise level of 8.5 dBA. Since land uses along this roadway section are predominantly industrial, few noise sensitive receptors would be affected by these increased noise levels. The Hidden Valley Road outside Moapa would have a decibel level increase of 6 dBA over a short distance; however, no noise sensitive receptors have been identified in this section of the Hidden Valley Road (Table 4-4).

After mine production has ceased and during reclamation, background levels would have increased because of regional population increases; however, mining-related traffic would have decreased substantially and mining-related traffic noise levels would also have decreased. Although some Project-related traffic would be present, no effect on overall projected noise levels beyond background levels is anticipated during reclamation activities.

Coal haul trucks would not use compression (Jake) brakes in communities with local noise ordinances. Trucks would also undergo routine safety and maintenance inspections prior to every shift, and drivers would be instructed to not travel in convoys. Drivers would be required to maintain truck speeds through communities at or below posted limits, which should also help reduce truck noise levels (Appendix A, Section A.2.7, Truck Maintenance Facility and Truck Haul).

After mine closure, traffic levels would drop to projected future background levels and then continue to increase because of continued regional population increase; noise levels would increase accordingly. Cumulative noise effects from other projects (Appendix B) have been considered in the noise estimates discussed above. All effects on noise levels from mining-related traffic are in addition to future cumulative traffic volumes.

The Agencies conclude that impacts from noise generated along the roads in the Warm Springs Project area from mining-related traffic would be minor to moderate over the short term and minor over the long term.

Table 4-4 — Future Peak-Hour Traffic Noise Projections along Selected Area Roads

Roadway	Section	Traffic Noise w/o Project[1]	Traffic Noise w/ Project	Increase in Traffic Noise[1]
COMMON ROUTE TO HURRICANE				
Warm Creek Road	All.	46.7	71.0	24.3
U.S. Hwy. 89	Big Water to Kanab.	70.0	73.3	3.3
Utah Route 11	Kanab to Arizona State line.	71.1	73.9	2.8
U.S. Hwy. 89A	Utah State line to Fredonia.	74.6	76.1	1.5
Arizona Route 389	Fredonia to Colorado City/Utah State line.	74.9	76.3	1.4
Utah Route 59	Hildale/Arizona State line to Hurricane.	71.9	74.3	2.4
ROUTE TO MOAPA				
Utah Route 9	Hurricane to Interstate-15.	76.7	77.7	1.0
Interstate-15	Utah Route 9 to Arizona State line.	83.8	84.0	0.2
Interstate-15	Utah/Arizona State line to Arizona/Nevada State line.	83.4	83.7	0.3
Interstate-15	Nevada/Arizona State line to exit 88 in Nevada.	81.6	82.0	0.4
Hidden Valley Road	Interstate-15 to Moapa.	65.7	71.7	6.0
ROUTE TO IRON SPRINGS				
Utah Route 9	Hurricane to La Verkin.	74.8	76.2	1.4
Utah Route 17	LaVerkin to Interstate-15.	70.0	73.3	3.3
Interstate-15	Utah Route 17 to exit 59.	83.2	83.4	0.2
Utah Route 56	Interstate-15 to Iron Springs Road.	71.1	73.8	2.7
Iron Springs Road	Utah Route 56 to Iron Springs.	65.8	74.3	8.5

[1] IN dBA.
(See Appendix E for assumptions used in calculating future dBA.)

4.2.8.2 Impacts from Noise Generated in the Iron Springs and Moapa Areas with Mining-Related Loadout Activities

During loadout construction, the principal source of Project-related noise would be from operation of construction equipment, such as backhoes and dump trucks. Noise levels from equipment at a distance of 50 feet would range from 75 to 95 dBA for front loaders, backhoes, and trucks (Table 4-5). Noise levels for pumps, generators, and compressors would range from 70 to 85 dBA at 50 feet (EPA 1971). Noise levels would decrease with distance from the source. At 1,000 feet from the source, levels would be about 60 dBA, and at 4,500 feet from the source, they would be at a level acceptable for sensitive areas of about 51 Ldn. No noise-sensitive receptors, such as schools or residences, have been identified within a 4,500-foot radius of either of the proposed loadouts.

Noise sources associated with operation of the loadouts would include arrival and departure of trucks and trains, operation of conveyor belts, dumping coal, dozing the coal piles, and loading railroad cars. A dBA of 55 would be anticipated at distances of 700 to 850 feet from the loadout operations, and an Ldn of 55 would be anticipated at distances of about 2,180 to 2,600 feet from the loadout operations. (See Appendix E, Section E.6, Noise (Ldn) Level Calculations.) These levels are all within accepted noise limits identified by EPA for sensitive areas (EPA 1974, 1978).

Both the the Iron Springs and the Moapa unit-train loadout sites would be in essentially open country, adjacent to operating railway lines, and far from any residential or other sensitive land use. At the Iron Springs site, the nearest residential area is over 3 miles away. At Moapa, the nearest residential property is over 2 miles away. At any distance beyond 1 mile, the noise from these operations would be inaudible under conditions of normal sound propagation.

After completion of mine operations and reclamation, noise levels in the vicinity of the unit-train loadouts should return to generally premining operation levels. There may be some increase in ambient noise levels resulting from regional increases in traffic levels in the areas, but, generally, noise levels should be relatively low.

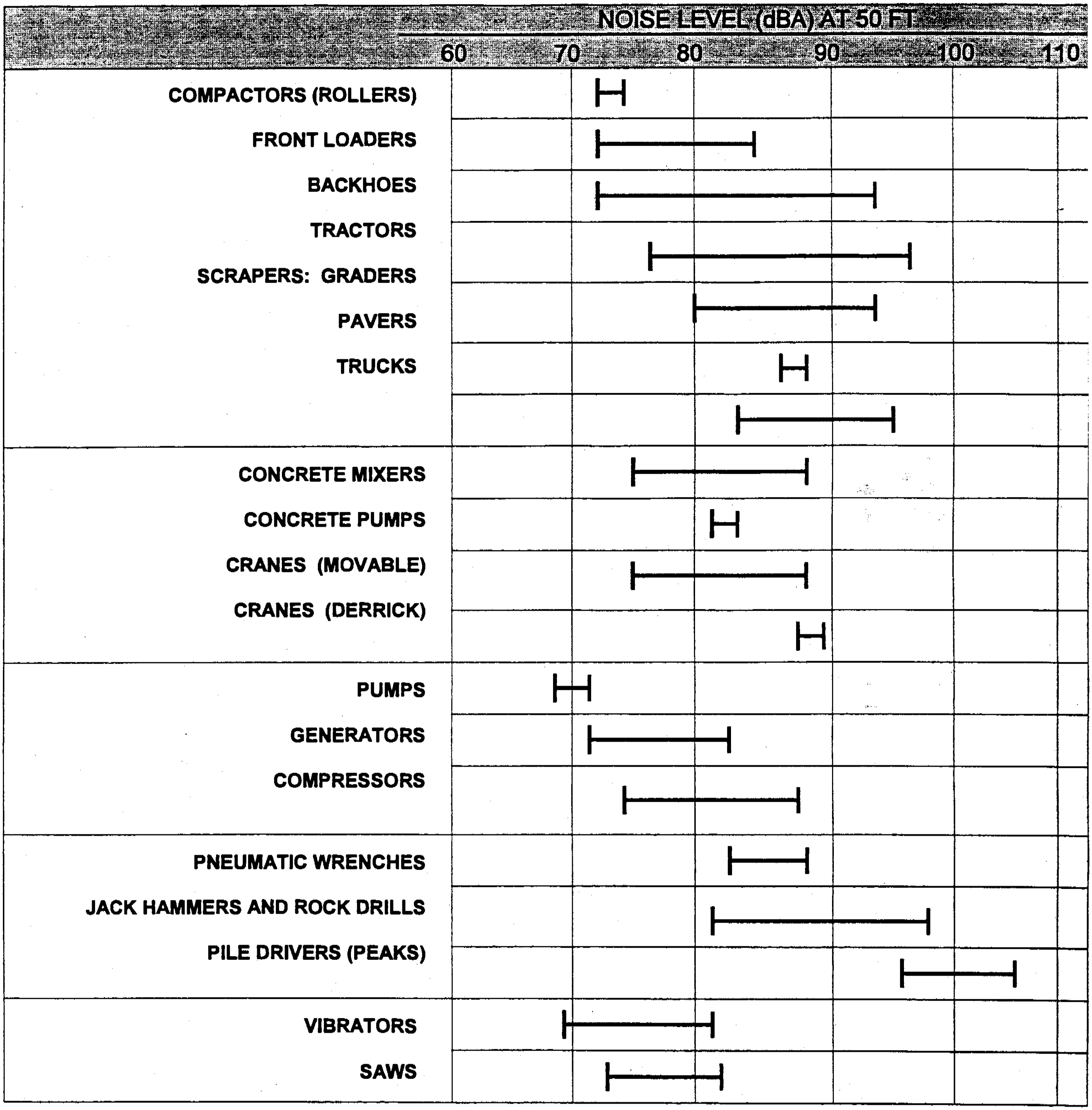
The Agencies conclude that impacts from noise generated in the Iron Springs and Moapa areas with mining-related loadout activities would be negligible over both the short and long terms.

4.2.8.3 Impacts from Noise Generated in the Smoky Mountain Area with Mining-Related Activities

Construction, operation, and reclamation activities in the Smoky Mountain area would increase noise levels in the area. During construction and reclamation, noise would generally be related to vehicle traffic and construction equipment, as discussed in Section 4.2.8.2 (above). Acceptable Ldn levels are expected to be

Table 4-5

Construction Equipment Noise Ranges



Source: EPA 1971

achieved outside a 4,500-foot radius. The Smoky Hollow surface facilities complex would lie in an isolated area, and no sensitive noise receptors, such as residences, have been identified within 1 mile of the minesite. The nearest areas of noise sensitivity appear to be the Burning Hills Wilderness Study Area, at a distance of over 3 miles, and the Glen Canyon NRA, at a distance of more than 6 miles.

During mine operation, principal noise sources at the surface facilities complex would be dominated by the crusher, truck loadout facility, and mine ventilating fan. Along the proposed Warm Creek/Benchtop Road, noise increases would be largely generated by mining-related traffic (Table 4-4). Noise increases related to mining traffic along the Warm Creek/Benchtop Road could increase by as much as 24 dBA above ambient background noise levels. No sensitive noise receptors are located along the Warm Creek/Benchtop Road outside Big Water, although the Benchtop road would pass near the Burning Hills Wilderness Study Area and the Warm Creek Road passes through a corner of Glen Canyon NRA. Coal trucks and other mining-related traffic would increase noise levels as single events. These single-event increases should be localized and generally confined to the areas immediately adjacent to the road. Average dBA levels in Big Water are estimated to range from 35 to 45 at night, and 50 to 60 during the daytime (Chapter 3, Table 3-8 and Figure 3-9). Mining-related traffic could increase noise levels to 71 dBA during both the day and night, a change of about 10 to 30 dBA from ambient conditions. EPA identifies noise increases of 10 or more decibels as being severe. (Section 4.2.8.1, Impacts from Noise Generated Along Roads in the Warm Springs Project Area with Mining-Related Traffic).

A 55 dBA Ldn is normally considered as an upper limit for acceptable residential conditions. With the 10 decibel nighttime weighing applied, an Ldn of 55 would be achieved by a continuous sound level at 48.6 dBA. A dBA of 48.6 (or Ldn of 55) would be expected at 2,089 feet from the proposed Smoky Hollow Mine crusher operation. An Ldn of 55 would be expected at 2,350 feet from the proposed truck loadout structure and at 4,940 feet from the proposed mine ventilating fan (Acoustical Engineers, Inc. 1994). (See Appendix E for a discussion on the noise measurements.) Based on the topography of the area and the proposed orientation of the mine equipment, it appears that any locations removed from the minesite by more than about 2,000 feet would benefit from the noise barrier effect of the surrounding mountains. Beyond this point, it would be expected that the noise levels from the mine operations would be essentially inaudible under any normal conditions of sound propagation. No noise sensitive receptors are located within 5,000 feet of the proposed Smoky Hollow surface facilities complex.

Heavy equipment used at the mine would be well maintained and fitted with adequate mufflers to further minimize noise levels. Also, loud stationary equipment would be partially or completely enclosed. Coal trucks would not use compression (Jake) brakes in communities with local noise ordinances. Trucks would also undergo routine safety and maintenance inspections prior to every shift, and drivers would be instructed to not travel in convoys. Drivers would be required to maintain truck speeds through communities at or below posted limits, which should also help reduce truck noise levels (Appendix A, Section A.2.7, Truck Maintenance Facility and Truck Haul).

After reclamation, activities would be completed, noise levels in the immediate vicinity of the surface facility complex would be expected to return to near premining levels. Traffic along the Warm Creek/Benchtop Road would be reduced substantially; however, the road would remain in place following mine closure, and projected future traffic along the road would prevent the complete return to premining noise levels.

The Agencies conclude that impacts from noise generated in the Smoky Mountain area with mining-related activities would be minor over both the short and long terms, with the potential to become significant along sections of the Warm Creek/Benchtop Road.

4.2.9 Socioeconomics

4.2.9.1 Impacts to Employment, Population, Personal Income, and Business Activity in the Warm Springs Project Area with Project-Related Activities

Employment created by the construction and operation of the proposed Warm Springs Project would include jobs associated with (1) development of surface and subsurface mine facilities, (2) construction of associated facilities, such as the 138-kV power transmission line, the unit-train rail loadouts, and the truck maintenance facility, (3) improvement/construction of the Warm Springs/Benchtop Road, (4) production and transportation of coal, and (5) postmining reclamation. In addition, secondary employment opportunities would be supported throughout the region by purchases of goods and services by the mining and transportation companies and by the households tied economically to the proposed Project. The secondary jobs supported by the proposed Project would benefit the region's economy and the residents by expanding the economic opportunities available and increasing the volume of business activity.

Peak employment effects during premining development, including secondary jobs, would reach about 580 jobs. The peak would occur in year 2 of the Project, when construction of ancillary facilities, premining development, and initial production would occur simultaneously. The new jobs would be widely dispersed between the unit-train loadout sites, the minesite, the truck maintenance facility, and communities in the region. In Iron County, Utah, and Clark County, Nevada, a maximum of 155 and 64 jobs would be created during construction, respectively. These would be the peak Project-related employment impacts occurring in these locations, as mining operations employment in these two counties would be lower than the temporary, construction employment.

At full production over the life of the Project, the combined direct and secondary employment would create a total of 822 to 832 jobs. Given the locations of the mine and truck maintenance facility and the anticipated residency patterns of direct Project-related employees, most of the added employment would be in Kane, Coconino, and Washington Counties (Table 4-6). The projected employment distribution also reflects a concentration of the secondary jobs supported by higher business and consumer purchases in Kanab, Page, Hurricane, and St. George.

Table 4-6 — Projected Project-Related Change in Regional Employment

County	Total[1] Employment Change with TMF[2] in		Baseline Employment in Year 2000	Project Employment Change Compared to Baseline-Year 2000	
	Fredonia	Hurricane		Fredonia (%)	Hurricane (%)
Coconino County, AZ	329	48	69,036	<1.0	<1.0
Kane County, UT	355	249	4,070	8.7	6.1
Washington County, UT	69	446	41,046	<1.0	1.1
Iron County, UT	55	55	15,591	<1.0	<1.0
Clark County, NV	24	24	680,026	<1.0	<1.0
Total	832	822	809,769	<1.0	<1.0

Source: U.S. Bureau of Economic Analysis 1994; Utah GOPB 1993.
[1]Total employment includes direct mine employment and secondary employment.
[2]Truck Maintenance Facility.

The hypothetical location of the truck maintenance facility is a major variable affecting the distribution of employment impacts. Locating the facility in Fredonia would increase employment impacts in Kane and Coconino Counties. Siting the facility in Hurricane would result in higher employment impacts in Washington County. The distribution of Project-induced secondary employment would be influenced by household residency patterns and the size of the local trade centers in the area. Thus, with the truck maintenance facility in Fredonia, many secondary jobs would be created in nearby Kanab, Utah, because of its larger base of stores and services. Similarly, businesses in Hurricane and St. George would be the principal beneficiaries of a truck maintenance facility in Hurricane. (A discussion of the economic and demographic projections methodology is presented in Appendix E, Section E.7, Economic-Demographic Impact Modeling.)

Employment impacts from the proposed Project would occur in addition to baseline economic expansion throughout the region. Both Clark County, Nevada, and Washington County, Utah, are expected to experience strong continued growth in the future. The competing demand for labor generated by such ongoing growth and the specialized skills associated with the direct Project-related employment opportunities would limit the number of positions filled by current residents. Thus, current residents of the region are projected to fill 21 percent of the employment opportunities generated by the proposed Project.

Households migrating to the region to fill available jobs would create population growth. Incremental population in the study area due to the proposed Project would range from 1,669 to 1,685 residents, with the distribution of Project-related employment and population mirroring the location of the proposed Project's primary job sites. Consequently, noticeable differences in the distribution of socioeconomic impacts would occur between the alternative locations of the proposed truck maintenance facility. (Projected Project-related changes in population are presented in Table 4-7.)

A commonly accepted planning assumption suggests that compounded population growth of 2.0 percent or more per year over a 3 to 5 year period will frequently tax a community's existing infrastructure and service provision capabilities. These situations may trigger additional housing construction, hiring of more staff, facility expansions, and infrastructure development. Much of the region is already facing such conditions with population increases in the Project area through the year 2010 projected to range from about 2.0 percent per year in Coconino County, Arizona, to 4.6 percent per year in Washington County, Utah. With the project in place, added growth pressures would result, with average annual growth rates increasing slightly to about 2.2 percent in Coconino County and 4.7 percent in Washington County. The most pronounced impact would occur in Kane County, with the truck maintenance facility in Fredonia, whereby the average annual growth rates would rise from 3.0 percent to 3.5 percent. Compared to the projected baseline populations in the year 2010, the largest impacts would be expected to occur in the communities of Big Water, Kanab, and Fredonia.

Table 4-7 — Projected Project-Related Change in Regional Population

County/Community	Population Change with TMF[1] in		Baseline Population in Year 2000	Project Change Compared to Baseline-Year 2000	
	Fredonia	Hurricane		Fredonia (%)	Hurricane (%)
COCONINO COUNTY, AZ					
Page	*249	*249	8,957	2.8	2.8
Fredonia	*179	7	1,486	12.0	<1.0
MOHAVE COUNTY, AZ	38	2	116,775	<1.0	<1.0
KANE COUNTY, UT					
Big Water	95	95	426	22.3	22.3
Kanab	690	230	4,448	15.5	5.2
Remainder	155	57	2,026	7.7	2.8
WASHINGTON COUNTY, UT					
Hurricane area[2]	*23	*298	10,406	<1.0	2.9
St. George	*95	*430	48,038	<1.0	<1.0
Remainder	26	198	23,401	<1.0	<1.0
IRON COUNTY, UT					
Cedar City	*97	*97	17,770	<1.0	<1.0
CLARK COUNTY, NV					
Moapa Valley	11	11	5,189	<1.0	<1.0
Remainder[3]	11	11	1,112,001	<1.0	<1.0
Total	1,669	1,685	1,350,923	<1.0	<0.1

Source: Andalex Resources, Inc. 1994
[1]Truck Maintenance Facility
[2]Includes the municipalitites of Hurricane, Toquerville, and La Verkin.
[3]Includes Mesquite and the Las Vegas Metropolitan Statistical Area.
*Includes individuals expected to reside in rural areas near the respective communities.

Wages and salaries to be paid to construction workers would total about $9.2 million over a 2-year period. Of the total, labor earnings of about $4.5 million would be associated with construction of the two unit-train loadouts, with an equivalent amount paid to construction workers developing the mine, associated facilities, and the Warm Springs/Benchtop Road (Andalex Resources, Inc. 1993).

During the premining development period, additional wages and salaries totaling $4.2 million per year would be paid to operating employees of the mine and the trucking contractor. At full production, projected annual wage and salary earnings totaling $15.8 million would be paid to employees directly associated with the proposed Project (Andalex Resources, Inc. 1993). These earnings would be important benefits accruing to the residents and businesses in the region. In 1992, average annual wage and salary earnings ranged from $14,725 in Kane County to almost $20,600 in Coconino County (U.S. Bureau of Economic Analysis, 1994a, b). The predicted average annual earnings of about $35,000 for the direct Project employees would be considerably above prevailing wages in the region.

Higher consumer household expenditures and local purchases of goods and services in the economy supported by the Project would stimulate secondary employment and incomes gains in the multicounty region. Household consumption outlays, not including housing costs, typically are about two-thirds of total personal income. Purchases of locally available goods and services by the mine and trucking firm are estimated at about $7.4 million annually (Andalex Resources, Inc. 1993). At full production, an additional $7.7 million in annual earnings would be realized by workers filling secondary jobs supported by the proposed Project. (See Appendix E for a discussion of how earnings were projected.) At full production, the combined direct and secondary wage and salary earnings associated with the proposed Project are projected at about $23.5 million annually (Table 4-8). This total is equivalent to 0.2 percent of the total wages and salaries paid to workers in the six potentially affected counties in 1992. However, the Project-related wages and salaries represent a substantial potential benefit to residents of the three Utah counties and Coconino County, Arizona, where the projected increase is equivalent to about 1.7 percent of the wages and salaries paid in 1992. Depending on the location of the truck maintenance facility, the proposed Project could generate up to a 50 percent increase in annual wage and salary payments in Kane County compared with those in 1992.

Retail, wholesale, and service establishments in Kanab, Page, Hurricane, St. George, and Fredonia would capture most of these sales. Businesses and institutions in St. George, such as health care providers, would also benefit. In addition, substantial expenditures for trucks, trailers, longwall mining equipment, and other mining supplies not available locally would be made to vendors located in central Utah, the Wasatch Front, and other locations outside the region.

While Iron, Washington, and Clark Counties have been successful in their industrial diversification efforts, the economies of Kane County and northern Coconino County remain heavily reliant on tourism. The proposed Project would benefit the local economies in Kane and Coconino Counties by increasing the

Table 4-8 — Projected Project-Related Change in Wage and Salary Income

County	Wage and Salary Increase with TMF[1] Operations (million $[2])		Wages and Salaries in Year 1992 (million $)	Project Change Compared to Year 1992 (%)	
	Fredonia	Hurricane		Fredonia	Hurricane
Coconino, AZ	$6.84	$3.92	$860.4	0.8	0.5
Mohave, AZ	0.22	0.22	550.6	0.0	0.0
Kane, UT	12.63	5.81	25.1	50.3	23.1
Washington, UT	0.97	10.77	302.4	0.3	3.6
Iron, UT	1.88	1.88	145.7	1.3	1.3
Clark, NV	0.97	0.97	10,775.7	0.0	0.0
Total	23.51	23.57	12,659.9	0.2	0.2

Source: U.S. Bureau of Economic Analysis 1994b.
[1]Truck Maintenance Facility.
[2]Wages and salaries in millions of constant dollars. Wage and salary are reported on a place of residence basis and include direct, indirect, and induced jobs. No allowances are included for non-earnings income.

economic diversification of the region, by creating higher wages and year-round employment, and by generating additional support for local businesses.

Increased truck traffic associated with the Project would result in increased traffic on the regional highway network, which could potentially affect future tourism and recreation visits in the region. Concurrently, improved access to Glen Canyon National Recreation Area and other Federal lands afforded by the Warm Creek/Benchtop Road could increase or alter the pattern of visitation. However, little or no net change of tourism-related employment, income, or sales would be expected as a result.

The end of mining and mining-related activity would occur in year 43 or 44. Most of the jobs and corresponding incomes directly associated with the proposed Project would be terminated at the end of full-scale production and initial reclamation. A limited number of jobs would continue through the completion of reclamation. The cutbacks in direct employment would trigger reductions in the number of secondary jobs supported by the Project. (The impacts to socioeconomic conditions at the end of mining and mining-related activity are discussed in Section 4.2.9.11.)

Although a number of projects have been identified as occurring within the Project area concurrent with the proposed Project (Appendix B), all have been considered in the projected economic and demographic baseline. Therefore, no additional cumulative impacts to employment, population, personal income, and business activity are projected. However, the Navajo Generating Station Scrubber Project (Appendix B) could temporarily generate additional economic and population growth in Page during the premining development period of the proposed Project.

The Agencies conclude that impacts to employment, population, personal income, and business activity in the Warm Springs Project area with Project-related activities would be beneficial and would range from moderate to major over both the short and long terms, with the potential to become significant in Big Water and Kanab, Utah, and Fredonia, Arizona.

4.2.9.2 Impacts to Local Government Fiscal Resources in the Warm Springs Project Area with Project-Related Activities

With approval of the proposed Project and the subsequent increases in population and economic activity, local governments would experience added demand for public services. Satisfying these demands may require more staff and operating and capital outlays. Public revenues would also increase, both directly and indirectly. Direct Project revenues include property taxes on improvements, equipment, and the capitalized value of the coal reserves, sales taxes on local purchases of goods and services, and other miscellaneous fees. Indirect revenues, generated by the same mechanisms, would be produced from households supported directly and indirectly by the mine or trucking firm.

Direct revenues to local governments would accrue primarily in Kane County in the form of property taxes levied on the assessed valuation of the mine. These revenues would fluctuate over time on the basis of the valuation of the coal reserves and as the equipment, such as the longwall mining system, is installed new, depreciates, and is then refurbished or replaced. Over the life of the mine, Kane County's annual property tax proceeds from the mine are projected to average about $334,000 (1994 dollars) based on current tax levies and the projected assessed valuation of the mine (Utah GOPB 1993; Utah Foundation 1992). Kane County would also realize substantial sales tax revenues, receiving credit for some purchases made elsewhere in Utah, as well as other taxes and fees. Once production and the initial reclamation have been completed, these incremental revenues would cease.

Iron County, Utah, and Clark County, Nevada, would receive property tax revenues in conjunction with the proposed unit-train loadouts estimated at about $13,400 and $11,900 annually over the short term (Andalex Resources, Inc. 1993; Utah Foundation 1992; Nevada Department of Transportation 1994). Washington County, Utah, or Coconino County, Arizona, along with the corresponding communities of Hurricane or Fredonia could garner property taxes from assessments on the truck maintenance facility and trucking fleet. There is some uncertainty regarding the applicability of such taxes, however, as the trucks would have apportioned registrations and may be considered interstate carriers and thus exempt from property tax.

Each of the five affected county governments would see some increase in local sales tax receipts. The increases would be limited in amount, as most of these purchases and the associated revenues would accrue primarily to the city governments.

Both county and municipal governments would benefit from indirect revenues associated with the proposed Project. These include property taxes on real and personal property, sales and franchise taxes and other fees, and intergovernmental transfers from the respective States and the Federal Government. Local governments increasingly rely on such revenue-sharing transfers. For example, as a result of statewide property tax reform in Arizona, transfers from the State, funded on a per capita basis, now account for more than 50 percent of the general fund budgets of Page and Fredonia (Kimball 1994a; City of Page 1992).

A fiscal analysis of the proposed Project by the State of Utah concluded that the net fiscal impact on local city and county governments in southwestern Utah (a region encompassing the three Utah counties considered in this study) would be decidedly favorable over the near term (Utah GOBP 1993). Net revenues to local governmental units, after accounting for projected increases in public service expenditures, were estimated at $1.8 million annually. The State's analysis used somewhat different assumptions regarding workforce and residency patterns from those developed for the current analysis, but the differences would not materially alter the conclusion of the State's analysis (Utah GOBP 1993).

The State's analysis did not address possible different effects among the various potentially affected units of local government. However, the direct property tax revenues attributed to the Warm Springs Project, most of which would accrue to Kane County and to the Kane County School District to support public education, are the single largest source of local revenue. If these are overlooked, the analysis still indicates a modestly favorable impact on local governments in southwestern Utah over the near term (Utah GOBP 1993). However, most localities would experience limited net fiscal impacts, either positive or negative, from approval of the proposed Project.

The city of Kanab would experience modest increases in both revenues and expenditures in conjunction with the development and operation of the mine and the associated increases in resident population and business activity. Added changes would result with the truck maintenance facility located in nearby Fredonia. Many employees of the trucking firm would be expected to live in Kanab and the surrounding area, thereby increasing demands on services. Concurrently, local business would benefit from higher retail trade. Local property taxes and other revenue streams would also expand. These changes would likely result in a favorable impact on the city's budgets. With the truck maintenance facility in Hurricane, such changes would be more limited, but the net effect would still be positive.

With the truck maintenance facility located in Hurricane, that community's fiscal resources would be affected substantially. Fiscal resources are already under pressure from ongoing growth and development. Property tax revenues generated on residences of Project-related employees, the fleet of trucks and trailers, and added commercial development would increase. Sales tax receipts would also climb, owing to local purchases by the trucking contractor and higher consumer spending. The revenues would be offset by the added costs of serving an expanded population. The net effect would likely be limited. However, the city of Hurricane could experience a modest adverse impact on its fiscal conditions should it be determined that the fleet is exempt from personal property taxes.

To the extent that net adverse impacts might occur, the communities most likely to be so affected include Big Water, La Verkin, and Toquerville the latter two being affected by the location of the proposed truck maintenance facility in Hurricane. These situations would arise as a result of the limited fiscal resources of these communities, the staff needs, and the infrastructure improvements that the communities would face to accommodate baseline and Project growth, as well as the limited additional revenues that would accrue from the proposed Project. With higher populations, increased allocations of State revenue transfers are likely, and impact assistance from the State of Utah could be pursued to address such needs. In Big Water, the added population and Project-related traffic could lead to additional retail trade that would substantially increase locally generated sales taxes.

Limiting the travel by the haul trucks to major State and Federal roads maintained by the respective State transportation agencies effectively shields most local governments from substantial increases in road maintenance burdens. However, a special situation arises in connection with Kane County and its plans to improve/construct the Warm Creek/Benchtop Road between Big Water and the top of Smoky Mountain. According to a resolution by the Kane County Commission the road will "provide safe and convenient accommodation of traffic associated with the management and use of public land resources within the county * * * and would also serve the Smoky Hollow Mine" (Kane County 1993). Construction financing has not been finalized. The basic plan under consideration by Kane County envisions the use of a long-term loan from the Permanent Community Impact Fund, or the issuance of a long-term debt to finance construction. The Permanent Community Impact Fund is funded by mineral lease royalties returned to the State by the Federal Government. It provides loans and/or grants to State agencies and political subdivisions of the State (e.g., counties, municipalities, school districts, and special districts) that are or may be socially or economically impacted by mineral resource development on Federal lands. Some mineral lease royalties would also accrue to the Utah DOT Special Service District Fund, which can be made available to address local transportation needs. The revenues however, are dispersed by the State; they do not accrue directly to the local governments.

Loan repayment or debt service is anticipated to be provided by some combination of the following: Kane County's allocations of Class "B" road funds from the Utah Highway Users Fund; grants from the Permanent Community Impact Fund (PCIF) and Utah DOT Special Service District Fund; repayment guarantees provided by the users, tolls, or possibly local revenues. Motor fuels taxes generated by the portion of coal hauling operation occurring in Utah would accrue to the State's Highway Users Fund, from which the class "B" distributions are made. Operation of the proposed Smoky Hollow Mine at full production would generate about $492,000 per year for the PCIF and about $379,000 per year for the Utah DOT Special Service District Fund during the life of the mine.

The fiscal analysis by the State of Utah concludes that the Warm Springs Project would generate sufficient revenues into the various funds to provide adequate debt service (Utah GOBP 1993). However, such funds are not statutorily dedicated for return to the county of origin, and the amounts to be generated are contingent upon full production at or above the assumed price-per-ton values. Lower than anticipated production prices or other unforeseen events, could require funds from other sources or other responses to satisfy repayment requirements. With no assurances regarding future revenues, it cannot be concluded that Kane County or another public entity would not face some residual fiscal risk in conjunction with construction of the Warm Creek/Benchtop Road.

Fiscal impacts to the towns of Moapa and Glendale would, by definition, be limited, owing to the small population impact and specific type of the activity at the Moapa unit-train loadout. Changes in both public sector revenues and expenditures would be limited.

In Arizona, the city of Page would see increased revenues and expenditures resulting from immigration of households employed at the mine and those supported indirectly by consumer and business purchases. The changes would begin during construction and extend through final reclamation after mining is complete. The city levies no property tax, relying instead on sales taxes generated largely from visitors to nearby Lake Powell and on transfers from the State and Coconino County. The transfers are generally on a per capita basis; higher revenues can be expected to accompany higher population. Consequently, approval of the proposed Project would not adversely affect Page's overall fiscal condition.

The town of Fredonia has seen its tax base weakened from cutbacks by two major employers. Sales taxes and intergovernmental transfers were adversely affected. Fredonia has no property tax supporting its general fund. With the truck maintenance facility in Fredonia, sales and use tax revenues and intergovernmental transfers would increase substantially. However, the town anticipates that it would only face a limited increase in municipal service costs to maintain/improve the level of services to the expanded population, as it has previously served a comparable population. Therefore, the town anticipates reaping fiscal benefits from the proposed Project (Kimball 1994a). Fredonia would experience little fiscal impact with a facility located in Hurricane, even though some workers would still locate there.

Neither of the Arizona municipalities nor Coconino County would have access to any direct impact assistance funded by mineral royalties from the proposed Project, as those funds are returned to the jurisdiction in which production occurs, which, in this case, is the State of Utah.

At the end of mining and reclamation, direct revenues from the Project would cease, and indirect revenues and expenditures would decline as a result of out-migration. (The impacts to socioeconomic conditions at the end of mining and mining-related activity are discussed in Section 4.2.9.11.)

Although a number of projects have been identified as occurring within the Project area concurrent with the proposed Project (Appendix B), all have been considered within the projected fiscal baseline used in this analysis. Therefore, no cumulative impacts to local government fiscal resources are projected to occur.

The Agencies conclude that impacts to local government fiscal resources in the Warm Springs Project area with Project-related activities would be beneficial and moderate to major over the short term and adverse and moderate over the long term. Fiscal impacts would be beneficially significant in Kanab, Big Water, and Kane County, with the potential to become beneficially significant in Fredonia and adversely significant in Hurricane.

4.2.9.3 Impacts to State and Federal Fiscal Resources with Project-Related Activities

State governments provide a wide range of administrative and support services to residents, businesses, and visitors. Among these are public revenue collection and distribution, provision and maintenance of safe highway systems, judicial systems and corrections, and public education.

Approval of the proposed Project would precipitate increases in general revenues to the State treasuries, as well as contribute to the overall requirements for services. Compared to the existing and future general revenues and expenditure requirements, the level of economic activity and population growth associated with the proposed Project would be generally imperceptible.

Impacts to fiscal resources can be separated between those that would be household related and those directly tied to the construction and operation of the Project. With respect to household-related effects, the following impacts on revenues and expenditures can be anticipated.

Nevada has no personal or corporate income tax. Rather, it relies on sales and excise taxes, taxes on gaming proceeds, and other direct taxes on businesses, such as a gross proceeds tax on mineral mining. Consequently, Project-related increases in general fund revenues would be very limited, both as a result of the small employment and income effects associated with the proposed Project and as a result of the State's fiscal structure. The small population impact in Nevada would similarly minimize the effect on the demand for services. Owing to the limited scale of these impacts, no quantification is undertaken.

Arizona imposes both personal and corporate income taxes, as well as sales and excise taxes. Population impacts in Arizona are projected at 258 people with the truck maintenance facility located in Hurricane and 466 residents with the truck maintenance facility located in Fredonia. Population impacts of this scale should not require higher State expenditures for infrastructure or capital. General expenditures by the State of Arizona for public education and highways averaged about $1,022 per capita (Chapter 3, Table 3-14, adjusted to 1994 dollars). Assuming that the Project induces proportional effects on expenditures, the corresponding annual impacts for the State of Arizona would be about $264,000 if the truck maintenance facility were located in Hurricane, or $476,000 if the truck maintenance facility were located in Fredonia. Offsetting these costs would be additional revenues. Incremental income and sales-tax-derived increases in household wage and salary income over the short term would yield $178,000 annually if the truck maintenance facility were located in Hurricane, or $303,600 annually if the truck maintenance facility were located in Fredonia. Revenues would also be derived from other taxes and fees. At the same time, no existing source of revenue would yield a substantial positive surplus to the State. Consequently, any net effect would be limited in absolute terms and in comparison with the overall budget of the State.

Impacts to the State of Utah's general revenues and expenditures would be greater than those to Arizona or Nevada, owing to the location of the proposed mine, one loadout, and the possible location of a truck maintenance facility in Utah. Consequently, economic and population effects would be more heavily concentrated in Utah. A comprehensive fiscal analysis of the proposed Project undertaken by the Utah Governor's Office of Planning and Budget (Utah GOPB) considered the direct and indirect impacts on the State's budgets (Utah GOBP 1993). The State's study concluded that the net fiscal impact of the proposed Project would be positive over the life of the Project, with indirect revenues accruing to the State projected to average about $2.25 million per year, compared to indirect expenditures projected to average about $1.94 million per year (both in 1993 dollars).

The proposed Project would generate substantial direct revenues beyond those accruing indirectly. These revenues include sales and use taxes, mineral lease royalties, State land payments and other miscellaneous taxes, as well as motor vehicle and fuel taxes and fees. With the truck maintenance facility located in Hurricane, virtually all the revenues, with the exception of some motor vehicle and fuel revenues, would accrue to the State of Utah. Nevada would gain few direct revenues, and the impact on Arizona's revenues would depend on the location of the truck maintenance facility.

In Utah, corporate income taxes would be minimal on the basis of the expected applicability of tax credits for exported coal and the operating margin for the trucking firm. At full production, the State's analysis projects annual general revenues averaging about $3.3 million. Mineral royalties, consisting of both the State's allocation of Federal royalties and the royalties accruing from production of reserves underlying State Trust lands, would account for nearly half the total, about $1.5 million annually. Sales and use taxes would average about $1.06 million, or about one-third, and the other revenues associated with the trucking operations would account for the remainder, $0.95 million (Utah GOBP 1993).

Only limited direct expenditures, with exception of construction and maintenance costs for highways, are foreseen. Almost the entire sum of the direct sales taxes and royalty revenues generated by the Warm Springs Project thus represent net gains to the State. However, the entire sums are not available to fund general expenditures, as statutory distributions have been established for both Utah's royalties from coal production on State leases and the State's share of Federal royalties from production on Federal leases. For Utah's share of Federal royalties, the distribution would include: 32.5 percent to the Community Impact Assistance Fund, 25.0 percent to Utah DOT, 33.5 percent to the Board of Regents, and 9.0 percent to other agencies and discretionary allocations. Royalties derived from State Trust lands are deposited in a permanent Trust fund, with the interest earned there upon allocated to public education. Distributions from these funds provide substantial revenues for impact mitigation precipitated by natural resource development and for the support of both higher and primary public education.

With the truck maintenance facility located in Fredonia, some of the sales taxes associated with the trucking operation would shift to Arizona. Utah would continue to receive the mineral royalty payments and sales taxes generated by direct purchases of the mine in Utah. The potential magnitude of such a shift is uncertain because of such factors as the location where the trucks and trailers are initially acquired and whether taxes are paid at the point of sale on purchases made outside Arizona. Assuming that all such revenues accrued to Arizona, the State would realize nearly $500,000 per year from this source. Arizona would also accrue sales tax revenues on purchases made by the mine in northern Arizona. With little increase in direct expenditures associated with the truck maintenance facility, these revenues would offset any potential shortfall revenues from indirect sources, leaving the State with a net gain.

A specific concern identified during scoping is the potential fiscal impact on the respective State transportation agencies responsible due to the added costs of highway construction and maintenance. The volume of heavy truck traffic generated by the Project would contribute to deterioration of highways along the haul routes, raising maintenance costs for rehabilitation and/or accelerating the need for major reconstruction. Utah DOT and Nevada DOT provided information regarding these costs (Utah GOBP 1993; Conti 1993; Law 1994). Data from Utah DOT were used to estimate future costs to Arizona DOT. On an annualized basis, the added highway maintenance and reconstruction costs attributed to the proposed Warm Springs Project are projected at $385,000 per year in Arizona, $175,000 per year in Nevada, and $760,000 per year in Utah (Table 4-9). The costs apply to the existing network, exclusive of future system improvements or modifications, such as new community bypasses, which might be built to address the combined baseline and Project-related traffic. The costs do not provide for any incremental staffing or other ongoing agency operating costs that may be required.

Revenues generated by the trucking operation to address these needs would include motor vehicle registration fees, overweight/overlength permits, and motor fuel taxes. The three States participate in two multistate agreements that provide for prorated distribution of such funds on the basis of the corresponding percentage of the annual mileage accumulated in each State. Thus, the three States would share in these revenues, regardless of where the truck maintenance facility would be located. All three States dedicate these revenues for highway construction and maintenance, rather than commingling them into the general fund. In addition, Utah DOT would receive a share of the State's allocation of Federal mineral royalty receipts.

Over the life of the Project, revenues accruing to Arizona are projected to average about $318,000 per year, which would precipitate a shortfall of about $67,000 per year relative to the added expenditures. Nevada revenues would be about $279,000 per year, yielding a surplus of about $104,000 per year. Nevada's comparatively higher revenues reflect its registration and overweight fee structure. Revenue accrual to Utah DOT would average about $949,000 per year, providing an average surplus of about $189,000 per year. The projected revenues do not include allowances for any additional Federal funds linked to the $1.24 million in motor fuel and heavy motor vehicle use taxes generated annually (Utah GOBP 1993; Utah State Tax Commission 1994a, b; Nevada Department of Transportation 1994; Arizona Department of Transportation 1994).

The proposed Project would produce revenues to the Federal treasury; for instance, general personal and corporate income taxes and excise taxes. There are specific revenues tied to mining that would yield substantial revenues. At full production these revenues would include: $1.75 million annually from the retained share of mineral royalties, $2.15 million in payments into the Federal Black Lung Program, and $375,000 for the Abandoned Mine Land Reclamation (AML) Fund. Federal highway users' revenues would exceed $1.24 million annually at full production (Andalex Resources, Inc. 1993).

Upon completion of production, coal hauling, and reclamation, revenues derived directly from mining and mining-related activity would cease accruing to the Federal and State treasuries. However, some of the

Table 4-9 — Projected Project-Related Change in State Highway Maintenance Budgets

State	Share of Total Mileage (%)	Expenditures Over 40 Years Mid-Range	Revenues Over 40 Years[2]	Surplus or (Deficit)
Arizona	23.7	$11,550,000	$9,555,000	($1,995,000)
Nevada	9.1	5,250,000	8,372,000	3,122,000
Utah	67.2	22,800,000	28,463,000	5,843,000

Source: Utah GOPB 1993, Conti 1993, Law 1994.
[1]See Appendix E for additional details regarding limitations of expenditure and revenue computations.
[2]Revenues based on assumption that 1.25 million tons of coal is transported to each loadout.

indirect revenues and expenditures derived from household expenditures could continue to accrue, and funds added to Utah's permanent Trust fund would continue to earn interest to support education. (The impacts to socioeconomic conditions at the end of mining and mining-related activity are discussed in Section 4.2.9.11.)

Although a number of projects have been identified as occurring within the Project area concurrent with the proposed Project (Appendix B), all have been considered within the projected fiscal baseline used in this analysis. Therefore, no cumulative impacts to State and Federal fiscal resources are projected to occur.

The Agencies conclude that the impacts to State and Federal fiscal resources with Project-related activities would range from minor to moderate over the short term and minor over the long term. Impacts would be beneficially significant in Utah.

4.2.9.4 Impacts to Housing Availability in the Warm Springs Project Area with Project-Related Population Growth

With approval of the proposed Warm Springs Project and the subsequent increase in population, there would be increased demand for housing. Housing impacts may occur if an area's housing supply is inadequate to support construction or operations households moving to the area. Housing inadequacy can be caused by a number of factors, such as a lack of affordable housing, low vacancy rates due to high demand, and depressed economic conditions in the area (which lead to little demand to support construction of additional housing), or inadequate utility infrastructure to serve new housing units. Potential impacts related to inadequate housing include longer commutes, trespass camping, higher workforce turnover, and workers residing in motel accommodations, potentially impacting availability of accommodations for tourists.

Although housing availability is generally limited throughout southern Utah and northern Arizona, there appears to be adequate land and interest in developing additional housing for the projected baseline and Project-related population. Recent growth in southern Utah and northern Arizona has created a considerable demand for housing in Page, Kanab, Hurricane, and Toquerville.

Page is about 40 miles from the Project site. Page and the nearby areas would be expected to house many of the construction and mine workers. At full production, the projected population in Page would be 193 people, with an associated peak housing demand of 64 units. There are currently 527 lots approved in Page, and existing housing will likely become available following completion of the Navajo Generating Scrubber Station in 1999. Thus, it is not anticipated that housing availability would be a problem in Page. However, Page is exceeding its Federal daily pumping allocation from Lake Powell for domestic water supply and may not have adequate water for future population growth if this problem is not resolved (Nichols 1994) (Section 4.2.9.7, Impacts to Water and Sewer Systems from Project-Related Population Growth).

Although the current housing market is tight in Fredonia, it is anticipated that there would be adequate housing available for in-migrating workers choosing to live there. More than 200 lots are currently approved for development of either mobile homes or site-built homes; this is more than adequate, assuming 54 housing units are required for the maximum Project-related population increase of 163 people within Fredonia.

Housing markets are limited in Kane County, Utah, both for rentals and for units listed for sale. However, housing development already is occurring to meet demand associated with the Navajo Generating Station Scrubber Project at nearby Page, Arizona, and to meet demands associated with other non-Project related growth. The Warm Springs Project would create a maximum additional demand for 314 dwelling units in Kane County, based upon the projected population growth of 845 persons. The town of Big Water, the nearest community to the proposed Smoky Hollow Mine, would require 10 percent of the total, or about 32 housing units. The remaining 282 housing units would be required in and near Kanab.

There is adequate land available for development in Big Water. Approved lots in Big Water, as well as those in the Greenehaven development (1,100 units approved), located just south of the Utah-Arizona State line between Big Water and Page, could provide adequate housing for those operations workers who would choose to live relatively close to the mine. No speculative development is occurring now in these areas in anticipation of the proposed Project.

Peak housing demand in and near Kanab would occur in conjunction with full-scale coal production at the Smoky Hollow Mine, during which time direct and indirect employment stimulated by the proposed Project would stabilize. Peak demand for housing in Kanab also would be associated with the location of the truck maintenance facility in Fredonia, Arizona. Impacts on housing in and near Kanab would be lower if the truck maintenance facility were located in Hurricane, Utah. Because of housing development already occurring in the area, Kanab is predicted to be able to meet housing needs created by the Warm Springs Project (Alvey 1994).

If the truck maintenance facility were located in Hurricane, the projected demand for housing in that community during operations of the proposed Project would be 75 housing units. Hurricane has 400 to 500 approved residential lots available for development; this would be more than adequate to meet the projected proposed Project population of 225, assuming no other large-scale projects commence operations in the area prior to the proposed Project. However, Hurricane may also be limited in its ability to allow housing development owing to water availability (Section 4.2.9.7, Impacts to Water and Sewer Systems from Project-Related Population Growth).

Housing growth in Toquerville is currently limited by the fact that the city does not have adequate water supplies to serve new development. The question of whether Toquerville can provide the 10 housing units for the projected population increase of 30 persons related to the Project if the truck maintenance facility were to be located in Hurricane would depend on whether water becomes available in the next several years (Wahlquist 1994).

The limited number of employees at the unit-train loadouts (Appendix A) are not expected to have noticeable effects on housing, schools, or utilities in the Iron Springs/Cedar City or Moapa areas.

After the end of mining and mining-related activity, many Project-related employees would emigrate to other locations for job opportunities, making some housing available for other growth that may occur in the communities of the Project area. (The impacts to socioeconomic conditions at the end of mining and mining-related activity are discussed in Section 4.2.9.11.)

Although the Agencies have identified a number of projects that may occur concurrently with the proposed Project (Appendix B), these projects have been considered in the projected baseline used for the analysis. Therefore, there would be no additional impacts to housing owing to reasonably foreseeable cumulative development within the Project area. The construction workforce at the Navajo Generating Station Scrubber Project is scheduled for downsizing about the time that the proposed Project would reach operating levels. The net effect would be generally positive, in that housing demand created from the proposed Project potentially could be met by housing vacated by construction workers leaving the area.

The Agencies conclude that the impacts to housing availability in the Warm Springs Project area with Project-related population growth would be moderate over both the short and long terms. Impacts to housing have the potential to become significant in Page and Toquerville.

4.2.9.5 Impacts to Public Safety Agencies in the Warm Springs Project Area with Project-Related Activities

Public safety agencies, such as fire departments, law enforcement agencies, and ambulance services, respond to the demands related to population levels and traffic volumes. The fewer people and vehicles in an area, the less frequently routine problems occur. Therefore, as the population base increases and traffic volumes increase, the number of problems also increases. Service requirements increase, necessitating additional staff, equipment, and overall expenditures for public safety operations and equipment.

Many of the Project area's emergency responders operate with limited personnel (Nichols 1994; Crosby 1994; Fawcett 1994; Jackson 1994; Wahlquist 1994). Accidents in one location can leave an agency without sufficient personnel to respond to other emergencies. Additional traffic and criminal activity from increased population related to the proposed Project would exacerbate the existing situation. Without additional personnel and equipment in the affected areas, response time could increase, and the overall level of service potentially could decline.

Project-related population impacts would be greatest in Kanab if the truck maintenance facility were to be located in Fredonia. Fredonia law enforcement is adequate to serve the projected future population (Kimball 1994a), but one more police officer and support equipment would be required in Kanab to accommodate the maximum projected Project-related population growth of 690 persons (Crosby 1994). To maintain a higher level of service, two officers and support equipment would be needed. Additional staff would also be needed for clerical work for the courts, justice and attorney functions, dispatch, and the jail.

An additional sheriff's deputy would be required to provide adequate coverage for the population growth of 940 people projected to occur in Kane County if the truck maintenance facility were to be located in Fredonia (Jackson 1994). Currently, Big Water needs a full-time deputy stationed in the town, to serve the existing population. If this position were not filled prior to development of the proposed Project, two officers would be needed to handle the influx of new population.

Regional population increases over the life of the mine would gradually increase the number of emergency responses required in the area. After the end of mining and coal transport, the number of calls and the emergency response time related to public safety problems would be reduced. (The impacts to socioeconomic conditions at the end of mining and mining-related activity are discussed in Section 4.2.9.11.)

Mine Safety and Health Administration (MSHA) regulations require that all coal mining operations have available 24-hour ambulance service or other emergency transportation for any person injured at the mine. Both the Kane County Hospital (Kanab) and the Page Hospital maintain advance-life-support intermediate-level ambulances, which could respond to emergency calls from the Smoky Hollow Mine. The mine operator would also maintain company-owned vehicles at the minesite for emergency transportation. Adequate first aid stations would also be maintained within the mine at each underground working section and at the working areas of the surface facilities complex, such as the shop/warehouse, the bathhouse, and the main office. Similar first aid stations would be maintained at the loadouts as well.

The Agencies have not identified reasonably foreseeable cumulative projects within the proposed Project area that would add to the impacts on public safety providers, over and above the current economic expansion in the Project area, which has been incorporated in the projected baseline for this analysis.

The Agencies conclude that the impact to public safety agencies in the Warm Springs Project area with Project-related activities would be moderate over both the short and long terms.

4.2.9.6 Impacts to Public Schools in the Warm Springs Project Area with Project-related Population Growth

Projected population effects of the proposed Project indicate public school enrollment increases of 370 to 375 students during premining development. During the extended operations period, total enrollment changes are estimated at 559 to 563 students, depending on the location of the truck maintenance facility. (See Appendix E for a discussion on student enrollment.)

Based on household residency patterns, the increases would be distributed across seven school districts in six different counties in three States. Enrollment effects in eastern, nonmetropolitan Clark County, Nevada, and Mohave County, Arizona, are limited; therefore, impacts on the districts servicing these areas were not considered. Impacts were assessed for the Iron County, Washington County, and Kane County School Districts in Utah, and the Page Unified District No. 8 (Page) and Fredonia-Moccasin Unified School District No. 6 (Fredonia) in Arizona.

Among these five districts, the peak change in enrollment ranges from 21 students in Iron County, Utah, to 207 students in Kane County, Utah (Table 4-10). The peak changes affecting the Kane County, Fredonia, and Page School Districts would occur during full production at the mine and with the truck maintenance facility located near Fredonia.

Higher enrollments would translate into needs for more instructional, administrative, and support staff, higher payrolls, and other maintenance and operating expenditures. Based on 1992-93 outlays and the projected enrollments, the Project-related impacts range from less than $9,000 per year for the Fredonia district (assuming the truck maintenance facility were to be located in Hurricane) to $824,688 per year for Kane County School District (assuming the truck maintenance facility were to be located in Fredonia) (Table 4-10). In most instances, the predicted impact relative to the current operating budgets is 2 percent or less. The Kane County School District would experience substantially higher operating outlays under either truck maintenance facility location option. Should the truck maintenance facility be located in Hurricane, the effect on Washington County costs would rise to $567,936, compared to $89,088 for the Fredonia location.

Both Arizona and Utah have State-supported public education systems. Consequently, the added enrollments would likely increase the amount of State funding received, relieving the individual districts from bearing the full burden for local public education. As a result of the statewide funding support for public education, school officials in the various districts anticipate little or no adverse impacts on local maintenance, operating, and nonfacility capital budgets from the proposed Project (Sides 1994; Tate 1994; Willardsen 1994).

In addition to immediate effects on maintenance and operations outlays, enrollment growth could also affect facility requirements of the various school districts. The effect would depend on the relationship between the peak Project-related enrollment and available capacity to accommodate further growth (Table 4-11). Peak Project-related enrollments, on a district-specific basis, represent increases ranging from less than 1 percent to 26 percent of current enrollments. Relative to available capacity, the added enrollments would absorb 15 percent or less of the reserves in four of the communities.

Table 4-10 — Projected Project-Related Changes in School District Operating Budgets

District	1992-1993 Operating Expenditures	Operating Expenses/Pupil	Peak Enrollment Impact[1]	Additional Operating Expenditures	Project Impact (%)
Iron County	$17,232,632	$3,308	21	$69,468	<1
Kane County	5,379,818	3,984	207;84	824,668; 334,656	15;6
Washington County	38,461,448	2,784	32;204	89,088; 567,936	<1;2
Fredonia/Moccasin	1,771,980	4,471	39;2	174,375; 8,942	10;<1
Page	15,018,094	4,451	55	244,812	2

Source: Arizona Department of Education 1994; Utah Department of Education 1993. (See Appendix E for additional information on school budget projections and enrollment.)

[1] Peak enrollment effects reflect long-term stabilized operations. Where two numbers are shown, e.g., 186;63, they indicate effects assuming truck maintanence facility (TMF) in Fredonia;TMF in Hurricane.

Table 4-11 — Projected Project-Related Change in Assessed Valuation Support For Public Education

District	Assessed	Project Assessed	Peak Enrollment	Incremental
Iron County	$156,500	$8,075,000	21	$384,500
Kane County	157,300	147,050,000	207	710,400
Washington County	117,500	[3]36,474,000	204	178,800
Fredonia /Moccasin	30,300	456,000	39	11,700
Page	36,200	707,000	55	12,900

Source: Various state fiscal reports, UGOPB 1993; and U.S. Bureau of the Census 1990. (See Appendix E for additional information on public education.)

[1]The apparent differences between Utah and Arizona reflect difference in assessment procedures; e.g., residential property is assessed at full value in Utah, but at 10 percent of current market value for owner-occupied residential property in Arizona.

[2]Esimated project assessed valuation includes direct additions (Utah GOPB 1993) plus allowances for indirect increases generated by residential development.

[3]Assumes the truck maintenance facility to be located in Hurricane.

The effects on Kane County schools in Big Water and Kanab are more dramatic, although in some respects the potential impacts are viewed positively (Willis 1994). In Big Water, Project-induced growth would absorb an estimated 30 percent (21 students) of the available capacity of 70 students. With a proposed truck maintenance facility located in Fredonia, projected growth of 186 new students in Kanab would exceed available capacity by 104 students. This new student population could potentially affect the elementary, middle school, and high school. Existing classrooms could be reconfigured to accommodate more students (up to 30 students per classroom in the elementary school), but it appears that all schools would be operating beyond their capacity with this level of impact until new facilities become available (Bayles 1994).

The Fredonia-Moccasin District has more than adequate capacity in all schools for the anticipated 39 Project-related new students associated with employment should the truck maintenance facility be located in Fredonia.

Consideration of currently available capacity provides a basis for assessing whether the proposed Project's enrollment would contribute in a substantive fashion to the need for additional facilities. Where the student increase is large relative to the available capacity and where the district is already facing growth pressures, the Warm Springs Project would be characterized as contributing to such needs. This would occur in Kane County and Page, given either location of the truck maintenance facility, and in Washington County, assuming that the truck maintenance facility would be located in Hurricane (Tables 4-12 and 4-13). The three primary options available to these districts to expand capacity include (1) adding portable classrooms and/or expanding existing facilities, (2) seeking voter approval to issue additional indebtedness for construction of new schools, or (3) converting to a year-round schedule of classes to increase utilization of the current facilities. Decisions regarding which options to implement may depend on the age distribution of new students in the Project-related population. School districts with facilities constraints requiring expansion or construction of new facilities to accommodate higher enrollments could be adversely affected by delays between the need for greater capacity and the availability of funding for capital construction.

Project-related assessed valuation in Kane County, and to a lesser extent in Washington County, would increase the debt service capacity to retire future issuances of bonded indebtedness. In Kane County, the potential revenues would be greater than the proposed Project's impact on capacity. In Washington County, the added tax base would be insufficient to cover its relative impact. The district could seek impact assistance funds from projected mineral lease payments or from royalties earned from Trust lands involved in the proposed Project. Any additional shortfall would be funded by taxpayers, although this effect would be offset by payments made by the Project-related tax base to retire presently outstanding debt. The overall impact would likely be limited.

After the end of mining and mining-related activity, enrollments would decline, making available some capacity to address other growth that may be occurring in the respective districts. Locally generated

Table 4-12 — Projected Project-Related Change in Public School Enrollment

District/ Affected Community	1992 Fall Enrollment	Available Capacity	Peak Project-Related Enrollment[1]		
			Number	Compared to Current Total (%)	Share of Available (%)
Iron County					
Cedar City	4,199	321	21	<1	7
Kane County					
Big Water	80	70	21	26	30
Kanab	1,013	82	186;63	18;6	227;77
Washington County					
Hurricane/ Toquerville	2,315	816	5;66	<1;3	<1;8
Fredonia/Moccasin	425	255	39;2	9;<1	15;<1
Page	3,454	430	55	2	13

Source: Arizona Department of Education 1994; Utah Department of Education 1993.

[1] Peak enrollment effects would occur during long-term stabilized operations. Where two numbers are shown, e.g., 186;63, they indicate effects assuming truck maintenance facility (TMF) to be in Fredonia;TMF to be in Hurricane, respectively.

Table 4-13 — Projected Project-Related Change for Affected School Districts

District	Reliance on State Support[1]	Peak Project Enrollment[2]	Project Triggers Facility Needs[1]	Outstanding Debt (millions $)
Iron County	No Change	21	No	11.8
Kane County	Decrease	207;84	Yes;Yes	3.7
Washington County	No Change;Decrease	32;204	No;Yes	52.0
Fredonia/ Moccasin	Increase;No Change	39;2	No;No	2.2
Page County	No Change	55	Yes	27.0

Source: Alvey 1994; Bayles 1994; Dobb 1994; Peterson 1994; Pogreva 1994; Robins 1994; Sides 1994; Tate 1994; Willardsen 1994. (See Appendix E for additional information on school enrollment.)

[1]When two statements are shown, e.g., No Change;Decrease, they indicate effects assuming truck maintenance facility (TMF) in Fredonia;TMF to be in Hurricane, respectively.

[2]Peak enrollment effects reflect long-term stabilized operations. Where two numbers are shown, e.g., 186;63, they indicate effects assuming TMF to be in Fredonia;TMF to be in Hurricane, respectively.

revenues would cease, and some loss of State equalization revenues could occur. (The impacts to socioeconomic conditions at the end of mining and mining-related activity are discussed in Section 4.2.9.11.)

The Agencies have not identified reasonably foreseeable cumulative projects within the Project area that would add to the impacts on public schools. Current economic expansion in the Project area is assumed to already be part of the projected population growth for this analysis.

The Agencies conclude that the impacts to public schools in the Warm Springs Project area with Project-related population growth would be major and beneficial over the short term and minor over the long-term. Impacts would be beneficially significant in Kane County.

4.2.9.7 Impacts to Water and Sewer Systems in the Warm Springs Project Area with Project-Related Population Growth

Throughout the Project area, future growth could be constrained by lack of water. Many communities potentially affected by the proposed Project would have to obtain additional water to serve the Project-related population growth. On the other hand, sufficient sewage treatment capacity generally exists in the Project area, either in the form of public systems or individual septic treatment. An exception to this general condition is the Ash Creek Sewer and Sanitation District, which serves Hurricane, La Verkin, and Toquerville.

Additional water would have to be developed in both Page and Kanab to serve Project-related growth. Page relies on a Federal water allocation from Lake Powell and currently exceeds its daily pumping allowance by as much as 40 percent on some days. The city of Page would need to obtain additional water supplies from Lake Powell or from another source to adequately serve the current population, projected growth without the proposed Project, growing tourism demand, and projected Project-related growth of 193 people.

Kanab has adequate water rights but would need to develop 2 new wells, at a cost of $80,000 to $100,000 per well, to accommodate general population increases and a maximum Project-related population growth of 690 persons. The Kanab Public Works Department, which operates the water, sewer, and the electric utility systems, is understaffed, as well. To maintain existing levels of service, assuming a Project-related population growth of 690 persons, the Public Works Department would require two to three more staff persons, plus vehicles (Merrill 1994).

Hurricane has adequate water supplies for its present population plus the Project-related population growth of 225 persons, assuming that the truck maintenance facility would be located in Hurricane. However, the agencies serving the community are nearing capacity for water storage and sewage treatment. The proposed Project would utilize some of the existing excess capacity in Hurricane but would not require immediate expansion or construction of new facilities (Fawcett 1994).

Toquerville has an adequate water supply for the existing populations but not for additional growth. Although there are more than 450 lots proposed for development within Toquerville's water service area, approval is not being granted because water supplies are not presently available. Toquerville is pursuing additional water rights and hopes to obtain them and complete a new well and storage tank soon. Sufficient supply would be developed to accommodate anticipated growth, including Project-related growth (Wahlquist 1994). However, if the current water supply situation does not change, Toquerville would be constrained from meeting even the demand for 10 additional housing units projected as needed to accommodate Project-related growth.

Fredonia and Big Water have adequate water to serve the potential Project-related population growth. Both municipalities are served by individual septic systems, and the carrying capacity of developable lands is sufficient for additional growth in the future. However, Fredonia has identified a public sewerage system as desirable for the community and is pursuing outside funding for that project.

At the end of mining and mining-related activity, population would decline with a resultant potential decline in water needs. (The impacts to socioeconomic conditions at the end of mining and mining-related activity are discussed in Section 4.2.9.11.)

No development has been identified within the Project area that would add to impacts on water and sewer systems beyond those already described because all reasonably foreseeable cumulative developments (Appendix B) have been accounted for in baseline growth projections used in this analysis. However, development already ongoing or anticipated as part of the projected baseline growth would trigger the need to acquire additional water or sewerage capacity in the Washington County communities, in Page, and in Kanab.

The Agencies conclude that the impacts to water and sewer systems in the Warm Springs Project area with Project-related population growth would be minor to moderate over both the short and long terms, with the potential to become significant in Page and Toquerville.

4.2.9.8 Impacts to the Regional Quality of Life in the Warm Springs Project Area with Project-Related Growth

The growth impacts of the Project to the quality of life in the southern Utah, northern Arizona, and southeastern Nevada area begin with Project-related direct and secondary jobs. These impacts would occur against a projected baseline of anticipated economic expansion throughout the area. However, a large percentage of the jobs attributable to the Project would be created in communities where local economic growth has been weaker than for the area as a whole, including Kanab and Big Water, Utah, and Fredonia, Arizona.

Local residents are projected to fill about one-fifth of the total employment opportunities generated by the proposed Project. The remaining available jobs would be filled by workers who migrate to the area with their families, bringing new population to communities near Project facilities. The distribution of the total population influx would reflect the location of the proposed Project's job sites. Therefore, the communities of Kanab, Big Water, Fredonia, Page, and the Hurricane area, would experience the most population growth among the communities within the proposed Warm Springs Project area, with the impacts in some communities depending on the location of the truck maintenance facility. The relatively small number of employees (20 over the life-of-mine) at the unit-train loadouts would not be anticipated to have noticeable effects on employment, housing, utilities, or quality of life in the Iron Springs/Cedar City or Moapa areas.

Several communities are projected to experience relatively large growth impacts (Table 4-7): Big Water, Kanab, and Fredonia (with the truck maintenance facility located in Fredonia), Page, and Hurricane (with the truck maintenance facility located in Hurricane). Awareness of the potential employment opportunities and fiscal benefits associated with the proposed Project is especially high in Kanab and Fredonia, where households, businesses, and local governments anticipate new jobs, enhanced business income, and potential tax revenues from the Project. This has created a base of support for the proposed Project wherever there is a lack of other economic opportunities. The impacts would be perceived most strongly in Big Water, where few local jobs exist at present, and in Kanab and Fredonia, where residents see a need to reinforce an economic base, which has suffered recently from the diminished level of logging and mining activity and the current reliance on relatively low paying jobs in retailing and services directed toward tourists and retirement in-migrants.

In the Hurricane, St. George, Cedar City, and Moapa areas, job opportunities and population growth have been relatively strong recently (Appendix B). Therefore, the jobs that would be created by the proposed Project are valued, but not as highly by residents of these communities, in relative terms, as they are in Kanab, Fredonia, and Big Water.

The southern Utah, northern Arizona, and southeastern Nevada area as a whole and the communities within it have sufficient resources to assimilate Project-related growth without experiencing a decline in the perceived quality of life. Several elements contribute to this capacity. First, there exists a base of positive experience, attitudes, and values related to growth and change, to economic development of natural resources in general, and to mining in particular. This predisposes local opinion to view the Project favorably. Further, local social structures are diverse and open enough to allow for the social integration of newcomers in all communities.

Local political structures, although straining to cope with the existing growth pressures, have demonstrated adequate capability in addressing past growth to indicate that Project-related growth would be adequately managed in the future. Finally, Project-related growth probably would not materially change prevalent local lifestyles. In most cases, with the possible exception of the very small and isolated community of Big Water, communities would retain their present small-town feeling even as they grow.

Despite the general pattern of support that exists throughout the Project area, differences in attitudes toward growth do occur, suggesting that not all residents perceive Project-related growth as having a positive effect on the quality of life. Groups exist in all communities who prefer the status quo or who oppose natural resource development and would feel themselves adversely affected by additional growth and change resulting from the Project. This effect would occur to some degree in Kanab, Page, and Fredonia, the Hurricane area, and Big Water, where some groups and individuals oppose development of the type represented by the proposed Project because of their beliefs about the Project's potential effect on the environment.

Circumstances potentially giving rise to adverse effects on perceptions of the quality of life differ by community. In Hurricane, there is emerging dissatisfaction with the pace of growth, even without the effects of the proposed Project. As a result, some already see a decline in many aspects of the quality of life (personal and property security, child pedestrian safety, and the level of traffic on city streets) and may wish to prevent further decline through growth management (Van Wagoner 1994). In Toquerville, there is a strong commitment to preserving the uniquely residential character of the community. In Big Water, because of the community's extremely small size, residents who value an isolated lifestyle would perceive themselves to be especially adversely affected. And in Kanab, Fredonia, and Big Water, there are groups who oppose the proposed Project because of a perceived potential for conflict with the economic activity and well-being generated in the area by tourism and recreation.

The end of mining and mining-related activity would lower social and economic well-being for households losing jobs and income. Individuals who opposed development of the Project at the outset probably would continue to view any residual effects of mining and mining-related activity, including the improved Smoky Mountain Road System, as reminders of an unwanted activity that precluded a return of the area to its exact premining condition. (The impacts to socioeconomic conditions at the end of mining and mining-related activity are discussed in Section 4.2.9.11.)

The growth impacts of the Project would occur against a projected baseline of anticipated economic expansion throughout the southern Utah, northern Arizona, and southeastern Nevada area. The Agencies have identified many specific projects that are part of the economic expansion prevailing throughout the area (described in Appendix B) as cumulative development. However, the growth implied by the projects described in Appendix B and by other non-Project-specific growth-inducing economic forces (not included in Appendix B) underlie the projections of employment and population growth used as the baseline for the analysis. Therefore, no further impacts to the quality of life are expected from cumulative development in the Project area, although it is anticipated that impacts to the quality of life in Page could intensify temporarily, during the time period in which premining development of the proposed Project and peak employment levels of the Navajo Generating Station Scrubber Project could coincide.

The Agencies conclude that impacts to the regional quality of life in the Warm Springs Project area with Project-related population growth would be beneficial and moderate to major over both the short and long terms. Quality of life impacts would have the potential to become significant in Fredonia, Big Water, and Kanab.

4.2.9.9 Impacts to the Regional Quality of Life in the Warm Springs Project Area with Project-Related Truck Traffic

Public concerns have been expressed about the Project-related coal haul trucks that would travel through communities during the life of the proposed Project. The concerns reflect expectations about the potential effects on traffic flow, public safety, the quality of, and cost to maintain, public highways, the residential character of some communities, and the value of residential property adjacent to the haul routes.

Coal haul truck traffic would contribute to (1) traffic safety problems along the haul route, (2) safety impacts compounded by ice and snow on Utah Route 9 between Hurricane and Toquerville and on Interstate-15 approaching Cedar City, and (3) the potential for accidents in school zone and pedestrian crossings in Hurricane, Fredonia, Kanab, La Verkin, and Toquerville (Section 4.2.7, Transportation).

Hurricane, La Verkin, and Toquerville, and, to some extent, Cedar City, Kanab, and Fredonia are projected to experience the greatest impacts on quality of life from truck traffic. Concerns about truck traffic have been expressed by many people in these communities, and in most cases the concerns have been expressed intensely. These concerns have motivated some residents of Hurricane, La Verkin, Toquerville, and Cedar City to become publicly involved in political or other institutional activity centered on the issue of Project-related truck traffic.

Hurricane residents have expressed particular concern about safety on the segment of Utah Route 59 east of Hurricane, known as Hurricane Hill. Attitudes regarding potential truck traffic from the Project were an important factor in Hurricane's last municipal election, along with the issue of growth management in general. A petition against the truck traffic from the Project gathered about 1,000 signatures in Hurricane, and concerns were voiced by the general public at a meeting in Hurricane held to describe the proposed Project to the public (Van Wagoner 1994). At the same time, another group in Hurricane is concerned that if a bypass were established, local businesses would be adversely affected if tourist traffic were to be diverted along with the heavy trucks.

La Verkin and Toquerville residents also have strong opinions on potential Project-related truck traffic, although the issue has not affected local politics the way it has in Hurricane. Some Toquerville residents oppose having the truck haul through town and would like to see a different route or some other way of transporting coal from the proposed Project (Wahlquist 1994).

In Cedar City and parts of Iron County near Cedar City, truck traffic on Utah Route 56 west of Cedar City has been an issue for several years. Residents of neighborhoods along Utah Route 56 have voiced concerns about child safety at school bus stops and congestion at intersections. Iron County has investigated the possibility of an alternative route from Interstate-15 to the unincorporated area west of Cedar City to alleviate existing traffic impacts and to serve existing and future industrial development around the municipal airport and west of the proposed unit-train loadout. In the past few years, a group of Cedar City residents, organized as the Taxpayers for Safe Utah Roads, has publicly campaigned against the proposed Project (Cohen and Geerling 1994). Despite the concerns and activities of these groups, many residents of Cedar City remain uninvolved in the issues at this time.

Many residents of Kanab anticipate increased truck traffic from the proposed Project but believe it can be accommodated without adversely affecting other parts of the economy or the quality of life. At the same time, concerns exist about the potential negative effects of Project-related truck traffic to school crossing safety, child safety in general, traffic flow and convenience of movement, Kanab's appeal as to its lifestyle and to retirement move-ins, and quality of the tourist experience, all of which would negatively affect local perceptions of the quality of life.

In Fredonia, town government has supported the Project but has also officially acknowledged the Project's potential effect on local traffic (Fredonia Planning Commission 1994).

Moapa and Glendale residents have expressed no concerns about existing traffic, which includes agricultural trucks and coal trucks making deliveries to the powerplant. Project-related coal truck traffic would avoid these communities, and current public attitudes would not be expected to change.

Although the proposed Project has received unqualified support from some political leaders in the Project area (Hansen 1994), others have said that the potential impact from transportation of coal upon communities is an issue in need of resolution (Hatch and Bennett 1994). Work has continued through the present on identifying potential rights-of-way for an alternative highway corridor in southern Washington County (Bevan 1994). In a letter to the Governor, State Representative Met Johnson (1994) said an alternate route through southern Washington County "deserves emergency status to eliminate the very dangerous situations in these communities."

Local government representatives in Washington County have been exploring the concept of such an alternate truck route through southern Washington County. The mayors of cities and towns in eastern Washington County formed a committee to address the bypass concept, and Washington County hired a planning consultant to identify a potential corridor for a bypass (Washington County Commission 1993).

Then the Washington County Commission established the Southern Corridor Task Force, a committee with city, county, State, Federal, and general public representation. Since its inception, the Task Force has considered a number of highway concepts for southern Washington County, the Hurricane truck bypass among them. These activities have been motivated in part by perceived traffic conditions, including existing truck traffic levels, projected increases in the volume of through traffic, daily truck traffic serving the nearby Wal-Mart Distribution Center (Appendix B), and the potential truck traffic that would result from the proposed Project. Recently the Southern Corridor Task Force collaborated with the Utah DOT to obtain Federal and State funds for a study to identify a feasible route through the southern Washington County corridor (Washington County Commission 1993, 1994; Lewis 1995).

The end of mining and mining-related activity would improve the quality of life for residents, business owners, and motorists to some extent. Although the impacts of the truck haul would be eliminated, other regional traffic would continue to increase. (The impacts to socioeconomic conditions at the end of mining and mining-related activity are discussed in Section 4.2.9.11.)

The impacts to the regional quality of life of Project-related truck traffic would occur against a projected baseline of anticipated expansion of traffic levels, including trucks, throughout the southern Utah, northern Arizona, and southeastern Nevada area. The Agencies have identified many specific projects that are part of the general pattern of expansion, and they have been described in Appendix B as cumulative development. However, the quality-of-life impacts implied by the projects (described in Appendix B), as well as by other non-Project-specific growth-inducing economic forces (not included in Appendix B), have already been incorporated into this analysis. Therefore, no further impacts to the quality of life from truck traffic are expected from cumulative development in the Project area.

The Agencies conclude that impacts to the regional quality of life in the Warm Springs Project area with Project-related traffic growth would be moderate to major over the short term and moderate over the long term. These impacts would be significant in the communities of Hurricane, La Verkin, and Toquerville. .

4.2.9.10 Impacts to Residential Property Values in the Warm Springs Project Area with Project-Related Population and Traffic Growth and Truck Traffic

Impacts to residential property values would occur from the effects of general population and traffic growth, as well as from the Warm Springs Project-related growth and truck traffic. The impacts to residential property values would be positive and general, affecting to some degree all communities expecting growth, including that resulting from the proposed Project. The effects of any truck traffic would be negative and limited in geographic scope to residential properties immediately adjacent to the truck routes.

Positive effects on the value of residential property in the southern Utah, northern Arizona, northeastern Nevada area would occur as the Project-related growth contributes to additional housing demand. This demand would act to raise residential property values. The magnitude and duration of the effect depends upon the existing housing supply and other factors that contribute to the ability of a community to produce adequate housing in a timely way.

Effects of this type would be expected throughout the area. To date, there has been no speculative increase in the residential property market that is attributable to the proposed Project. However, housing supplies are limited in Kanab and in the Hurricane area, whereas values have been depressed by recent economic decline in Fredonia (Eves 1994; Alvey 1994; Solie 1994). Under these circumstances, the expansion of population and housing demand that potentially would be created by the Project and other growth would tend to increase the value for existing homes, buildable residential lots, and developable residential properties in these communities.

A temporary beneficial effect on residential property values may be experienced in Page as Project-related demand is added to the demand created by the Navajo Generating Station Scrubber Project. This effect would disappear as scrubber project employment declines and is phased out entirely through the year 2000 (Appendix B).

While growth would have positive effects on residential property values in general, negative effects to residential property values would occur in specific locations along the truck routes because of higher levels of noise, emissions, visual effects, and potential safety hazards associated with truck traffic. The magnitude of the effect on property values is uncertain because it depends on factors specific to each residential area.

Two specific locations potentially would be affected by Project-related coal truck traffic: the neighborhood in Hurricane at the base of Hurricane Hill and the residential development adjacent to the truck haul route through Toquerville. In Toquerville, where property values have been in an upward trend, the proposed truck haul route is located in an entirely residential area, with homes situated very close to the shoulder of the highway. Present levels of traffic, including trucks, have had no apparent impact on the value of residential properties in Toquerville to this point in time (Wahlquist 1994).

Residential property values in general potentially could decline in affected communities at the end of mining and mining-related activity as some workers and their households out-migrate, placing a number of homes on the market. However, determining the direction and magnitude of the effect is extremely uncertain because it would depend on the specific housing market conditions that exist several years in the future. (The impacts to socioeconomic conditions at the end of mining and mining-related activity are discussed in Section 4.2.9.11.)

Increases in Project-related coal haul truck traffic would be accompanied by an overall increase in truck traffic as a share of all traffic throughout the southern Utah, northern Arizona, northeastern Nevada area. The cumulative effect of these increases may also contribute to a decline in residential property values along and adjacent to the truck haul route in Hurricane and in Toquerville.

The Agencies have identified many specific projects that are part of the this general pattern of expansion, described as cumulative development (Appendix B). The impacts implied by the described projects (Appendix B), as well as by other non-Project-specific growth-inducing economic forces (not enumerated in Appendix B), have already been incorporated into this analysis. Therefore, no further impacts to residential property values from Project-related population and traffic growth are expected from the cumulative development in the Project area.

The Agencies conclude that impacts to residential property values in the Warm Springs Project area with Project-related population and traffic growth would be beneficial and minor to moderate over both the short and long terms, with the potential to become beneficially significant in Page. Impacts have the potential to become adversely significant for some properties along and adjacent to the truck haul route in Hurricane and Toquerville.

4.2.9.11 Impacts to Socioeconomic Conditions at the End of Mining and Mining-Related Activity

The end of mining and mining-related activity as proposed would occur in year 43 or 44 after full recovery of the coal reserves. Direct Project-related jobs and the incomes they provide would end. Indirect jobs would be lost, too, as businesses adjust to the reduction and eventual elimination of spending by the Applicant, the truck haul contractor, and direct and indirect employees. Unemployment would increase, at least temporarily, as jobs are lost by Project employees and employees of indirectly affected employers.

Public sector revenues associated with direct and indirect spending, such as sales taxes, would be affected almost immediately. Public sector revenues derived from property taxes and intergovernmental transfers would be affected more gradually, with the effects spread over a period of time following the end of mining and mining-related activity. Mineral royalties, motor fuel taxes and related fees, and other production-based revenues that accrue to State and Federal Governments also would be lost at the end of mining and mining-related activity.

The end of mining and mining-related activity would have a negative effect on local populations because many households, especially those headed by working-age adults, would move to find new jobs. Not every household losing a job would emigrate. Depending on economic conditions prevailing at the time of closure, some households would remain in the region, inasmuch as some individuals may be able to find a job locally, and some may be in a position to retire. Therefore, the subtractions from local population at the end of mining and mining-related activity probably would be less than the additions to population change predicted to occur because of the Project.

After taking into account the net migration of households that would occur at the end of mining and mining-related activity, the population of various geographic areas within the region would stabilize at levels slightly above those projected for the future, based upon assumptions made for this analysis about growth in the region without the Project. In other words, population levels sustained in the region after the end of mining and mining-related activity would probably be greater than current population levels, despite the loss of the Project and Project-related jobs.

An indirect consequence of the end of mining and mining-related activity, caused by subtractions from local populations and reductions in public sector revenue, potentially would be losses of public sector jobs, especially in school districts and law enforcement agencies. However, the capabilities and service levels of public agencies may stabilize at higher than current levels after the end of mining and mining-related activity because of the growth predicted to occur without the Project.

Subtractions from employment, income, population, business, and public sector revenues would have repercussions throughout the socioeconomic environment. However, actual economic conditions prevailing within the region at the end of mining and mining-related activity could temper the effects of changes on communities. Baseline population growth and economic growth are predicted to occur throughout the region, even without the Project.

Therefore, the end of mining and mining-related activity could free up facility and service capacity, making capacity available to accommodate baseline growth, at least temporarily. For example, the end of mining and mining-related activity could improve housing availability and affordability. Reductions in public school enrollments could forestall or delay needs for facility expansion or construction in one or more of the affected school districts. Public water, sewer and utility providers could also see lower capacity utilization and an easing of demands on their respective infrastructure systems. Whereas construction and operation of the proposed Project would add growth over and above projected baseline growth, the accumulation of baseline growth would dampen the effects of the negative changes predicted to occur at the end of mining and mining-related activity.

The end of mining and mining-related activity also would affect the regional quality of life and property values. Effects would include lowered social and economic well-being for households losing jobs and income and an improved quality of life for some residents and business owners because the impacts of the truck haul would be eliminated. Owners of residential properties along the corridor adversely affected by the traffic associated with the proposed Project may see increases in property values, although higher traffic projected without the Project probably would temper such effects. Individuals who opposed development of the Project at the outset probably would continue to view any residual effects of mining and mining-related activity, including the improved Smoky Mountain Road System, as reminders of an unwanted activity that precluded a return of the area to its exact premining condition.

Motorists traveling along the haul route, particularly the frequent traveler, would sense a reduction in traffic volume, particularly of heavy trucks, with some beneficial impacts on the driving experience. Over time, the need for highway rehabilitation and reconstruction would be reduced, but so would the level of funds available for rehabilitation and reconstruction projects.

Although the end of mining and mining-related activity as proposed would occur after full recovery of coal reserves, a change in circumstances could trigger the premature end of, or perhaps a prolonged hiatus in, mining and mining-related activity before the coal reserves are fully recovered. Either occurrence could be caused by unforeseen changes in markets or other conditions that could adversely affect the Applicant and the proposed Project. Either occurrence would cause socioeconomic effects similar to those projected to occur because of the normal end of mining and mining-related activity.

However, the potential exists for particular effects to local governments in the event of the premature end of, or a prolonged hiatus in, mining and mining-related activity. There are local governments within the region that may choose to construct and finance facilities and infrastructure in order to meet needs associated with growth, including the proposed Project. These include the Kane and Washington County School Districts, both of which are considering facilities expansions, and Kane County government, which plans to undertake the improvement to the Smoky Mountain Road System.

The capacity to construct such capital facilities may depend upon revenues derived from mining and mining-related activity expected to materialize over an extended time horizon. Therefore, to the extent that local governments undertake capital facilities construction, and to the extent that local governments anticipate Project-related revenues to help finance the construction, local governments may risk lower than anticipated revenues in the event of the premature end of mining and mining-related activity.

In the absence of Project-related revenues, the burden of financing facilities expansion projects already undertaken would shift to residents, businesses, and taxpayers in the affected jurisdictions. The Kane County School District and Kane County would be most susceptible to impacts of this type, given that the proposed Project potentially would come to constitute a large share of the local tax base. The loss of royalty revenues could also affect Kane County with respect to the financing arrangements used to fund improvements to the Smoky Mountain Road System.

The relative magnitude of fiscal impacts of this type, which involve local governments potentially taking on debt to construct capital facilities, would be sensitive to the exact timing of a premature end of mining and mining-related activity. The longer the period of operations and the larger the aggregate level of production achieved prior to closure, the less the potential for adverse fiscal impacts to occur. As production continues over time, debt may be repaid. Also, revenues from whatever source may accumulate and be available to replace lost Project-related revenue. Utah's Permanent Community Impact Fund, various funding programs for education, and the Utah DOT Special Service District Funds are examples of funds potentially benefitting

Utah jurisdictions where revenues may accumulate over time, potentially providing resources to cushion adverse fiscal effects in the event of the premature end of mining and mining-related activity.

The town of Fredonia, an Arizona jurisdiction, potentially would face a similar fiscal risk. If the truck maintenance facility were to be located in Fredonia, the town may choose to proceed with major capital improvements, perhaps funded by bonded debt, in turn predicated on the anticipation of additional revenues from mining-related development. In the event of a premature end to mining-related development, the town may lose anticipated mining-related revenues, shifting an additional share of the burden of debt repayment to local residents, businesses, and taxpayers.

The Agencies conclude that impacts to socioeconomic conditions at the end of mining and mining-related activity would be minor to moderate over both the short and long terms, with the potential to become significant in Kane County and Kanab, Utah, and Fredonia, Arizona.

4.2.10 Air Quality

4.2.10.1 Impacts to Air Quality in the Smoky Mountain, Iron Springs, and Moapa Areas with Mining-Related Activities

Air quality in the project area would be affected by both construction and operation of mining facilities and other Project-related activities. Particulate concentrations may exceed the allowable National or State ambient air quality standards (Table 4-14). Construction and reclamation activities associated with the development and the eventual closing of the Smoky Hollow Mine and the coal loadouts would cause an increase in fugitive and gaseous emissions in the local area during these phases.

Air quality effects from construction would result in temporary increases in local fugitive dust levels. Dust generated from these open sources is termed "fugitive" because it is not discharged to the atmosphere in a confined flow stream (e.g., stack, chimney, or vent). The principal sources of fugitive dust would be related to construction and operation activities, including land clearing, earth moving, scraping, hauling, and materials storage and handling; drilling and blasting; truck loading operations; wind erosion from coal, soil, and spoil stockpiles; and coal handling operations. In addition, other fugitive emissions impacts would be caused by mud/dirt carryout onto paved surfaces by trucks and other vehicles. The additional surface loading would cause an increase in fugitive emissions during the lifetime of the construction project.

The air quality impact of a fugitive dust source depends on the quantity and drift potential of the dust particles released into the atmosphere. The larger dust particles settle out near the source, while finer particles are dispersed over much greater distances. Theoretical drift distances, as a function of particulate diameter and mean wind speed, have been computed for fugitive dust emissions. For a typical wind speed of 10 miles per hour (mph), particles larger than 100 micrometers (μm) are likely to settle out within 20 to

Table 4-14 — Particle Size Distribution, in Percent, for a Typical Coal-Mining Operation

Process/ Particle Size	Diameter (μm)[1]						
	<2.5	2.5-5.0	5.0-10.0	10.0-15.0	15.0-30.0	>30.0	Total
Material Handling	0.13	0.10	0.13	0.12	0.25	0.27	100
Unpaved Roads	.10	.10	.16	.14	.30	.20	100
Composite	.11	.10	.14	.13	.28	.24	100

Source: EPA 1985.
[1] Micrometer.

30 feet from the source. (For comparison, a human hair has a thickness of about 100 μm.) Particles 30 to 100 μm in size, depending on the extent of atmospheric turbulence, are likely to settle within a few hundred feet of their source. Dust particles smaller than 30 μm are generally recognized as emissions that may remain suspended indefinitely. The fraction of fugitive emissions in the various size categories is derived from the major emission source categories for a typical mining operation and is summarized in Table 4-14 (EPA 1985).

During construction and reclamation, vehicle exhaust emissions would be increased; however, these emissions are small compared to fugitive emissions from earth moving, hauling, and other construction activities and would not affect regional air quality. Particulate impacts from construction and reclamation activities would be variable and would depend on the activity location and the daily weather conditions. While mitigation measures, such as watering, would reduce the amount of emissions from such activities, some level of fugitive dust emissions would be unavoidable, owing to the nature of the work. Although some impacts on air quality would inevitably occur during construction and reclamation, they would be transitory, limited in duration, and would end at the completion of that particular phase of the work. Once reclamation is completed, pollutant concentrations would return to background levels.

Air quality impacts resulting from the operation of the surface facilities complex, the coal haul trucks, and the coal loadouts would continue throughout the life of the Project. Emissions from mining and coal hauling would occur throughout the operational phase of the project. At the surface facilities complex, the primary pollutant would be NO_x, generated by the diesel generator exhaust, vehicles, and other mobile equipment. Although there would be some exhaust emissions from the haul trucks, bulldozers, and front-end loaders at the loadouts, the primary pollutant of concern would be the fugitive dust particulates generated at the sites. The proposed Project would be a minor source of sulfur dioxide (SO_2) and suspended particulates but could still contribute to the formation of some haze in the region. Sulfur dioxide emissions would result from the operation of diesel-powered equipment and vehicles.

Fugitive dust and emissions of SO_2 at the surface facilities complex and at the unit-train loadouts would be reduced through several means (Appendix A, Section A.3.5.4, Air Quality Enhancement). Sulfur dioxide emissions would be less than 10 percent of the present background concentrations for 3-hour, 24-hour, and annual averaging periods for SO_2 at the property boundaries. The SO_2 emissions would contribute to reduced visibility through the formation of aerosols. These aerosols would be evident as haze, which restricts visibility at extended distances from the emission source. Particulate and aerosols are removed naturally by precipitation (rain or snow) which results in improved visibility. At distances beyond the Project boundary, impacts from emissions would be lessened, owing to mixing and dispersion of the pollutant. Fugitive dust emissions could reduce visibility near the source of the emissions, but, as settling and dispersion of these particles would take place away from the source, visibility would improve.

The Smoky Hollow Mine and the train loadout facilities are classified as minor sources of air pollutants. The mine facilities are expected to produce less than 50 tons per year of NO_x, and even lesser amounts of particulate, CO, and SO_2 emissions. Greatest impacts from these emissions would occur on days that have light winds and poor dispersion conditions (temperature inversion). These conditions normally occur during winter in the early morning hours.

Modeling results at the surface facilities complex, the Moapa unit-train loadout, and the Iron Springs unit-train loadout show that maximum concentrations of PM_{10}, NO_2, CO, and SO_2 would not exceed State or Federal Ambient Air Quality Standards (Table 4-15), and air quality degradation by PM_{10}, NO_2, and SO_2 emissions would be less than the applicable PSD Class II increments. Modeling studies showed that maximum 24-hour PM_{10} concentrations would fall below 1 $\mu g/m^3$ within about 1 mile of the proposed minesite and that annual concentrations of NO_2 would be less than 0.1 $\mu g/m^3$ within 0.6 mile of the mine (Conger 1992b). Process and fugitive dust emissions from the facilities would be below the 250 tons per year threshold requiring a PSD permit. The States of Utah and Nevada have granted air quality permits for the Smoky Hollow Mine, the Iron Springs unit-train loadout, and the Moapa unit-train loadout. The project would comply with all existing air quality standards in Utah, Arizona, and Nevada.

Cumulative air quality impacts in the vicinity of the surface facilities complex would be very slight, as there are no other permitted sources of air pollution nearby. A large construction project involving the installation of air pollution control equipment on the Navajo Generating Station (NGS) (Appendix B) will increase the number of people working in the Page, Arizona, area during the next 5 years. The increase may have a slight influence in the amount of traffic in the overall Project area during the construction period. The air pollution control equipment to be installed at the NGS will improve the region's air quality in the future by reducing SO_2 emissions at the plant, thereby reducing regional haze conditions.

The closest source to the Iron Springs unit-train loadout facility, which was required to obtain an air quality permit from the State of Utah, is Western ElectroChemical Company (WECCO) (Appendix B). Dispersion modeling analysis showed that concentrations of PM_{10} emitted from the proposed Iron Springs unit-train loadout would decrease to about 2 $\mu g/m^3$ or less within 0.6 mile of the boundary of the facility. Since the loadout facility would be more than 1 mile from the WECCO plant, the cumulative impacts would be slight, on the order of 1 $\mu g/m^3$.

Cumulative impacts from the Reid Gardner Powerplant (Appendix B) were assessed in the air permitting process for the proposed Moapa unit-train loadout. The dispersion modeling results showed that the combined effects of the Moapa unit-train loadout and the powerplant would be well within NAAQS and that air quality degradation would be much less than the allowable PSD increments. The CMS Generating Company plans to construct a new cogeneration powerplant (Appendix B) about 2 miles northeast of the Reid Gardner Powerplant. Because the distance to the Moapa uni-train loadout would be about 3 miles, the

Table 4-15 — Projected Project-Related Concentrations and National Ambient Air Quality Standards (NAAQS)

Pollutant	Averaging Period	Modeled Maximum Concentration ($\mu g/m^3$)[1]	Background Concentration ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS[2] ($\mu g/m^3$)	Percent of NAAQS
		SMOKY HOLLOW MINE				
PM_{10}	24-hour	17.7	30	47.7	150	32
	Annual	2.1	8	10.1	50	20
NO_x	Annual	1.3	0	1.3	100	1
CO	1-hour	29.4	0	29.4	40,000	<1
	8-hour	16.1	0	16.1	10,000	<1
SO_2	3-hour	9.8	117	126.8	1300[2]	10
	24-hour	5.3	52	55.3	365	16
	Annual	.2	13	13.2	80	17
		MOAPA UNIT-TRAIN LOADOUT				
PM_{10}	24-hour	2.4	26.1	28.5	150	19
	Annual	.8	9.2	10.0	50	20
NO_x	Annual	0	6.0	6.0	100	6
CO	1-hour	8.9	NA	8.9	40,000	<1
	8-hour	1.5	NA	1.5	10,000	<1
SO_2	3-hour	5.5	9.1	14.6	1,300[2]	<1
	24-hour	1.2	6.0	7.2	365	2
	Annual	.3	3.6	3.9	80	5
		IRON SPRINGS UNIT-TRAIN LOADOUT				
PM_{10}	24-hour	17.9	30	47.9	150	32
	Annual	3.4	8	11.4	50	23
NO_x	Annual	1.2	30	31	100	31
CO	1-hour	16.7	0	16.7	40,000	<1
	8-hour	6.0	0	6.0	10,000	<1
SO_2	3-hour	6.3	117	123.3	1,300[2]	1
	24-hour	1.5	52	53.5	365	15
	Annual	0.3	13	13.3	80	17

Source: Conger 1992b.
[1]Mircograms per cubic meter.
N/A = Data not available.
[2]Secondary standard for 3-hour concentration of SO_2 (National Ambient Air Quality Standard).

cumulative impacts of the Moapa unit-train loadout and the new powerplant would be minimal, as any emissions from either facility would be dispersed over this distance.

In the future, after cessation of mining activities and the subsequent reclamation, the air quality in the region would return to premining background levels. Improved roads in the Smoky Mountain area would reduce the level of fugitive emissions, resulting in improved air quality after the Project closes. However, better roads and increased regional population may also encourage more traffic, thereby increasing emissions of other pollutants related to automobile exhaust.

The Agencies conclude that impacts to air quality in the Smoky Mountain, Iron Springs, and Moapa areas with mining-related activities would be minor over the short term and negligible to minor over the long term.

4.2.10.2 Impacts to Air Quality Along the Roads in the Warm Springs Project Area with Mining-Related Activities

Haul trucks carrying coal from the Smoky Hollow Mine to the coal loadouts would cause an incremental increase over the normal traffic volume on these public haul routes (Chapter 3, Section 3.7, and Chapter 4, Section 4.2.7, Transportation). There would be a proportional increase in particulate and exhaust emissions along these routes because of the increased traffic volume.

Particulate and gaseous emissions occur whenever a vehicle travels over a paved surface, such as public and industrial roads and parking lots. During mine operations, direct air emissions would come from coal truck exhaust and particulate matter from wear of bearings and brake linings and abrasion of tires against road surfaces. Particulate emissions, known as reentrainment, may originate from material previously deposited on the travel surface or from resuspension of material from tires and undercarriages. In general, emissions arise primarily from surface material loading, and that loading is replenished by other sources, such as deposition from other vehicles. Reentrained fugitive dust consists primarily of common sand and soil, mostly tracked or deposited onto the roadway by vehicle traffic. Reentrainment rates are higher if the pavement surface has deteriorated.

Emissions from all paved roads increase directly as the amount of silt-size dust particles increase on the road surface (EPA 1985). Emissions also become greater with an increase in traffic on the roads. Because of the importance of the surface loading, available control techniques attempt to prevent material from being deposited on the surface and from removing any material that has been deposited. Some coal dust could escape from trucks during transport; however, all trucks would use tarps, mechanical closures, or other effective means to minimize these emissions.

Impacts of the coal truck traffic on air quality along the haul routes were evaluated using an EPA-approved dispersion model (Conger 1993). Sections of two-lane and four-lane highways were modeled at three locations: Interstate-15 by Zion National Park at Kolob Canyon; the highway adjacent to a residential area outside Iron Springs; and the Warm Springs Road outside Big Water. The modeling methodology and results are applicable to all areas adjacent to the haul routes. In all cases, maximum impacts occurred within 60 feet of the edge of the roadway and were small enough that there would not be violations of either the NAAQS or the PSD increments from these sources. Exhaust emissions are controlled for all mobile sources through the Federal- and State-mandated emissions programs for vehicles that use public roads. Paving the proposed Warm Springs/Benchtop Road would decrease dust emission levels along that road.

Cumulative impacts from the haul truck traffic would be confined to the areas immediately adjacent to the edges of the roadways. Emissions from all paved roads increase in direct proportion to traffic volume increases, so there would be a proportional increase in particulate and exhaust emissions along these routes resulting from the increased traffic volume from regional traffic; as well as from the coal trucks. As the local population continues to grow and recreational activities in the region attract more traffic to the area, the proportion of the air quality impacts caused by coal trucks would decrease.

Long-term effects near the haul route after mine closure would likely result in improved local air quality in the Smoky Mountain area, as the improved road would have less fugitive dust emissions than the present road. Improvements to air quality may be somewhat offset over the long term if the better roads were to attract more recreational traffic to the area.

The Agencies conclude that impacts to air quality along the roads in the Warm Springs Project area with mining-related activities would be minor over the short term and negligible to minor over the long term.

4.2.11 Visual Resources/Aesthetics

4.2.11.1 Impacts to Visual Resources/Aesthetics in the Smoky Mountain Area with Mining-Related Activities

Mining-related activities within the Smoky Hollow life-of-mine area and at the microwave communication sites would impact visual resources in the area to varying degrees. Facilities associated with the surface facilities complex, the ventilation shafts, and the microwave communication system would be present throughout the period of active mining. Activities related to exploration borehole drilling, monitoring, operation of the topsoil borrow area, and mining-related subsidence would be of a more temporary nature.

The proposed surface facilities complex would be located in a 400-foot deep, enclosed part of Smoky Hollow Canyon. This part of the canyon is bounded by steep slopes and canyon walls covered by a mixture of low shrubs and very large boulder talus. The canyon bottom is very dry in this area and has no developed riparian community that would be discernable to the casual visitor. Visual evidence of previous mining disturbance is present in a relatively small part of the proposed site. Because of the deep, confined nature of this canyon site, the proposed facility complex would not be visible from the WSAs or any other sensitive viewpoints outside Smoky Hollow. The visual influence of the surface facilities complex would therefore be limited to a relatively short segment of the Warm Creek/Benchtop Road within the canyon. Because of the confined nature of the canyon, viewers along this stretch of the improved road would see essentially all the mine surface facilities from very close by. Proposed landform modifications (coalpile, topsoil storage pile, sedimentation pond, and building/parking pads) and structure modifications (substation, loadout, conveyors, mine portals, and various buildings) would appear very prominent at this distance and angle of view. The level of visual contrast would be high, in effect, reducing the current Class II landscape to one consistent with VRM Class IV standards.

The topsoil borrow area, if needed, would not be used until mine closure. It would then be immediately recontoured and reseeded. Located on a flat part of Smoky Mountain with shrub and juniper vegetation, the current disturbance associated with an abandoned landing strip is not visually prominent. Additional disturbance from topsoil removal would not create more than a low to moderate level of visual contrast as seen from the Smoky Mountain Road (the only affected viewpoint). Similar results would be expected at the sites for the exploration boreholes and the ventilation shafts.

Subsidence may affect the surface topography to some degree (Section 4.2, Geology and Topography). The natural process of erosion may be accelerated as a result in areas of cliffs and steep slopes; however, it would not alter the existing visual character of the surface lands above the mine.

The Spring Point microwave reflector facility would be visible from some segments of the Warm Creek Road, and, as such, would be seen primarily in the context of the surface facilities complex. While technically in a line of sight to other viewpoints on the mesa top, its design should make it essentially unnoticeable. The building and ground support facilities of the Mustard Point microwave repeater facility should not be visible from any sensitive viewpoint. However, the tower would be visible to some viewpoints below, including Big Water, U.S. Hwy. 89, and a segment of the reconstructed Warm Creek Road. Actual visibility of the microwave tower and dishes would be low to very low because of their distance, scale, and position in a recessed area of the cliff face as seen from these viewpoints. The Big Water microwave terminal linkage facility would be visible from residences in and near Big Water and from U.S. Hwy. 89. However, it would not be particularly out of character with other structures in and near Big Water.

The visual effects of the surface facility complex have been mitigated to a large degree by its placement in the Smoky Hollow drainage rather than on top of Smoky Mountain, where its visibility would affect a much wider area and impact other sensitive viewpoints including the WSAs. To help reduce the visual effects of the surface facilities complex and microwave sites to viewers, all facilities would be painted a neutral, gray or tan to blend with the earthen colors of the surrounding shales, siltstones, and sandstones. Dust (coal and soil) suppression would be actively maintained. To limit the effects of night lighting, all facility lighting would be shielded and directed downward. This would preclude effects of night glow on the WSAs and other sensitive viewpoints to all but infrequent periods of close cloud cover. After cessation of mining, all surface structures, including the microwave communication structures, would be removed, and disturbed areas would be regraded to the approximate original contour and reseeded. The topsoil borrow area, if needed, and the borehole sites would also be contoured and reseeded (Appendix A, Section A.3.4, Reclamation Activities). Over the long-term, visual effects of the surface facilities complex would be reduced to a low level of visual contrast, and the site would be returned to its existing VRM Class II status.

The Agencies conclude that the impacts to visual resources/aesthetics in the Smoky Mountain area with mining-related activities would be minor to moderate over the short term and minor over the long term.

4.2.11.2 Impacts to Visual Resources/Aesthetics in the Smoky Mountain Area with Reconstruction and Operation Activities Along the Warm Creek Road

Between Big Water and Warm Creek Canyon, the land along the existing Warm Creek Road is flat to gently rolling and in many places is nearly devoid of vegetation. It lies below scenic and impressive cliff formations which tower 800 to 1,200 feet above the road. The relatively flat mesa lands over which the road travels slope gently away from the cliffs toward Lake Powell (which cannot be seen from this area). The onsite physical contrasts of landform and vegetation disturbance of the proposed roadway modifications should be minimal because of the sparse vegetation, relatively flat terrain, and the presence of the existing roadway. Onsite structure contrasts, in the form of a chip-and-sealed road surface, would be greater because of its color, which would contrast with the adjacent colors in some areas. Physical contrasts created by cut and fill would continue over the long term; revegetation of the slopes would slightly reduce these contrasts with time.

Parts of the reconstructed road between Big Water and the entrance to Warm Creek Canyon would be visible from various viewpoints, including intermittent segments of U.S. Hwy. 89, residences in and near Big Water, and the community of Greenehaven, Arizona, various four-wheel-drive and recreation access roads, a Glen Canyon NRA overlook south of the Wahweap marina, and about 3 square miles in the southwest corner of the Burning Hills WSA. Most of these viewpoints afford only views across isolated segments of the upgraded road from nearly the same elevation as the roadway. As a result, only a very narrow and discontinuous band of change would be visible in most places. Exceptions include the Big Water area, parts of the four-wheel-drive roads southwest of Big Water, distant segments of the Smoky Mountain Road, and one ridge within the Burning Hills WSA, where elevated views of extended segments of the new paved road surface would be visible.

The level of visibility from the Big Water area would be high, owing to the combination of proximity, duration, and angle of view. Visibility levels from all other viewpoints would be lower because of the modifying influences of long distance, indirect orientation, and angle of view, as well as the brief duration coupled with the indirect and intermittent pattern of the roadway visible in the landscape. As a result, the visual contrast would be moderate from Big Water (high visibility of a moderate structures contrast) and low from all other viewpoints (moderate onsite contrasts and moderate to low visibility). None of the proposed Warm Creek Road improvements in either Warm Creek Canyon or Smoky Hollow would be visible from outside viewpoints.

From most potentially affected viewpoints, vehicle lights on U.S. Hwy. 89, within communities, and on nearby access roads are already a common sight. Nevertheless, those viewpoints currently affected by night lighting would see an increase in night vehicular use from the direction of the Warm Creek Road. From the remainder of the potentially affected viewpoints (principally the ridge in the southwest corner of the Burning Hills WSA, the Kelly Grade Branch of the Warm Creek Road, and the road on Romano Bench), night lighting in the vicinity of the Warm Creek Road is presently an infrequent occurrence and would increase substantially over current conditions. Note, however, that nighttime use of these areas is infrequent; hence, the number of potentially affected users is low. After mine closure, truck traffic would be discontinued, and night lighting in the area would be reduced to near premine levels.

To reduce visual impacts, the road has been designed with a gray chip-and-seal surface, which would curtail dust while creating less color contrast than would an asphalt surface.

The Agencies conclude that impacts to the visual resource/aesthetics in the Smoky Mountain area with reconstruction and operation activities along the Warm Creek Road would be minor and permanent. Changes in views caused by physical contrasts would constitute an irretrievable commitment of the visual resource.

4.2.11.3 Impacts to the Visual Resources/Aesthetics in the Smoky Mountain Area with Construction and Operation Activities Along the Route of the Benchtop Road

The lands along the route of the proposed Benchtop Road consist of a wide variety of landscape conditions. Minor escarpments occur below Haycock Point; major escarpments occur at Tibbett Canyon and at John Henry Canyon. In these areas, the form, line, color, and texture contrasts of cut-and-fill slopes would be high. Vegetation contrasts would be relatively low in these areas because of the sparse vegetation present. The segments of the proposed road along Nipple Creek and in Smoky Hollow would create moderate to high landform contrasts, owing to the sloping and broken topography. Landform contrasts elsewhere would be low because of the flat to gently rolling terrain. Both the structure contrasts from the new 28-foot-wide chip-and-seal surfaced road and the vegetation contrasts would occur along the entire route, except for the part immediately north of Big Water, where similar patterns now exist.

One or both of the minor escarpment crossings below Haycock Point would be visible from a number of viewpoints, including U.S. Hwy. 89, Nipple Creek Road, homes in and near Big Water, and various recreation and residential viewpoints farther to the south. Because of the close distance, the orientation, and the angle of view, visibility levels would be high from parts of U.S. Hwy. 89, Nipple Creek Road, Warm Creek Road, and Big Water. Visibility of the entire roadway within the Nipple Creek drainage would be high, as viewed from the Nipple Creek Road, which the drainage closely parallels, and from a part of the Wahweap WSA just to the west. Segments of the proposed road on Nipple and Tibbett Benches would also be highly visible from nearby parts of the Wahweap WSA. The crossing of Tibbett Canyon would be highly visible from the Tibbett Canyon Road. The high degree of visibility combined with the high degree of physical contrast in these areas would result in high levels of visual contrast.

The cut-and-fill slopes in the upper reaches of John Henry Canyon would be visible from Pilot Knoll and from some isolated segments of the Smoky Mountain Road near Pilot Knoll. The visibility of the high physical contrasts anticipated here would result in noticeable levels of visual contrast. The high degree of physical contrast caused by cut and fill would remain visible over the area over the long term, although revegetation of the slopes may reduce contrast levels over time.

Night lighting from vehicles is currently a common condition for viewers at viewpoints near Big Water and along U.S. Hwy. 89. Truck traffic night lighting would be a new experience for viewers in backcountry use areas. The viewpoints which would be most affected in this regard include the Nipple Butte Road, the Smoky Mountain Road near Pilot Knoll, Tibbett Canyon Road, and numerous scattered ridges within the Wahweap WSA.

To reduce visual impacts, the road surface of the proposed Benchtop Road would be a gray chip-and-seal surface, rather than a more contrasting asphalt surface.

The Agencies conclude that impacts to visual resources/aesthetics in the Smoky Mountain area with construction and operation activities along the route of the Benchtop Road would be moderate and permanent. Changes to visual resources from physical contrasts produced by cut and fill would constitute an irretrievable commitment of the visual resource.

4.2.11.4 Impacts to the Visual Resources/Aesthetics in the Smoky Mountain Area with Construction and Operation Activities Along the Route of the 138-kV Power Transmission Line

The southernmost 6 miles of the proposed 138-kVpower transmission line would parallel Utah Power and Light Company's existing Sigurd 230-kV power transmission line (Appendix B). The lands along this part of the line can be characterized as somewhat elevated, rolling sage and juniper land. The physical contrasts to the landform, vegetation, and structures caused by construction of the new line in this area would be low due to the presence of similar modifications. From just south of the U.S. Hwy. 89 crossing, the proposed power transmission line would be on a new alignment. Crossing U.S. Hwy. 89 in gently sloping sage lands, the line would continue north, cross Wahweap Creek about 1.5 miles northwest of Big Water, then ascend the escarpment on the west side of Haycock Point. From here, the line would cross the flat, sage-covered lands on Nipple and Tibbett Benches, and span Tibbett Canyon, which divides these two benches. The line would then descend into Smoky Hollow Canyon and parallel the Warm Creek/Benchtop Road for the last 2 miles to the proposed surface facilities complex. The physical contrast of structural modifications would be high for the part of the line on the new alignment, except for a segment near Big Water, which would be moderate. Equipment travel down the right-of-way for construction purposes would create a low to moderate degree of disturbance to vegetation and a low degree of landform disturbance; no disturbance would be anticipated to escarpment faces, as they would not be traversed for construction or maintenance purposes.

Visibility of the power transmission line would be limited to viewpoints within about a half mile of it. Beyond this distance, visibility would drop quickly. Viewpoints within one-half mile would include: four-wheel-drive roads (along that part which parallels the Sigurd Line), U.S. Hwy. 89, the Nipple Butte Road at the Wahweap Creek crossing, the Tibbett Canyon Road, and the Warm Creek/Benchtop Road. The community of Big Water, parts of the Nipple Creek Road, and a few limited areas of the Wahweap WSA would have moderate visibility of the proposed power transmission line.

Visual contrast of the proposed line would be highest at the Nipple Butte Road/Wahweap Creek crossing, at the Tibbett Canyon crossing, and along the paralleled segment of the Warm Creek/Benchtop Road in Smoky Hollow. Visual contrast would be moderate at the U.S. Hwy. 89 crossing (owing to the proximity of the Sigurd Line crossing), and from some limited areas near the Wahweap WSA. Visual contrast would be high at any canyon crossing because of the visibility of the orange aircraft warning balls that would be used on the lines in these locations.

Visual impacts from the power transmission line would be reduced by not clearing the entire right-of-way, by immediately revegetating disturbance areas, by spanning canyons where feasible, and by constructing the line from below and above escarpments, thereby avoiding disturbance to escarpment faces. Weathering of the power conductors would reduce visual impacts from reflections. Insulators would be light gray to blend in with the surrounding topography. After mine closure, the power transmission line structures would be removed, and disturbed areas would be revegetated.

The Agencies conclude that impacts to visual resources/aesthetics in the Smoky Mountain area with construction and operation activities along the route of the 138-kV power transmission line would be minor to moderate over the short term and negligible over the long term.

4.2.11.5 Impacts to the Visual Resources/Aesthetics in the Iron Springs, Moapa, and Hurricane/Fredonia Areas with Mining-Related Activities

The proposed Iron Springs unit-train loadout site is at the west end of a large area that has undergone widespread disturbance from previous mining-related activities. Although most structures have been removed, large-scale landform modifications are readily evident. This area has little scenic value and has been designated as VRM Class IV. Construction of the loadout would not be expected to create visual effects beyond existing levels and those acceptable for this classification. The Moapa unit-train loadout site is under the visual influence of the Reid Gardner Powerplant, a buried gas pipeline, and three high-voltage power transmission lines. The site has low to moderately low visibility from Interstate-15 and has been designated as VRM Class IV. The hypothetical location chosen for the proposed Fredonia truck maintenance facility is generally compatible with the character of the existing nearby land uses. Visual contrast would be generally low. The hypothetical location chosen for the proposed Hurricane truck maintenance facility would also be generally compatible with the character of existing surrounding land uses and, as a result, would not create a very high level of visual contrast. Facilities in the Moapa and Iron Springs areas would be removed and the disturbance reclaimed when the mine closes. They should return to premine visual contrast levels. Facilities in the Hurricane/Fredonia area would be privately owned and may not be removed upon closure of the mine.

Night lighting at all of the facilities would be shielded and directed downward to reduce visual impacts. In addition, all structures would be painted a neutral, gray or tan color to blend with the surrounding environment.

The Agencies conclude that impacts to the visual resources/aesthetics in the Iron Springs, Moapa and Hurricane/Fredonia areas with mining-related activities would be negligible over both the short and long terms.

4.2.12 Recreation

4.2.12.1 Impacts to Dispersed Recreational Opportunities in the Smoky Mountain Area with Mining-Related Construction and Operation Activities

Construction and operation of the proposed Smoky Hollow Mine and associated roads create a perception that the quality of the backcountry experience and wild character of this area would be diminished. These activities could degrade the recreational experience of this area for some people. Better, improved access resulting from reconstruction/construction of the proposed Warm Creek/Benchtop Road would increase the opportunities for dispersed nonmotorized and motorized recreation in the area by providing recreational access to people who previously did not or could not visit the area because of its relative inaccessibility. This would be particularly true of the proposed Benchtop Road. Improved access would make it easier for all recreation users to get into this area. ORV use in the area would likely increase with construction of the Benchtop Road and could cause users to venture farther out from the new road and into areas that were previously nonmotorized in setting. Improving the Warm Creek Road would increase public accessibility into the Smoky Mountain area and could increase traffic on the Lake Powell access at Crosby Canyon as well.

The Smoky Mountain Road System is currently used by dispersed recreationists and would continue to be an integral part of the Kane County road network upon completion of the Warm Creek/Benchtop Road. Distinct and uninterrupted public access would be maintained on all Kane County roads throughout and after the life of the proposed mine, including that part that runs next to and beyond the Smoky Hollow Mine surface facilities complex. The public part of the road would be separated from the operational areas of the surface facilities complex by embankments, fences, gates, barricades, or other effective means. Mine operations would not hinder public use of the road. Unrestricted use of the roads would return after closure of the mine.

Dispersed recreational activities would not be directly impacted by mining-related activities, although hunting could be temporarily disrupted as a result of noise, dust, and human activities associated with construction. Temporary displacement of some large game animals would be expected to occur, particularly near the surface facilities complex. Some displaced big game animals could relocate to adjacent lands and actually increase hunting opportunities in some instances. In general, however, the impact to hunting would increase with proximity to active construction and operation areas.

Increased illegal hunting pressure could occur and would be associated with adverse impacts to big and small game species (Section 4.2.6, Wildlife). As a result of improved access into the area, traffic and human use in the area would increase and could result in increased legal and illegal harvesting of big game and small game animals. An increase in hunting pressure and in human presence could reduce the primitive hunting experience in the area.

According to Utah DWR, there is a direct correlation between increased traffic and increased poaching activity. Additionally, areas of easy accessibility tend to have a higher poaching rate. The more remote an area, the greater the chance for poaching opportunities. The remoteness makes detection difficult; however, remoteness may also provide some deterrent because of the amount of time required to travel out of the area, thereby increasing the chances of being apprehended. Construction of the Benchtop Road through the area would shorten the time between the illegal hunting and travel out of the area. Conversely, a road providing increased traffic may act as a deterrent to poaching within sight of the road. It may not, however, have any effect in areas away from the road. Generally speaking, increased hunting pressure could result in increased violations and an increase in enforcement effort.

The Warm Creek/Benchtop Road would remain permanently in place following closure of the mine. Recreational use of the area by the public would continue and could increase, owing to gradual increases in regional population over time.

The Applicants would provide assistance to Utah DWR in its studies of the Paunsaugunt Mule Deer Herd, as well as providing other wildlife enhancement measures that would support game animals and deter unauthorized hunting (Appendix A, Section A.3.5.6.3, Enhancement Activities, Wildlife).

The Agencies conclude that impacts to dispersed recreational opportunities in the Smoky Mountain area from mining-related construction and operation activities would be minor to moderate over the short and long terms.

4.2.12.2 Impacts to Recreation Use and Management of the Glen Canyon NRA with Reconstruction and Use of the Warm Creek Road

Improvement and the increased use of the Warm Creek Road through a corner of the Glen Canyon NRA, particularly by coal haul trucks, would increase noise, night lighting, and dust levels in the area. This would have a negative impact on recreation users in this specific area, particularly on those recreationists who currently use the road or go to this benchtop area to seek solitude. Improvement of the road would, however, increase accessibility into the area, and recreators who may not have been able to visit the area in the past may now be able to do so. Increased use may also increase management problems for NPS in the area.

Impacts to recreational use in the Glen Canyon NRA would continue after mine closure, as the Warm Creek Road would remain permanently in place. Impacts could increase slightly over time because of gradual increases in population in the region. NPS management should eventually be able to accommodate the changes to recreational opportunities resulting from improved access and increasing population.

The Agencies conclude that impacts to recreation use and management of the Glen Canyon NRA with reconstruction and use of the Warm Creek Road would be moderate over the short term and minor over the long term.

4.2.13 Wilderness

4.2.13.1 Impacts to the Potential Wilderness Designation of the Wahweap and Burning Hills Wilderness Study Areas with Mining-Related Construction and Operation Activities

Construction and operation of the proposed Project would have no direct, physical impact on any of the wilderness study areas (WSAs) or the potential designation of wilderness areas in the Smoky Mountain area. The proposed project may have indirect noise, visual, and subsidence effects in the vicinity of the WSAs and may have negative impacts on the WSAs' solitude because of the improved access, increased numbers of people in the area, and structures associated with the proposed Smoky Hollow Mine, the proposed 138-kV power transmission line, and the proposed Warm Creek/Benchtop Road. Solitude is defined as the "state of being alone or remote from habitations; isolation in a lonely, unfrequented, or secluded place."

The proposed Smoky Hollow surface facilities complex would be about 3 miles and 4.5 miles away from the Burning Hills WSA and Wahweap WSA, respectively. Any locations removed from the surface facilities complex by more than 2,000 feet would benefit from the noise barrier effect of the surrounding mountains; consequently, there would be no noise impacts to the outstanding opportunities for the solitude criterion of the Burning Hills and Wahweap WSAs (Section 4.2.8.3, Impacts from Noise Generated in the Smoky Mountain Area with Mining-Related Activities). The visual influence of the surface facilities complex at the Smoky Hollow Mine would be limited to a relatively short segment of the Warm Creek Road within the canyon; therefore, there would be no visual impacts to outstanding opportunities for the solitude criterion in the Wahweap and Burning Hills WSAs (Section 4.2.11.1, Impacts to Visual Resources/Aesthetics in the Smoky Mountain Area with Mining-Related Activities). Exploratory drilling and ventilation shaft development would occur in the life-of-mine area and could be visible temporarily from the WSAs, but no drilling or shaft development would be conducted within the boundaries of the WSAs. Underground mining activity and the potential for surface effects of the resulting subsidence would extend about 1 mile beyond the southwestern edge of the Burning Hills WSA and about 1.5 miles beyond the southeastern edge of the Wahweap WSA. Although very unlikely because of the extensive overburden in these areas, limited subsidence-related cracking or sloughing of the surface could occur and may be temporarily visible to some observers. Most of the cracks and other surface subsidence effects are expected to weather and close during the first few months following subsidence (Section 4.2.1.1, Impacts to Topography In and Around the Smoky Mountain Area with Mining-Related Subsidence). The possibility of mining-related subsidence should not influence the potential designation of these areas as wilderness.

The Benchtop Road and 138-kV power transmission line would lie less than 0.25 mile and about 0.5 mile, respectively, from the Wahweap WSA at their closest points. Intermittent segments of the Benchtop Road and power transmission line may be visible from the WSA, and an occasional coal truck or other traffic could be seen and/or heard. However, the 10 percent of the Wahweap WSA that meets the "outstanding opportunities for solitude" criterion for areas under wilderness review does not include the Fourmile Bench, Jack Riggs Bench, or Horse Flat, areas from which the Benchtop Road and power transmission line would be most exposed (BLM 1991). The WSA is not compact in configuration, and the numerous cherry-stemmed intrusions that penetrate the unit tend to lessen the opportunities for solitude (BLM 1991). The construction and use of the Benchtop Road and the power transmission line should not alter the necessary characteristics for wilderness designation of the Wahweap WSA.

The proposed Benchtop Road and 138-kV power transmission line would lie more than 5 miles away from the Burning Hills WSA and would have no impact on the "outstanding opportunities for solitude" criterion for this WSA. The existing Warm Creek Road, however, is about 2 miles from the Burning Hills WSA at its closest point. Intermittent segments of the Warm Creek Road, as well as the proposed improvements, would be visible from locations within the southwest corner of the WSA. The 45 percent of the Burning Hills WSA that meets the "outstanding opportunities for solitude" criterion for areas under wilderness review are not affected (BLM 1991). The proposed improvements for the existing Warm Creek Road should not alter the necessary characteristics for wilderness designation of the Burning Hills WSA.

Improved access provided by the Warm Creek/Benchtop Road may increase the numbers of recreators visiting the WSAs. This would continue after mining in the area had ceased, as the road would remain in place after mine closure.

The Agencies conclude that impacts to the potential wilderness designation of the Wahweap and Burning Hills Wilderness Study Areas with mining-related construction and operation activities would be negligible to minor over both short and long terms.

4.2.13.2 Impacts to Wilderness Characteristics in the Smoky Mountain Area with Mining-Related Construction and Operation Activities

Mining-related construction and operation activities would improve public access into the Smoky Mountain area and may increase noise and the numbers of recreators in the vicinity. Although the Smoky Hollow Mine would be located within a few of the units included in the most recent version of HR Bill 1500 (Table 4-16), previous coal exploratory drilling and engineering investigations have substantially impaired the naturalness of the area. Previous disturbance also includes the inactive Missing Canyon Coal Mine, an abandoned airstrip on Smoky Mountain, and existing access roads, including a segment of the existing Warm Creek Road. Many of these roads are currently used for dispersed recreational opportunities and mineral exploration activities and generally detract from the opportunity to experience naturalness and solitude. Construction and operation of the Smoky Hollow Mine would disturb additional area and would increase noise levels, further decreasing the opportunities for naturalness and solitude in the areas.

The Benchtop Road and 138-kV power transmission line would cross units included in various versions of HR Bill 1500 (Table 4-16). The naturalness of the areas where these components would be located has been impaired by mineral exploration activities, access roads, and ORV use. Construction and operation of the Benchtop Road and the power transmission line would disturb additional acreage and further impair the naturalness of the area (Chapter 1, Table 1-1). In addition, use of the Benchtop Road would increase noise levels and adversely impact the opportunities for solitude in the area.

Reconstruction of the existing Warm Creek Road would disturb additional acreage along a previously disturbed road corridor and further impair the naturalness of that area. In addition, increased use of the Warm Creek Road would increase noise levels and adversely impact the opportunities for solitude in the area.

Underground mining and associated subsidence activity could result in surface cracks, slope instability and failure, rock toppling, and alteration of topography and drainage patterns within parts of the Wahweap and Burning Hills WSAs, as well as in a few of the units included in various versions of HR Bill 1500. Surface expressions of the underground activity have the greatest potential to occur in the southern parts of the life-of-mine area where thinner overburden, steep slopes, weathered materials, and unstable structural conditions exist (Section 4.2.1.1, Impacts of Topography In and Around the Smoky Mountain Area with Mining-Related Subsidence). These surface expressions may be temporarily visible to some observers but would generally be associated with naturally occurring erosion events rather than underground mining activity. Most of the cracks and other surface subsidence effects are expected to weather and close during the first few months following subsidence. They should have little effect on the naturalness of a particular area or on a visitor's opportunity for solitude in that area.

The Smoky Hollow Mine and 138-kV power transmission line would be closed/removed, and all surface disturbance would be reclaimed at the end of active mining. Impacts to naturalness and solitude in these areas would reduce accordingly. The Warm Creek/Benchtop Road would remain permanently in place following cessation of mining and would continue to provide improved access into the area.

The Agencies conclude that impacts to wilderness characteristics in the Smoky Mountain area with mining-related construction and operation activities would be minor to moderate over both the short and long terms.

Table 4-16 — Utah Wilderness Recommendations in the Smoky Mountain Area

Project Component	BLM's Initial Roadless Areas Inventory	BLM's Final Initial Wilderness Inventory Areas	BLM's WSAs	HR Bill 1500 (Congressman Owens)	HR Bill 1500 (Congressman Hinchey)
Recommendations[1]	Wahweap Burning Hills Nipple Bench Head of the Creeks Warm Creek	Wahweap Burning Hills	Wahweap Burning Hills	Wahweap Burning Hills Warm Creek Smoky Hollow	Wahweap Burning Hills Nipple Bench Warm Creek Squaw Canyon
Smoky Hollow Surface Facilities Complex	Warm Creek Head of the Creeks	—	—	—	Squaw Canyon Warm Creek
Benchtop Road Alignment	Nipple Bench Head of the Creeks	—	—	Warm Creek	Nipple Bench Warm Creek
Warm Creek Road Improvements	Nipple Bench Warm Creek Head of the Creeks	—	—	Warm Creek Smoky Hollow	Nipple Bench Squaw Canyon Warm Creek
138-kV Power Transmission Line Alignment	Nipple Bench Head of the Creeks	—	—	Warm Creek	Nipple Bench Warm Creek

[1]Recommendations consist of the various wilderness study areas identified under each BLM inventory or HR Bill 1500.
WSA = Wilderness Study Area.
BLM = Bureau of Land Management.

4.2.14 Cultural Resources

4.2.14.1 Impacts to Prehistoric and Historic Resources in the Warm Springs Project Area with Mining-Related Activities

Potential adverse effects to prehistoric and historic resources include direct land disturbance by mining and associated operations (powerline construction and maintenance, road construction and maintenance, construction of ancillary facilities for truck maintenance and unit-train loadout, exploration drilling, etc.), subsidence, unauthorized artifact collecting, and vandalism. Damage or destruction may occur at sites exposed to any of the activities named above; the loss of physical integrity diminishes research potential that contributes to the importance of sites (i.e., their eligibility for enrollment on the National Register of Historic Places [NRHP]). Visual intrusions to the setting or environmental context of sites may also create potential adverse effects. Subsidence may adversely affect sites, such as lithic scatters, by inducing mixing of subsurface deposits located at the margins of the subsidence areas.

Thirty-three NRHP-eligible sites in the proposed Smoky Hollow life-of-mine area could be adversely affected by mining-related activities, specifically subsidence, exploratory drilling, and the construction of ventilation shafts and access roads. These sites consist of lithic scatters (13); ground-stone scatter (1), lithic and ceramic scatter (1); lithic scatter with historic component including petroglyph (1); lithic scatters with one or more hearths and/or ash or fire-cracked rock (6); lithic and ground-stone scatters with one or more hearths or ash (3); lithic and ceramic scatter with hearth (1); lithic, ground-stone, and ceramic scatters with hearths (2); prehistoric rock shelter complexes (2); prehistoric rock shelter complex with historic component (1); masonry granary; and historic brush fence. (See Appendix E, Table E-10 for a listing of important sites identified by project component.)

Eleven NRHP-eligible sites along the existing Warm Creek Road could be adversely affected by road reconstruction and maintenance or related activities including excavation in fill/borrow areas and establishment of staging areas. These sites include four lithic scatters with hearths and/or fire-cracked rock, one lithic and ground-stone scatter with hearths and fire-cracked rock, two rock shelter sites with lithic, ground-stone, and ceramic artifacts and hearths and/or fire-cracked rock; and one rock shelter with lithic and ground-stone artifacts and fire-cracked rock; one rock shelter with lithic and ceramic artifacts and fire-cracked rock; one ground stone concentration with fire-cracked rock; and one roasting pit.

Five NRHP-eligible sites along the proposed alignment for the Benchtop Road could be adversely affected by road construction and maintenance or related activities including establishment of staging areas and side casting areas, and construction of culverts and bridges. These sites consist of three lithic and ground stone scatters with hearths and/or fire-cracked rock, one lithic scatter with hearths and fire-cracked rock, and one game drive.

No NRHP-eligible sites have been identified in the proposed locations for the three microwave communication system facilities.

Thirteen NRHP-eligible sites along the proposed alignment for the 138-kV power transmission line could be adversely affected by powerline or access road construction or maintenance. These sites consist of three lithic and ground-stone scatters with fire-cracked rock or ash; two lithic scatters with hearths and/or fire-cracked rock; one lithic, ground-stone, and ceramic scatter with hearths and fire-cracked rock; one lithic and ground-stone scatter; one ground-stone scatter with structure; one lithic scatter with slab feature, hearths, and fire-cracked rock; one rock shelter with lithic scatter, hearth, and rock alignment; two sites with rock shelters and associated lithic, ground-stone, and ceramic scatter and hearths or fire-cracked rock; and one rock shelter with lithic scatter. One other site that could be adversely affected, a lithic scatter, has not been assessed.

Two NRHP-eligible sites could be adversely affected by proposed construction and maintenance of the Moapa unit-train loadout or associated powerlines and access roads. These sites consist of one abandoned railroad grade with associated features and artifacts and one lithic scatter with associated dried corn cobs.

No recorded NRHP-eligible sites would be adversely affected by proposed construction and maintenance of the Iron Springs unit-train loadout.

No recorded NRHP-eligible sites would be adversely affected by proposed construction and maintenance at the hypothetical Fredonia truck maintenance facility. Direct impacts to cultural resources cannot be evaluated in the absence of intensive field inventory data and because of the hypothetical nature of the facility location.

One recorded NRHP-eligible site could be adversely affected by proposed construction of the hypothetical Hurricane truck maintenance facility. This site consists of a historic trash dump. Overall impacts of the facility cannot be evaluated in the absence of intensive field inventory data and because of the hypothetical nature of the facility location.

Adverse effects to NRHP-eligible prehistoric and historic sites from mining-related activities would be appropriately mitigated by avoidance or by approved data recovery techniques (Chapter 2, Section 2.1.1, Alternative 1: Approval of the Applicants' Proposals, with Conditions (the Preferred Alternative), and Appendix A, Sections A.3.5.4, Air Quality Enhancement, and A.3.5.5, Archaeological and Paleontological Enhancement). Several potentially eligible sites in direct impact areas associated with the Warm Creek Road, Benchtop Road, and 138-kV power transmission line rights-of-way and access roads have already been avoided by rerouting the alignment of these activities. Data recovery on remaining sites could include surface collection, partial or complete excavation, surface mapping, artifact and feature analysis, architectural documentation, archival research, or some combination thereof, depending on final evaluation by the

Agencies. Construction monitoring may also be required in some cases. Beneficial impacts may occur from data recovery procedures implemented to mitigate adverse effects to NRHP-eligible sites, as important information would be contributed to existing prehistoric and historic regional data bases. Data recovery would also prevent loss of the information through unauthorized collecting or vandalism.

The Agencies conclude that impacts to prehistoric and historic resources in the Warm Springs Project area with mining-related activities would be minor and permanent. Loss of NRHP-eligible prehistoric and historic sites would be irretrievable.

4.2.14.2 Impacts to Undiscovered Prehistoric and Historic Resources in the Warm Springs Project Area with Mining-Related Activities

Mining and associated activities could adversely affect undiscovered prehistoric and historic sites. Cultural resource inventories may not locate all important sites. Buried sites, in particular, may be missed in the course of field inventories. The Smoky Hollow life-of-mine area, the Fredonia truck maintenance facility, and the Hurricane truck maintenance facility have not been surveyed in their entirety; thus, unrecorded sites may exist at these localities, even on the surface.

The probability of unrecorded sites occurring in the Project area is greatest in localities where permanent or ephemeral water sources exist, and in the vicinity of known site concentrations. Such localities are known to be present along the Warm Creek Road, Benchtop Road, and 138-kV power transmission line rights-of-way, at the Moapa unit-train loadout, and near the area selected for the hypothetical Fredonia truck maintenance facility. They could also be present in some areas of the Smoky Hollow life-of-mine area and in the vicinity of the Big Water terminal linkage facility.

The chance of encountering unrecorded sites in the course of mining and related operations would be minimized by intensive surveying of any previously uninventoried project facilities in advance (Chapter 2, Section 2.1.1, Alternative 1: Approval of the Applicants' Proposals, with Conditions (the Preferred Alternative)). In the event that a previously unidentified site is located during mining activities, work would be temporarily stopped around the site, and the appropriate Federal or State agency would be contacted to evaluate the site. In all cases, avoidance is regarded as the preferable form of mitigation.

The Agencies conclude that impacts to undiscovered prehistoric and historic resources in the Warm Springs Project area with mining-related activities would be minor and permanent, with the potential to become significant if important undiscovered sites are destroyed. Loss of prehistoric and historic sites would be irretrievable.

4.2.14.3 Impacts to Native American Cultural and Religious Concerns in the Warm Springs Project Area with Mining-Related Activities

Ethnohistoric and ethnographic information on Native American groups using the various Warm Springs Project areas is very modest. No data on specific Native American traditional or ritual use areas for Warm Springs Project areas were found in the printed literature; this is to be expected, given the highly personal, private, and sacred nature of traditional and ritual use areas. A range of Native American sacred cultural resources, including religious and burial sites, may be present in the Alton-Kaiparowits region of southern Utah and northern Arizona. There is only very general information about the sacred resources and even less information as to their locations (Stoffle 1980). Information on site-specific Native American traditional and ritual use areas, however, was not supplied in response to letters of inquiry sent to representatives of 21 Native American groups in the region. The absence of specific information does not necessarily imply an absence of Native American traditional or ritual use areas in Warm Springs Project areas. Such areas, if present, may be disturbed or destroyed by mining-related activities.

The chance of encountering unrecorded NRHP-eligible or burial sites in the course of mining and related operations would be minimized by intensive surveying of any previously uninventoried Project facilities in advance (Chapter 2., Section 2.1.1, Alternative 1: Approval of the Applicants' Proposal (the Preferred Alternative)). In the event that previously unrecorded sites are encountered during such activities as construction, work would be temporarily discontinued around the site, and the appropriate Federal or State agency any potentially interested Native American Group would be contacted to evaluate the site and, if necessary, proceed with the appropriate mitigation for the site (Section 4.2.14.1, Impacts to Prehistoric and Historic Resources in the Warm Springs Project Area with Mining - Related Activities). In all cases, avoidance is regarded as the preferable form of mitigation.

The Agencies conclude that the impacts to Native American cultural and religious concerns in the Warm Springs Project area with mining-related activities would be minor and permanent, with the potential to become significant if previously unidentified Native American religious sites are destroyed. Loss of Native American cultural and religious sites would be irretrievable.

4.2.14.4 Indirect (Secondary) Impacts to Prehistoric and Historic Resources in the Warm Springs Project Area with Increased Levels of Activity

Indirect impacts to prehistoric and historic resources are those which would result from increased human access to, and generally increased levels of activity in, the Project area. Indirect impacts might occur in the form of looting (surface collecting, pot hunting), vandalism (e.g., graffiti on rock art), or erosion caused by increased foot or vehicle traffic. A number of sites were discovered during surveys associated with this Project but would not be mitigated because they lie outside of areas of direct impact. Previously unrecorded sites could be located and disturbed as well, owing to the overall increased access into the area.

Six NRHP-eligible sites within a 1-mile-wide buffer straddling the existing Warm Creek Road direct impact zone (one-half mile to either side of the centerline) could sustain indirect impacts. These sites include four lithic scatters, one lithic scatter with fire-cracked rock, and one historic mine. Four other sites within this zone, all lithic scatters, have not been fully evaluated. They could also be adversely affected.

Eleven NRHP-eligible sites within a 1-mile-wide buffer straddling the proposed alignment for the Benchtop Road direct impact zone could sustain indirect impacts. These sites consist of six lithic scatters, one lithic scatter with fire-cracked rock, three lithic and ground-stone scatters with fire-cracked rock, and one ground-stone scatter with fire-cracked rock. Two other sites within this zone, both lithic scatters, have not been fully evaluated. They could also be adversely affected.

Two NRHP-eligible sites occur within one-half mile of the proposed location for the Big Water terminal linkage facility and could sustain indirect impacts. These sites consist of one lithic scatter and one lithic scatter with fire-cracked rock. Two additional sites in this same area, both lithic scatters, have not been evaluated for significance. They could also be adversely affected.

Two NRHP-eligible sites within a 1-mile-wide buffer straddling the proposed alignment for the 138-kV power transmission line right-of-way could sustain indirect impacts. These sites consist of one lithic and ceramic scatter and one rock overhang with ground-stone and ceramic scatter plus charcoal and fire-cracked rock. Nine other sites within this zone have not been fully evaluated and could also be adversely affected. They include six lithic scatters, two prehistoric rock shelters, and one historic inscription.

One NRHP-eligible site within a half-mile-wide buffer surrounding the proposed location for the Moapa unit-train loadout could sustain indirect impacts. This site consists of a trash concentration with features and is probably railroad related. Another 16 sites within this zone have not been fully evaluated. They include five rock shelters with various combinations of artifacts (lithics, ground stone, ceramics, arrow shaft) and, in one case, possible features; one lithic and ground-stone scatter; one lithic scatter with depressions; one lithic and ceramic scatter with depressions; one lithic and ceramic scatter with pit house; two historic trash scatters, possibly railroad related; one historic trash dump; and four sites lacking descriptive data. These sites could be adversely affected.

One NRHP-eligible site within a half-mile-wide buffer surrounding the proposed location for the Iron Springs unit-train loadout could sustain indirect impacts. It consists of historic tent foundations with associated depressions and trash.

No sites are known to exist within one-half mile of the area selected for the hypothetical Fredonia truck maintenance facility.

One NRHP-eligible site within a half-mile-wide buffer surrounding the area selected for the hypothetical Hurricane truck maintenance facility could sustain indirect impacts. It consists of a multicomponent Pueblo/Paiute site with surface architecture and artifacts.

Two NRHP-listed properties along the proposed truck haul route could be adversely affected. The historic Naegle House (Naegle Winery) is situated beside Utah Route 17 in Toquerville; structures associated with early Mormon pioneers are located at Pipe Spring National Monument along U.S. Hwy. 89 in Arizona. Either could be harmed by vibration associated with increased regional truck traffic. This type of impact, which poses a much greater threat to the Naegle House because of that site's immediate proximity to the highway, would continue to occur regardless of whether the Warm Springs Project is approved.

The full potential of the Project to bring about indirect impacts to cultural resources is unknown because most lands within the half-mile-wide buffer zones identified for analysis purposes have not been inventoried. Most sites known to exist in these areas were recorded in the course of surveys for previous undertakings unrelated to the Warm Springs Project. These sites have not been marked, and their actual locations are known only to the Agencies and archaeologists working in the area. They cannot necessarily be taken as representative in terms of site attributes, distribution, or importance.

All construction and operational personnel would be informed about the appropriate cultural and historic laws and cautioned not to disturb any sites they might discover. The employees would receive annual training to develop an awareness of and sensitivity to cultural/historic issues and concerns specific to the area (Appendix A, Section A.3.5.5, Archaeological and Paleontological Conservation). In consideration of various laws, such as NHPA, AIRFA, and SMCRA, specific information on the nature and location of important cultural resources are kept confidential.

The Agencies conclude that indirect (secondary) impacts to prehistoric and historic resources in the Warm Springs Project area with increased levels of activity would be minor and permanent, with the potential to become significant if important prehistoric or historic sites are disturbed. The loss of prehistoric or historic resources would be irretrievable.

4.3 IMPACTS OF DISAPPROVAL UNDER ALTERNATIVE 2

4.3.1 Geology and Topography

4.3.1.1 Impacts to Topography in and Around the Smoky Mountain Area Associated With Disapproval of the Proposed Project

Natural erosion and weathering will continue to occur with slope failure and rock toppling, resulting in alterations to topography and drainage patterns. Subsidence would not occur in the life-of-mine area.

The Agencies conclude that impacts to topography in and around the Smoky Mountain area associated with disapproval of the proposed Project would be negligible and irreversible.

4.3.1.2 Impacts to Mineral Resources In and Around the Smoky Mountain Area Associated with Disapproval of the Proposed Project

The coal resources in the life-of-mine area would not be recovered at this time but would be available for future development and use. A source of low-sulfur coal would not be immediately available to help meet regulatory demands for cleaner- burning electrical generation.

Leasing for oil and gas exploration would proceed subject to existing and possible future stipulations governing the resolution of conflicts between coal leases and oil and gas leases. Also, oil and gas leasing would continue to be subject to restrictions based on areas designated or under study as wilderness. The demand on local gravel resources would be subject to future construction needs of the Smoky Mountain area.

The Agencies conclude that impacts to mineral resources in and around the Smoky Mountain area associated with the disapproval of the proposed Project would be negligible to minor.

4.3.1.3 Impacts to Topography Along the Warm Creek/Benchtop Road Associated with Disapproval of the Proposed Project

Natural processes, current management, and ORV traffic would continue to impose topographic changes along the proposed route of the Benchtop Road and along the existing Warm Creek Road. Kane County's desire to provide public access to Smoky Mountain would necessitate the need for an improved roadway in the area at some time in the future.

The Agencies conclude that impacts to topography along the Warm Creek/Benchtop Road associated with disapproval of the proposed Project would be negligible to minor.

4.3.2 Paleontology

4.3.2.1 Impacts to Paleontological Resources in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Current management of the area would continue to determine the impacts to paleontologic resources. Gradual human population increases in the area could contribute to increase in fossil collecting in the area and in new fossil deposit discoveries. Fossil resource discoveries and scientific data that could potentially be gained from mining-related survey and mitigation activities would not occur. Deposits in the area would remain accessible to study. ORV traffic, amateur collecting, vandalism, and natural processes would continue to affect paleontological resources.

The Agencies conclude that impacts to paleontological resources in the Smoky Mountain area associated with disapproval of the proposed Project would be negligible, with the potential to become significant if important fossil discoveries are damaged or destroyed. Any loss of scientifically important paleontological information would be irretrievable.

4.3.2.2 Impacts to Paleontological Resources in the Iron Springs and Moapa Areas Associated with Disapproval of the Proposed Project

Current management of the areas would continue to determine the impacts to paleontologic resources. Gradual human population increases would contribute to a general increase in fossil collecting and in new fossil deposit discoveries. Fossil resource discoveries and scientific data that could potentially be gained from mining-related activities would not occur. ORV use, vandalism, and natural processes would continue to impact paleontological resources in the Iron Springs area.

The Agencies conclude that impacts to paleontological resources in the Iron Springs and Moapa areas associated with disapproval of the proposed Project would be negligible, with the potential to become significant if important fossil discoveries are damaged or destroyed. Any loss of scientifically important paleontological information would be irretrievable.

4.3.3 Hydrology

4.3.3.1 Impacts to Water Quality and Quantity in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Water quality and quantity would continue to be determined by climate, recharge, natural chemical processes, erosion, and natural structural changes in the area. The continued use of the Warm Creek Road in its present condition would allow the continued erosive effects of vehicle traffic to cause sediment transport into Warm Creek, Wahweap Creek and others. The 180 acre-feet of Wahweap Creek water that could have been used each year for 1 to 2 years during road construction would be available for other uses.

The Agencies conclude that impacts to water quality and quantity in the Smoky Mountain area associated with disapproval of the proposed Project would be negligible.

4.3.3.2 Impacts to Water Quality and Quantity in and Around the Warm Creek Drainage System Associated with Disapproval of the Proposed Project

Water quality and quantity would continue to be determined by climate, recharge, natural chemical processes, and erosion in the area.

The Agencies conclude that impacts to water quality and quantity in and around the Warm Creek Drainage System associated with disapproval of the proposed Project would be negligible.

4.3.3.3 Impacts to the Navajo Aquifer in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

The 400-acre-feet of Navajo Aquifer water that would have been used each year during the life of the mine would be available for other uses. The demand for fresh water sources is expected to continue whether or not the proposed Project is approved because of increasing regional population and local development, although demand is not expected to be very high in this area.

The Agencies conclude that impacts to the Navajo Aquifer in the Smoky Mountain area associated with disapproval of the proposed Project would be negligible.

4.3.3.4 Impacts to Water Quality and Quantity in and Around the Iron Springs and Moapa Areas Associated with Disapproval of the Proposed Project

Water quality and quantity would continue to be determined by climate, recharge, and ongoing chemical and erosional processes at the sites.

The Agencies conclude that impacts to water quality and supplies in the Iron Springs and Moapa areas associated with disapproval of the proposed Project would be negligible.

4.3.4 Soils

4.3.4.1 Impacts to Soil Productivity in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Natural processes, including erosion, and current management, including grazing, would continue to determine changes in soil productivity throughout the area. Previously unreclaimed disturbed lands would not be reclaimed. Increased ORV use resulting from population increases would continue to have impacts on soil productivity.

The Agencies conclude that impacts to soil productivity in the Warm Springs Project area associated with disapproval of the proposed Project would be negligible. Any loss of soil productivity would be irretrievable.

4.3.4.2 Impacts to Soils in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Natural processes, grazing, and current management would continue to determine changes in the area. Increased ORV use of the area resulting from future population increases may gradually increase disturbance to soils over time.

The Agencies conclude that impacts to soils in the Smoky Mountain area associated with disapproval of the proposed Project would be negligible.

4.3.4.3 Impacts to Cryptogamic Soils in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Natural processes, grazing, and current management would continue to determine changes in the area. Growth of cryptogamic soils would continue. Increased ORV use of the area resulting from population increases may gradually increase disturbance to cryptogamic soils over time. Cryptogamic soils would continue to develop and fix nitrogen and aid in controlling erosion.

The Agencies conclude that impacts to cryptogamic soils in the Smoky Mountain area associated with disapproval of the proposed Project would be negligible.

4.3.5 Vegetation

4.3.5.1 Impacts to Vegetative Productivity and Community Stability in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Grazing by domestic and wild animals would continue to occur throughout the area. Existing disturbance would not be reclaimed. Recreational use of the area would gradually increase in response to population increases in the area and may result in an increase in impacts from ORV use and plant collecting. Climatic events, such as drought, would continue to affect vegetation in the area.

The Agencies conclude that impacts to vegetative productivity and community stability in the Warm Springs Project area associated with disapproval of the Project would be negligible. Any loss of vegetation productivity would be irretrievable.

4.3.5.2 Impacts to Wetland and Riparian Communities in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Riparian habitat would continue to exist under current environmental conditions in the area. Tamarisk invasion and dominance would continue to degrade habitat quality. Infrequent flash-flooding may continue to periodically disrupt riparian communities and periods of drought may reduce seep and spring flows. Recreational use of the area would gradually increase in response to population increases in the area and may result in an increase in impacts from ORV use and plant collecting.

The Agencies conclude the impacts to wetland and riparian communities in the Smoky Mountain area associated with the disapproval of the proposed Project would be negligible. Loss of riparian productivity would be irretrievable.

4.3.5.3 Impacts to the Smoky Mountain Evening Primrose and Higgins Biscuitroot Associated with Disapproval of the Proposed Project

Populations of the Smoky Mountain evening primrose and the Higgins biscuitroot would continue to be subjected to infrequent grazing by domestic livestock and wildlife species, trampling by ORVs, collecting by the public, and accidental disturbance by maintenance activities along the existing Warm Creek Road. No information surveys on the primrose or the biscuitroot would be obtained from proposed surveys in the Project area.

The Agencies conclude that impacts to populations of Smoky Mountain evening primrose and Higgins biscuitroot associated with disapproval of the Project would be negligible.

4.3.6 Wildlife

4.3.6.1 Impacts to Mule Deer Movement During Migrational Periods Along Interstate-15 and Highway 89 Associated with Disapproval of the Proposed Project

Traffic would continue to gradually increase along U.S. Hwy. 89 between Kanab and Big Water because of regional population and recreational traffic increases. These increased traffic levels would directly affect the Paunsaugunt Mule Deer Herd during seasonal movements between winter and summer habitats as they cross U.S. Hwy. 89. Traffic levels would also continue to increase along Interstate-15 from Utah Route 17 to exit 59.

The Applicants would not participate in the Utah DWR study of the Paunsaugunt deer migration patterns, habitat use, and vehicle-related mortalities along U.S. Hwy. 89 and would not be assisting the Utah DWR in developing mitigation measures to minimize deer mortalities along U.S. Hwy. 89.

The Agencies conclude that impacts to mule deer movement during migrational periods along Interstate-15 and U.S. Hwy. 89 associated with disapproval of the proposed Project would be negligible to minor. Deer mortality would be an irretrievable commitment of the resource.

4.3.6.2 Impacts to Wildlife Habitat and Productivity in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Recreational use of the Smoky Mountain area would gradually increase, with resultant gradual increases in ORV use, hunting, collecting, and harassment of wildlife. Erosional changes would continue to affect topography; however, no changes (either adverse or beneficial) would occur to the specific microclimate and microhabitats associated with the topography. Access into the area would continue to be limited. No baseline surveys to determine important habitat for resident wildlife species would be conducted and no monitoring of existing seeps and springs would occur.

The Agencies conclude that impacts to wildlife habitat and productivity in the Smoky Mountain area associated with disapproval of the proposed Project would be negligible. Habitat loss would constitute an irretrievable commitment of the resource.

4.3.6.3 Impacts to Wildlife in the Smoky Mountain Area from Increased Human Presence Associated with Disapproval of the Proposed Project

Recreational use of the Smoky Mountain area and associated human disturbances would continue to increase. Hunting, ORV use, collecting and harassment would continue to occur in the area. No environmental education opportunities would be available, relative to wildlife resources. Access into the area would continue to be limited.

The Agencies conclude that impacts to wildlife in the Smoky Mountain area from increased human presence associated with disapproval of the Project would be negligible to minor. Wildlife mortality would constitute an irretrievable commitment of the resource.

4.3.6.4 Impacts to the Ferruginous Hawk, Golden Eagle, Peregrine Falcon, and Other Raptors in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

The projected increase in human use of Project areas would continue at the current level with a resultant gradual increase in harassment and illegal hunting. No baseline surveys would be conducted to determine occupied raptor nests in the area.

Traffic and related eagle mortality would continue to increase along Highway 56 between Cedar City and Iron Springs at its current rate. Future traffic levels are projected to increase along this segment of highway without the Project (Section 4.3.7, Transportation).

The Agencies conclude that impacts to the ferruginous hawk, golden eagle, peregrine falcon, and other raptors in the Warm Springs Project area associated with disapproval of the proposed Project would be negligible. Any raptor mortalities would be an irretrievable commitment of the resources.

4.3.6.5 Impacts to the Mexican Spotted Owl in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Habitat and population trends for the Mexican spotted owl in the Smoky Mountain area would be based on existing conditions, if owls are present. Projected human use of the Smoky Mountain area would continue to increase, relative to existing access and regional population increases, with resultant gradual increases in poaching, hunting, ORV use, and harassment. No Mexican spotted owl inventories would be conducted within the John Henry or Wesses Canyon systems to determine the potential presence/absence of individual birds.

The Agencies conclude that impacts to the Mexican spotted owl in the Smoky Mountain area associated with disapproval of the proposed Project would be none to negligible.

4.3.6.6 Impacts to the Desert Tortoise in the Moapa and Hurricane Areas Associated with Disapproval of the Proposed Project

The Moapa and Hurricane areas would continue to experience recreational pressure (e.g., ORV use) and other activities commonly occurring on public and private land. Land near the town of Hurricane would continue to experience current land use and development, with a resultant loss of tortoise habitat. A certain level of tortoise habitat degradation would continue to occur as a result of ongoing regional activities.

The Agencies conclude that impacts to the desert tortoise in the Moapa and Hurricane areas associated with disapproval of the proposed Project would be negligible to minor. Any tortoise mortality would be an irretrievable commitment of the resource.

4.3.7 Transportation

4.3.7.1 Impacts to Open Road Traffic Flow in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Area-wide traffic volumes would continue to increase gradually with projected increases in population and employment. Truck and other heavy vehicle traffic would show a corresponding increase at about the existing percentages of total traffic. Table 4-2 provides the future traffic volumes projected for roadways in the proposed Project area, corresponding to a planning horizon of about 20 years.

Warm Creek Road is not expected to undergo reconstruction and traffic flow would not be improved. Traffic volumes along the existing road are not projected to increase appreciably over the existing 20 vpd. The current LOS "A" during all periods would be maintained under this minimal volume of traffic.

Increased traffic along U.S. Hwy. 89 between Big Water and Kanab could result in a projected future ADT of 2,980 vpd. This condition would maintain the existing LOS "A" during the morning peak hour and LOS "B" during the afternoon peak hour.

On Utah Route 11 between Kanab and the Arizona State line, a future ADT of 3,990 vpd is projected. This volume of traffic would not be sufficient to decrease the existing morning and afternoon peak hour LOS "A" and LOS "B," respectively.

On U.S. Hwy. 89A in Arizona, the future ADT is projected to be 6,600 vpd, resulting in a decrease from the existing morning and afternoon peak hour levels of service of LOS "A" and LOS "B" to LOS "B" and LOS "C," respectively.

On Arizona Route 389 between Fredonia and the Utah State line, a future ADT volume of 7,000 vpd is projected. This volume of traffic would result in a decrease from the LOS "A" currently experienced during the morning peak hour and the LOS "B" during the afternoon peak hour to LOS "B" and LOS "C," respectively.

On Utah Route 59 between the Arizona State line and Hurricane, a future ADT of 3,420 vpd is projected. This volume of traffic would not be sufficient to decrease the existing morning and afternoon peak hour LOS "B" and LOS "C," respectively.

The section of Utah Route 9 between Hurricane and Interstate-15 would experience a projected future traffic volume of 20,180 vpd. Widening this roadway to four lanes (scheduled to be completed in 1996) would allow acceptable levels of service (LOS "A" for peak periods) to be maintained throughout the 20-year planning horizon.

The section of Interstate-15 between Utah Route 9 and the Arizona State line is projected to experience a future ADT of about 25,990 vpd, maintaining the existing peak hour levels of service of LOS "A."

The section of Interstate-15 which traverses Arizona is projected to experience an ADT of about 23,800 vpd within a 20 year horizon, maintaining the morning peak hour level of service at LOS "A," but resulting in a decrease from the existing afternoon peak hour level of service of LOS "A" to LOS "B."

In Nevada, traffic volumes on Interstate-15 are projected to increase to 15,500 vpd in the future. These volumes would cause a decrease from the existing afternoon peak hour LOS "A" to LOS "B". No decrease in morning peak hour operations is projected.

In Nevada, the Hidden Valley Road would experience a projected future ADT of 400 vpd. The current LOS "A" during all periods would be maintained under this minimal volume of traffic.

The section of Utah Route 9 between Hurricane and La Verkin could experience a projected 21,475 vpd in the future. This volume of traffic would decrease the existing two-lane morning and afternoon peak hour LOS "C" and LOS "D" to LOS "E" during both peak hours. Future plans to widen this section of roadway to four lanes should eventually improve the LOS level to LOS "A" during all periods.

On Utah Route 17 between La Verkin and Interstate-15, an ADT of 2,640 vpd is projected for the future. This volume of traffic would not be sufficient to cause a decrease from the LOS "B" and LOS "C" currently experienced during the morning and afternoon peak hours, respectively.

The section of Interstate-15 between Utah Route 17 and exit 59 in Cedar City is projected to experience a future ADT of about 22,300 vpd. This volume of traffic would maintain all morning peak hour level of service at LOS "A," but, it would cause a decrease from the existing afternoon peak hour level of service of LOS "A" to LOS "B."

A future traffic volume of 3,800 vpd is projected on Utah Route 56 between Interstate-15 and the Iron Springs Road. This volume of traffic would cause a decrease from the existing afternoon peak hour LOS "A" to LOS "B". No decrease in morning peak hour operations is projected.

Iron Springs Road would experience an increase in ADT to 1,615 vpd by the future planning horizon, resulting in a reduction from LOS "A" to LOS "B" during both peak hours.

The Agencies conclude that impacts to open road traffic flow in the Warm Springs Project area associated with disapproval of the proposed Project would range from negligible to moderate with the potential to become significant along Interstate-15 from Cedar City to the Nevada State line and along Utah Route 9 between Hurricane and La Verkin.

4.3.7.2 Impacts to Traffic Flow at Intersections in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Areawide traffic volumes would continue to increase gradually with projected increases in area population and employment. Truck and other heavy vehicle traffic would show a corresponding increase at about the existing percentages of total traffic. These increases could affect LOS at intersections throughout the region.

The unsignalized intersection of U.S. Hwy. 89 and Warm Creek Road in Big Water, currently at LOS "A" during both peak hours, would experience a reduction in traffic operational conditions to LOS "B" during the afternoon peak hour on the Warm Creek Road approach, resulting from the projected future traffic volumes.

At the intersection of U.S. Hwy. 89 and Utah Route 11 in Kanab, the projected traffic increases would lower the existing signalized intersection operations from LOS "B" during both peak hours to LOS "C" during the afternoon peak hour.

In Arizona, the projected traffic volumes at the stop-sign-controlled intersection of U.S. Hwy. 89A and Arizona Route 389 in Fredonia would reduce the traffic operational levels, which are currently at LOS "A" for all movements during both peak hours. On the single-lane eastbound approach to this intersection, operations are projected to be LOS "C" and LOS "E" during the morning and afternoon peak hours, respectively. On the single-lane westbound approach, the afternoon peak-hour operations would be reduced to LOS "B."

At the signalized intersection of Utah Route 59 and Utah Route 9 in Hurricane, the projected increases in traffic would lower the existing LOS "B" during both peak hours to LOS "C" during the morning peak hour and LOS "E" during the afternoon peak hour.

The projected future traffic volumes at the Interstate-15/Utah Route 9 interchange west of Hurricane would reduce intersection operations, which are currently at LOS "A" for all movements. The right-turn operations on the northbound Interstate-15 off-ramp would reduce to LOS "B" and LOS "F" in the morning and afternoon peak hours, respectively, and left-turn operations would reduce to LOS "D" during both peak hours. Traffic operations on the southbound off-ramp would be lowered to LOS "B" during both peak hours.

In Nevada, the projected future traffic increases would not be sufficient to lower the existing LOS "A" at the two unsignalized intersections that constitute the Hidden Valley interchange near Moapa.

At the unsignalized intersection of Utah Route 9 and Utah Route 17 in La Verkin, the general increases in traffic levels contained in the future projections would lower the westbound left-turn operations, currently at LOS "A" and LOS "C" during the morning and afternoon peak hours to LOS "E" and LOS "F." The eastbound approach to this intersection would also experience a reduction from the current LOS "A" to LOS "C" during the afternoon peak hour.

At the Interstate-15/Utah Route 17 interchange north of La Verkin, the projected future traffic volumes would not cause a reduction in the existing LOS "A" for all affected movements.

The projected future traffic levels at the Interstate-15/Utah Route 56 interchange in Cedar City would represent an increase of sufficient magnitude to reduce the existing traffic operational conditions. At the intersections of the Interstate-15 off-ramps and Utah Route 56, traffic operations, which currently range from LOS "C" to LOS "E," would be reduced to LOS "F" during both peak hours. Left turns onto Interstate-15 from Utah Route 56, which currently operate at LOS "A," would also operate at reduced levels. The eastbound left turn would operate at LOS "B" and LOS "D" in the morning and afternoon peak hours, respectively, and the westbound left turns would operate at LOS "D" and LOS "E" during the morning and afternoon peak hours.

At the intersection of Utah Route 56 and the Iron Springs Road west of Cedar City, the projected traffic volumes would not be sufficient to lower traffic operations from the current LOS "A" experienced during both peak hours.

The Agencies conclude that impacts to traffic flow at intersections in the Warm Springs Project area associated with disapproval of the proposed Project would be minor to moderate. Impacts would have the potential to become significant at the intersections of U.S. Hwy. 89A and Arizona Route 389, Utah Route 59 and Utah Route 9, Utah Route 9 and Interstate-15, Utah Route 9 and Utah Route 17, and Interstate-15 and Utah Route 56.

4.3.7.3 Impacts to the Highway Infrastructure in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Traffic volumes are expected to increase gradually in the region as a result of increasing regional population (Table 4-2). These increases would include proportionate increases in heavy vehicle traffic. General traffic growth would increase the rate of wear to pavement and the structure of the roadways in the area and increase maintenance requirements, frequency of maintenance, and costs. Several roadway segments along the haul routes (Utah Routes 59, 17, and 56 and the Hidden Valley Road) are currently inadequate to sustain heavy truck traffic. These segments would require increased maintenance or possible reconstruction in order to handle expected increases in truck traffic over the 20-year planning period. The Warm Creek Road would not be improved, and the Benchtop Road would not be constructed. Also, coal truck fee revenues would not be available for defraying road maintenance costs.

The Agencies conclude that impacts to the highway infrastructure in the Warm Springs Project area associated with disapproval of the proposed Project would be minor to moderate, with the potential to become significant along segments of Utah Routes 17, 56, and 59, and the Hidden Valley Road.

4.3.7.4 Impacts to Public Safety Along Highways in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Traffic volumes in the area are expected to increase in the future as a result of general population and employment increases. These increases could also potentially increase the occurrence of accidents on area roadway facilities. Adverse weather conditions would compound the safety impacts of increasing traffic volumes. General increases in traffic through school zones would also tend to increase the potential for school bus and pedestrian accidents. It is projected that increases in traffic accidents would correspond to increased traffic volumes at about the existing accident rates. Tables 4-3 shows the projected future number of roadway accidents for the traffic volume increases expected over the 20-year planning horizon. Table 4-4 shows the predicted numbers of future intersection accidents projected under these conditions.

Total traffic accidents along U.S. Hwy. 89 would increase from the existing average of 43 per year to about 84 per year, and accidents involving heavy trucks would increase from 5 per year to 10 per year. Traffic fatalities, which currently occur on an average of two every 3 years, would increase in frequency to about one per year.

Under projected traffic volumes for Utah Route 11 between Kanab and the Arizona State line, only a minimal increase over the existing 4 total accidents per year is anticipated.

At existing accident rates and projected future traffic volumes, total traffic accidents on U.S. Hwy. 89A between the Utah State line and Fredonia would increase from the existing average of about one per year to about two per year. No traffic fatalities or accidents involving trucks were reported on this section of roadway during the 3 years of available data. The potential for increased frequency in fatal accidents in the future along this section could increase because of increases in future traffic volumes, although these increases are expected to be minimal.

Under the projected volumes for Arizona Route 389, between Fredonia and the Utah State line, total traffic accidents on this section of highway would increase from the existing average of 13 per year to about 43 per year. Accidents involving heavy trucks on Arizona Route 389 would increase from 1 per year to 2 per year, and traffic fatalities would also increase from an average of 1 per year to about 2 per year.

Under future traffic volumes, total traffic accidents on Utah Route 59 between the Utah State line and Hurricane would increase from the existing average of 16 per year to approximately 27 per year, and accidents involving heavy trucks would increase from 1 per year to 3 every 2 years. Traffic fatalities, which currently occur at a rate of one every 3 years, would increase in frequency to about one every 2 years.

Although planned roadway improvements along Utah Route 9 between Hurricane and Interstate-15 could improve the safety characteristics of this highway, the existing accident rates were applied to the projected volumes to project future accident frequency. Total traffic accidents on this section of Utah Route 9 would increase from the existing average of 26 per year to about 81 per year, and heavy truck accidents would increase from 2 per year to 6 per year. No traffic fatalities were reported on this section of roadway during the 3 years of available data. The potential for increased frequency in fatal accidents in the future along this segment could increase because of increases in future traffic volumes.

Under projected increase in traffic volumes, total traffic accidents on the section of Interstate-15 between Utah Route 9 and the Arizona State line would increase from the existing average of 51 per year to about 115 per year. Accidents involving heavy trucks would increase from 9 per year to 20 per year, and traffic fatalities would increase from an average of 1 per year to about 2 per year.

Total traffic accidents on the section of Interstate-15 in Arizona would increase from the existing average of 64 per year to about 138 per year. Heavy truck accidents would increase from 10 per year to 22 per year, and traffic fatalities would increase from an average of 3 to about 6 per year. Total traffic accidents on the segment of Interstate-15 in Nevada would increase from the existing average of 80 per year to about 112 per year. Accidents involving heavy trucks would increase from 12 per year to 13 per year, and traffic fatalities would increase from 3 to 8 per year.

Total traffic accidents on Utah Route 9 between Hurricane and La Verkin would increase from the existing average of 2 per year to about 6 per year in 2010. No traffic fatalities or accidents involving trucks were reported on this section of roadway during the three years of available data. The potential for increased frequency in fatal accidents in the future along this section could increase because of increases in future traffic volumes, although these increases are expected to be minimal. Future roadway improvements would, however, improve the safety characteristics of this section of highway.

Under future projected traffic volumes, total traffic accidents on Utah Route 17 between La Verkin and Interstate-15 would increase from the existing average of 7 per year to about 10 per year. Both heavy truck accidents and traffic fatalities would increase in frequency from the existing average of one each every 3 years to one each every 2 years.

Total traffic accidents on the section of Interstate-15 between Utah Route 17 and exit 59 in Cedar City would increase from the existing average of 135 per year to about 302 per year. Accidents involving heavy trucks along this intersection would increase from 16 per year to 36 per year, and traffic fatalities would increase from 3 to 6 per year.

Under the future projected traffic volumes for Utah 56 between Interstate-15 and the Iron Springs Road, total traffic accidents on this section Utah Route 56 would increase from the existing average of three per year to about four per year. Heavy truck accidents would increase in frequency from the existing average of one every 3 years to about one per year. Traffic fatalities would increase from the existing average of one every 3 years to one every 2 years.

No traffic fatalities or accidents involving trucks were reported on the Warm Creek Road near Big Water, the Hidden Valley Road near Moapa, or the Iron Springs Road near Cedar City during the three years of available data. Also, no accidents were reported for the following intersection: At the U.S. Hwy. 89 and Warm Creek Road intersection in Big Water, the U.S. Hwy. 89 and Utah Route 11 intersection in Kanab, the Arizona Route 389 and U.S. Hwy. 89A intersection in Fredonia, the Hidden Valley intersection with Interstate-15, or the Utah Route 56 and Iron Springs Road intersection. The potential for increased frequency in fatal accidents in the future along these sections of roadway and intersections could increase as a result of increases in future traffic volumes, although these increases are expected to be minimal.

The frequency of traffic accidents at the Utah Route 59 and Utah Route 9 intersection in Hurricane, currently averaging 4 per year, would increase to about 10 per year. At the Interstate-15/Utah Route 9 interchange west of Hurricane, traffic accidents, which currently occur at an average rate of one accident every 3 years, would increase to about one accident per year under the future traffic volume conditions. The frequency of traffic accidents at the intersection of Utah Route 9 and Utah Route 17 in La Verkin, currently occur at an average rate of 2 every 3 years, would increase in frequency to 10 per year. Under the projected volumes, total traffic accidents at the Interstate-15/Route 56 interchange in Cedar City would increase from the existing average of one per year to about two per year.

The Agencies conclude that impacts to public safety along highways in the Warm Springs Project area associated with disapproval of the proposed Project would range from moderate to major. Impacts have the potential to become significant along Interstate-15, Utah Route 9, Utah Route 59, and U.S. Hwy. 89.

4.3.7.5 Impacts to the Structural Integrity and Stability of County Roads in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Vehicle use of the county roads in the Smoky Mountain area would continue and is expected to increase in the future because of local and regional population increases. This traffic would continue to cause wear to the surface and structure of the roads in the area. The Warm Creek Road is not expected to be reconstructed or improved, but maintenance and repair would continue, including occasional regrading of the existing unimproved roadways.

Natural processes would also continue to act upon all roads in the existing county road system with structural integrity and stability of the roads subject to the severity of those natural processes. Use levels on the roads would gradually increase as the local populations increase. Subsidence effects on area roads would not occur, and regular maintenance activities would continue to take place.

The Agencies conclude that impacts to the integrity and stability of county roads in the Smoky Mountain area associated with disapproval of the proposed Project would be negligible.

4.3.8 Noise

4.3.8.1 Impacts from Noise Generated along the Roads in the Warm Springs Project Area Associatd with Disapproval of the Proposed Project

Noise levels along the proposed haul routes would continue to increase gradually with increasing regional traffic volumes. By about the year 2010, decibel levels in the area are expected to have increased by a range of 0.8 dBA along Utah Route 59 to 4.5 dBA along Utah Route 9 (Tables 3-9 and 4-5). Most road segments in the area will have dBA levels of 70 or higher, which may elicit complaints from residents near the roadway (Chapter 3, Section 3.8, Noise).

The Agencies conclude that impacts from noise generated along the roads in the Warm Springs Project area associated with disapproval of the proposed Project would be minor.

4.3.8.2 Impacts from Noise Generated in the Iron Springs and Moapa Areas Associated with Disapproval of the Proposed Project

Noise levels in the Moapa and Iron Springs areas would remain near current levels. Although highway and ORV traffic would continue to occur, Ldn levels would continue to range from about 35 to 45 dBA, consistent with open, outdoor settings.

The Agencies conclude that impacts from noise generated in the Iron Springs and Moapa areas associated with disapproval of the proposed Project would be negligible.

4.3.8.3 Impacts from Noise Generated in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Noise levels in the Smoky Mountain area would generally remain near existing levels. Although road and ORV traffic would continue to occur, Ldn levels would continue to range from about 35 to 50 dBA, consistent with open, outdoor settings. By about the year 2010, decibel levels along the existing Warm Creek Road would have increased slightly from existing levels of 47 dBA to about 48 or 49 dBA because of gradually increasing regional traffic. Noise levels would continue to gradually increase over time.

The Agencies conclude that impacts from noise generated in the Smoky Mountain area associated with disapproval of the proposed Project would be negligible.

4.3.9 Socioeconomics

4.3.9.1 Impacts to Employment, Population, Personal Income, and Business Activity in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Disapproval of the proposed Warm Springs Project would leave unaffected the underlying economic and demographic trends in southern Utah, northern Arizona, and southeastern Nevada. These trends would impart to the area a future that differs from existing conditions. The socioeconomic environment is subject to a variety of influences, but only some of these influences are known or are reasonably foreseeable at any point in time.

For the assessment of the impacts with disapproval of the proposed Project, the baseline future reflects recent trends, including the major events identified in Appendix B, all of which imply increases in employment, personal income, and population, as described in Chapter 3. Population of the Las Vegas metropolitan area and of St. George, Utah, and its environs would be expected to more than double between 1990 and 2010, with attendant substantial increases in employment and other measures of economic activity. Strong growth is also projected for Cedar City and Iron County, Utah.

Kane County, Utah, and the northern part of Coconino County, Arizona, also are expected to grow, but the magnitude of growth in this area would be more modest. Clark County, Nevada, and Washington and Iron Counties, Utah, would experience growth in industrial employment, in the trade and service sectors, and in the public sector. In Kane and northern Coconino Counties, economic development would be more limited because of greater reliance on tourism and recreation.

Residents, businesses and local governments in southern Utah, northern Arizona, and southeastern Nevada would not realize the benefits associated with Project-related jobs, earnings, business spending. Residents and businesses in Kane and Coconino Counties would experience adverse effects associated with the loss of potential job opportunities and incomes foregone. In Kane and Coconino Counties, the benefits foregone, including diversification of the local economic base, would be greater in magnitude than the benefits to be gained from baseline growth without the proposed Project.

Disapproval of the proposed Project could affect the recovery of the coal reserves associated with the proposed Project, thereby altering the socioeconomic future of southern Utah and northern Arizona until development occurs.

The Agencies conclude that impacts to employment, population, personal income, and business activity in the Warm Springs Project area associated with disapproval of the proposed Project would be moderate to major.

4.3.9.2 Impacts to Local Government Fiscal Resources in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Public sector fiscal conditions with disapproval of the Project would continue to respond to changes associated with baseline growth. Local government officials would continue to balance available revenues against competing demands and to establish funding priorities, while striving to maintain a solid fiscal foundation. Local government in Clark, Washington and Iron Counties, would see continued growth and diversification of their respective tax bases. Page and Coconino County would continue to see growth in sales taxes.

Project-related revenues would be foregone, and future expenditures to serve Project-related growth would be avoided. The Kane County government, and to a lesser extent the Kanab and Big Water governments, would not receive substantial direct revenues and tax base expansion and diversification associated with development and operation of the Project. All of the potentially affected local governments in Utah would forego the potential to obtain funding from the Permanent Community Impact Fund, some of which may have addressed general growth needs as well as Project-related growth needs. Depending on the location of the truck maintenance facility, either Fredonia or Hurricane would forego substantial future revenues.

To the extent that disapproval affects the development of the coal reserves in this area, the benefits local governments potentially could have achieved by applying fiscal resources generated by the proposed Project would be foregone until development occurs.

The Agencies conclude that the impacts to local government fiscal resources in the Warm Springs Project area associated with disapproval of the proposed Project would be moderate, with the potential to become significant in Kane County, Kanab, Big Water, and Fredonia or Hurricane.

4.3.9.3 Impacts to State and Federal Fiscal Resources Associated with Disapproval of the Proposed Project

State government budgets would continue to reflect growth in revenues and expenditures, assuming that the baseline growth projected for southern Utah, northern Arizona, and southeastern Nevada continues without the proposed Project. As with local governments, budgets would have to be balanced by State legislatures and executive branches.

With disapproval of the proposed Project, State governments would not benefit from increased tax revenues nor would incremental expenditures be required to serve a larger population. The net effects on Nevada and Arizona budgets would be limited. Utah would forego deposits to the permanent trust fund to support public education, as well as to general fund revenue levels, which are projected to be greater than the associated expenditures. Therefore, the State of Utah would forego the benefits of a positive net fiscal impact.

The Federal treasury and the Black Lung and Abandoned Mined Land Reclamation funds would not receive revenues from the proposed Project. The total revenues foregone would exceed $125 million.

If disapproval affects development of the coal reserves, benefits that State and Federal Government potentially would have achieved by applying fiscal resources generated by the proposed Project would be foregone until development occurs.

The Agencies conclude that impacts to State and Federal fiscal resources associated with disapproval of the proposed Project would be negligible to minor, with a potential to become adversely significant in Utah.

4.3.9.4 Impacts to Housing Availability in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

With disapproval of the proposed Project, fewer homes would be built or rented in southern Utah, northern Arizona, and southeastern Nevada. Continued growth in the area from tourist activity and other development is likely to continue. The existing tight housing market is likely to improve as developers decide to build housing in the area because of the existing high demand for housing and the projected baseline growth in population.

The Agencies conclude that the impacts to housing availability in the Warm Springs Project area associated with disapproval of the proposed Project would be minor to moderate.

4.3.9.5 Impacts to Public Safety Agencies in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Regional population would increase, and demands on public safety agencies associated with increased traffic and criminal activities, owing to population growth, would increase but at a lower rate than that expected with the mine in place. Many providers would continue to experience staffing shortages, however, the ratio of staff to population would be greater with Project disapproval.

The Agencies conclude that impacts to public safety agencies in the Warm Springs Project area associated with disapproval of the proposed Project would be minor to moderate.

4.3.9.6 Impacts to Public Schools in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

All school districts in southern Utah and northern Arizona, except the Fredonia/Moccasin District, are currently at or nearing capacity in one or more grade levels. These conditions would not change with disapproval of the Project. The region is experiencing growth because of increased tourism and retirement interest in the area. Several capital expansion projects and bond elections to approve financing of new facilities are slated for the next several years (1995-1998) to alleviate crowding. The expected property tax from the proposed Project, which would have helped support new facilities, would not be collected. State impacts funds to support public education would not receive an infusion of revenues that would have been generated by mineral royalties from production at the mine.

School district fiscal conditions with disapproval of the proposed Project would continue to respond to baseline growth pressures. Additional capital and staffing would be needed. State equalization would ensure equitable funding. Expansion of local assessed valuation to support locally generated revenues and funds for capital expansion would be foregone. Districts would face comparatively lower operating expenses.

The Agencies conclude that impacts to public schools in the Warm Springs Project area associated with disapproval of the proposed Project would be minor to moderate, with the potential to become significant in Kane County.

4.3.9.7 Impacts to Water and Sewer Systems in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Many water and sewer systems throughout southern Utah and northern Arizona are considering currently undertaking expansion and upgrading to accommodate the additional growth occurring throughout the area. Disapproval of the Project would probably increase the number of months or years before the current capacities would need to be expanded. Most jurisdictions are currently in the process of increasing capacities for either water and/or sewer systems in order to supply adequate service to the baseline growth. Toquerville and Page are currently trying to obtain additional water rights. Without the influx of the population related to the proposed Project, the pressure to supply additional water and sewer services would be reduced somewhat.

The Agencies conclude that impacts to water and sewer systems in the Warm Springs Project area associated with disapproval of the proposed Project would be minor, with the potential to become significant in Toquerville and Page.

4.3.9.8 Impacts to the Regional Quality of Life from Population Growth in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Additional Project-related economic growth would not occur with disapproval of the proposed project, so no improvement to the quality of life would be because of increased economic well-being. A sense of foregone potential would be felt with particular acuteness in Kanab, Utah, and Fredonia, Arizona, because the proposed Project has been regarded as potentially offsetting perceived weakness in the local economic base. However, employment and population would continue to increase and residents of the Project area would experience growth-related quality of life impacts similar to those described under Alternative 1 (Section 4.2.9.8), even with disapproval of the proposed Project, although at a more gradual rate.

The Agencies conclude that impacts to the quality of life from population growth in the Warm Springs Project area associated with disapproval of the proposed Project would be beneficial and moderate.

4.3.9.9 Impacts to the Regional Quality of Life from Traffic Growth in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Traffic levels, including truck traffic, would continue to increase because of regional growth, and residents of the area would experience quality of life impacts because of truck traffic similar to those described under Alternative 1, even with disapproval of the proposed Project, at a more gradual rate. Project-related truck traffic would not contribute additional traffic over and above baseline traffic growth, so the additional quality of life impacts anticipated in many communities within the Project area would be avoided.

The Agencies conclude that impacts to the regional quality of life from traffic growth in the Warm Springs Project area associated with disapproval of the proposed Project would be minor to moderate, with the potential to become significant in Hurricane, La Verkin, and Toquerville.

4.3.9.10 Impacts to Residential Property Values from Population and Traffic Growth in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Continued growth of employment, population, and truck traffic would continue to occur. As a result, residential property values would continue to be supported by increasing demand for housing. At the same time, residential neighborhoods in Hurricane, La Verkin, and Toquerville adjacent to existing truck routes would experience localized negative effects of rising levels of heavy truck traffic even with disapproval of the Project.

With disapproval of the proposed Project, growth pressure on residential property values in general would be held to levels consistent with baseline expansion alone, foregoing additional potential increases. Localized impacts on residential property values in the traffic-sensitive neighborhoods of Hurricane and Toquerville would still occur, but additional impacts from Project-related truck traffic would be avoided.

The Agencies conclude that the impacts to residential property values from population and traffic growth in the Warm Springs Project area associated with disapproval of the proposed Project would be beneficial and minor, with the potential to become adversely significant in traffic-sensitive neighborhoods within Hurricane and Toquerville.

4.3.9.11 Impacts to Socioeconomic Conditions Associated with Disapproval of the Proposed Project

Disapproval of the proposed Warm Springs Project would leave unaffected the underlying economic and demographic trends in southern Utah, northern Arizona, and southeastern Nevada. Public sector fiscal conditions with disapproval of the Project would continue to respond to changes associated with baseline growth, although the benefits local governments potentially could have achieved by applying fiscal resources generated by the proposed Project would be foregone for the foreseeable future. State government budgets would continue to reflect growth in revenues and expenditures consistent with the baseline growth projected for southern Utah, northern Arizona, and southeastern Nevada.

With disapproval of the proposed Project, fewer homes would be built or rented in the region and the existing tight housing market would likely remain the same unless development is stimulated by the existing high demand for housing and the projected baseline growth in demand.

All school districts in southern Utah and northern Arizona would continue to operate at capacity for the foreseeable future. Water and sewer systems throughout the region would still face a need to upgrade and expand, although disapproval of the proposed Project probably would effectively prolong the useful life of existing systems.

Additions to economic well-being due to Project-related growth would be foregone with disapproval of the proposed Project, and the impact of additional Project-related truck traffic would be avoided. However, baseline economic and traffic growth would still occur, even with disapproval of the proposed Project, bringing both beneficial and adverse impacts to the quality of life over time, although at a more gradual rate. Residential property values would continue to be affected by projected baseline growth in demand for housing, although additional upward pressure on property values would be foregone with disapproval of the proposed Project.

The agencies conclude that impacts to socioeconomic conditions associated with disapproval of the proposed Project would be negligible to minor.

4.3.10 Air Quality

4.3.10.1 Impacts to Air Quality in the Smoky Mountain, Iron Springs, and Moapa Areas Associated with Disapproval of the Proposed Project

Owing to the expected general population increase in the area to the year 2020, increased recreation activities utilizing existing unpaved roads would cause an increase in fugitive and gaseous emissions in the local area. The existing Warm Creek Road would remain unpaved if the proposed mine is not developed, and this road as well as other roads would continue to be used for access to the area for recreational purposes. Fugitive dust generated from an unpaved road is 5 to 10 times more than that generated from a paved road, given the same volume of traffic. Impacts to the air quality could also occur as a result of increased on- and off-road vehicle use in the area.

The Agencies conclude that impacts to air quality in the Smoky Mountain, Iron Springs, and Moapa areas associated with disapproval of the proposed Project would be negligible to minor.

4.3.10.2 Impacts to Air Quality Along the Roads in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Air quality along the proposed haul truck routes would continue to degrade as the regional population grows. Emissions from all paved roads would increase directly as traffic volume increases. There would be a proportional increase in particulate and exhaust emissions along these routes from the increased traffic volume as the local population continues to grow and the recreational activities in the region increase.

The Agencies conclude that impacts to air quality along the roads in the Warm Springs Project area associated with disapproval of the proposed Project would be negligible to minor.

4.3.11 Visual Resources/Aesthetics

4.3.11.1 Impacts to Visual Resources/Aesthetics in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Impacts to visual resources in the Smoky Mountain area could result from the increased recreational use in the area, which would occur over time. Existing visual modifications created by previous mining and exploration activities would continue to adversely affect the visual resource. VRM ratings in the area would not be expected to change.

The Agencies conclude that impacts to the visual resources/aesthetics in the Smoky Mountain area associated with disapproval of the proposed Project would be minor.

4.3.11.2 Impacts to Visual Resources/Aesthetics in the Smoky Mountain Area Along the Warm Creek Road Associated with Disapproval of the Proposed Project

Impacts to visual resources in the Smoky Mountain area could occur as a result of continued vehicle use and unauthorized off-road vehicle use; natural events, such as storms that may erode the existing roadbed; or from future road improvement projects that may be initiated by Kane County or the National Park Service. VRM ratings are not expected to change in the area.

The Agencies conclude that impacts to visual resources/aesthetics in the Smoky Mountain area along the Warm Creek Road associated with disapproval of the proposed Project would be minor.

4.3.11.3 Impacts to Visual Resources/Aesthetics in the Smoky Mountain Area Along the Route of the Benchtop Road Associated with Disapproval of the Proposed Project

Impacts to the visual resource could occur as a result of continued and increasing vehicle use of existing roads and unauthorized off-road vehicle use. Visual impacts from the plume generated by the Navajo Generating Station are expected to be reduced once the Navajo Generating Station Scrubber project is completed. VRM ratings in the area are not expected to change.

The Agencies conclude that impacts to visual resources/aesthetics in the Smoky Mountain area along the route of the Benchtop Road would be negligible.

4.3.11.4 Impacts to Visual Resources/Aesthetics in the Smoky Mountain Area along the Route of the 138-kV Power Transmission Line Associated with Disapproval of the Proposed Project

Impacts to the visual resource could occur as a result of possible future parallel construction along the existing UP&L 230-kV Sigurd line, which may be implemented to meet other future power needs. Additional impacts beyond this existing line could include disturbance from gradually increasing unauthorized off-road vehicle use.

The Agencies conclude that impacts to visual resources/aesthetics in the Smoky Mountain area along the route of the 138-kV power transmission line associated with disapproval of the proposed Project would be negligible.

4.3.11.5 Impacts to the Visual Resources/Aesthetics in the Iron Springs, Moapa, and Hurricane/Fredonia Areas Associated with Disapproval of the Proposed Project

Visual classifications are not expected to change in the Moapa, Iron Springs or Hurricane/Fredonia areas. Future development may still occur in the areas and would affect visual resources accordingly. Existing visual disturbances in the areas are expected to remain.

The Agencies conclude that impacts to the visual resources/aesthetics in the Iron Springs, Moapa, and Hurricane/Fredonia areas associated with disapproval of the proposed Project would be negligible.

4.3.12 Recreation

4.3.12.1 Impacts to Dispersed Recreational Opportunities in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Public access to the Smoky Mountain area would remain as it currently exists; the Benchtop Road would not be constructed, and the existing Warm Creek Road would not be upgraded and improved at this time. The level of recreational use, particularly hunting and ORV use, would continue and would remain at or near current levels, with a gradual increase occurring over time at this time regional population increases. Existing roads in the area would continue to remain available for use.

The Agencies conclude that impacts to dispersed recreational opportunities in the Smoky Mountain area associated with disapproval of the proposed Project would be minor.

4.3.12.2 Impacts to Recreation Use and Management of the Glen Canyon NRA from Use of the Warm Creek Road Associated with Disapproval of the Proposed Project

Public recreational access within the Glen Canyon NRA via the existing Warm Creek Road would remain at or near current availability. NPS has no current plans for any development along the Warm Creek Road or along the north shore of Lake Powell. According to the General Management Plan for the Glen Canyon NRA, the Warm Creek Road is to remain open for public access. NPS and Kane County are discussing plans to improve or upgrade the section of road through the NRA. Traffic levels along this road would most likely gradually increase with the increased regional population growth.

The Agencies conclude that impacts to recreation use and management of the Glen Canyon NRA from use of the Warm Creek Road associated with disapproval ofthe proposed Project would be negligible to minor.

4.3.13 Wilderness

4.3.13.1 Impacts to the Potential Wilderness Designation of the Wahweap and Burning Hills Wilderness Study Areas Associated with Disapproval of the Proposed Project

The wilderness characteristics present in the Wahweap and Burning Hills Wilderness Study Areas (WSAs) would remain intact, at or near current levels. ORV and other existing recreational activities would increase in relation to general population increases of the region. The majority of the acreage contained within these WSAs lacks the necessary characteristics to be considered for wilderness designation (BLM 1991). Disapproval of the proposed Project would have no effect on these determinations. Until a final determination is made concerning these areas, they would continue to be managed in a manner that would not impair their suitability for preservation of wilderness.

The Agencies conclude that impacts to the potential wilderness designation of the Wahweap and Burning Hills WSAs associated with disapproval of the proposed Project would be negligible.

4.3.13.2 Impacts to Wilderness Characteristics in the Smoky Mountain Area Associated with Disapproval of the Proposed Project

Wilderness characteristics in the Smoky Mountain area would remain at or near the current conditions. Increases in regional population over time would gradually increase the number of recreators in the Smoky Mountain area and may affect the noise and solitude characteristics of the area. Previous disturbances associated with past exploration and other development would continue to be present, impacting the naturalness of the area. Existing roads would remain intact and ORV use would continue.

The Agencies conclude that impacts to wilderness characteristics in the Smoky Mountain area associated with disapproval of the proposed Project would be minor.

4.3.14 Cultural Resources

4.3.14.1 Impacts to Prehistoric and Historic Resources in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Prehistoric and historic resources are currently affected by natural processes, such as erosion and fires; greater effects occur where human activities accelerate the natural processes. Deforestation and road construction are examples of activities contributing to resource disturbance. Vandalism, surface artifact collecting, and possibly pot hunting would continue to affect the resource base in potentially increasing levels relating to regional population increases. Some loss of information to the scientific community would result from the fact that no Project-related mitigation (data retrieval) of important sites would take place.

The Agencies conclude that impacts to prehistoric and historic resources in the Warm Springs Project area associated with disapproval of the proposed Project would be negligible and permanent, with the potential to become significant if any part of an important NRHP-eligible site is damaged or destroyed. The loss of any part of a prehistoric or historic site would be irretrievable.

4.3.14.2 Impacts to Undiscovered Prehistoric and Historic Resources in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Prehistoric and historic resources are currently affected by natural processes, such as erosion and fires; greater effects occur where human activities accelerate the natural processes. Vandalism, surface artifact collecting, and possibly pot hunting would continue to affect the resource base in potentially increasing levels relating to regional population increases. Some loss of information to the scientific community would result from the fact that no Project-related mitigation of important sites would take place, and no new identification of previously unknown sites could occur during construction.

The Agencies conclude that impacts to undiscovered prehistoric and historic resources in the Warm Springs Project area associated with disapproval of the proposed Project would be negligible and permanent, with the potential to become significant if any part of an important NRHP-eligible site is damaged or destroyed. The loss of any prehistoric or historic site would be irretrievable.

4.3.14.3 Impacts to Native American Cultural and Religious Concerns in the Warm Springs Project Area Associated with Disapproval of the Proposed Project

Native American resources are currently affected by natural processes, such as erosion and fires; greater effects occur where human activities accelerate the natural processes. Vandalism, such as defacing of rock art sites, would continue to affect the resource base and may increase gradually as the regional population increases. Some loss of information to the scientific community would result from the fact that no Project-related mitigation of important sites would take place.

The Agencies conclude that impacts to Native American cultural and religious concems in the Warm Springs Project area associated with disapproval of the proposed Project would be negligible and permanent with the potential to become significant if any part of a Native American religious or cultural site is damaged destroyed. The loss of any Native American religious or cultural site would be irretrievable.

4.3.14.4 Indirect (Secondary) Impacts to Prehistoric and Historic Resources in the Warm Springs Project Area Due to Increased Levels of Activity Associated with Disapproval of the Proposed Project

Prehistoric and historic resources are currently affected by natural processes such as erosion and fires; greater effects occur where human activities accelerate the natural processes. Vandalism, surface artifact collecting, and possibly pot hunting would continue to affect the resource base in potentially increasing levels regional population increases. Potential structural impacts to the Naegle House would continue to occur as a result of continued traffic on Utah Route 17.

The Agencies conclude that indirect (secondary) impacts to prehistoric and historic resources in the Warm Springs Project area due to increased levels of activity associated with disapproval of the proposed Project would be negligible and permanent with the potential to become significant if any part of an important NRHP-eligible site is damaged or destroyed. The loss of any prehistoric or historic site would be irretrievable.

4.4 COMPARISON OF ALTERNATIVES

Table 4-17 compares the Agencies conclusions regarding the magnitude and importance of the proposed Project's site-specific and cumulative impacts (Alternative 1) with those of the disapproval alternative (Alternative 2).

Table 4-17 — Summary of Impacts by Alternative for the Warm Springs Project

Impact Topic	Alternative 1	Alternative 2
GEOLOGY AND TOPOGRAPHY		
Impacts to topography in and around the Smoky Mountain area.	Minor to moderate over the short term, negligible to minor over the long term. Impacts on topography would be irreversible.	Negligible. Irreversible.
Impacts to mineral resources in and around the Smoky Mountain area.	Minor over the short term, negligible to minor over the long term. Coal removal would be an irretrievable commitment of the resource.	Negligible to minor.
Impacts to topography along the Warm Creek/Benchtop Road.	Minor to moderate over both the short and long terms.	Negligible to minor.
PALEONTOLOGY		
Impacts to paleontological resources in the Smoky Mountain area.	Minor over the short term, negligible over the long term. Potential to become significant. Loss of paleontological resources would be irretrievable.	Negligible. Potential to become significant. Loss of paleontological resources would be irretrievable.
Impacts to paleontological resources in the Iron Springs and Moapa areas.	Negligible over the short and long terms. Potential to become significant. Loss of paleontological resources would be irretrievable.	Negligible. Potential to become significant. Loss of paleontological resources would be irretrievable.
HYDROLOGY		
Impacts to water quality and quantity in the Smoky Mountain area.	Minor over both the short and long terms.	Negligible.
Impacts to water quality and quantity in and around the Warm Creek Drainage System.	Minor over both the short and long terms.	Negligible.
Impacts to the Navajo Aquifer in the Smoky Mountain area.	Minor over both the short and long terms.	Negligible.
Impacts to water quality and quantity in and around the Iron Springs and Moapa areas.	Negligible to minor over both the short and long terms.	Negligible.
SOILS		
Impacts to soil productivity in the Warm Springs Project area.	Minor to moderate over the short term, minor over the long term. Losses of soil productivity and development would be irretrievable.	Negligible. Losses of soil productivity and development would be irretrievable.

Table 4-17 — Summary of Impacts by Alternative for the Warm Springs Project — (Continued)

Impact Topic	Alternative 1	Alternative 2
SOILS (Con.)		
Impacts to soils in the Smoky Mountain area.	Negligible to minor over the short term, negligible over the long term.	Negligible.
Impacts to cryptogamic soils in the Smoky Mountain area.	Minor over both the short and long terms.	Negligible.
VEGETATION		
Impacts to vegetative productivity and community stability in the Warm Springs Project area.	Minor over the short term, negligible to minor over the long term. Loss of vegetative productivity would be irretrievable.	Negligible. Loss of vegetative productivity would be irretrievable.
Impacts to wetland and riparian communities in the Smoky Mountain area.	Negligible to minor over the short term, negligible over the long term. Temporary loss of riparian productivity would be irretrievable.	Negligible. Loss of riparian productivity would be irretrievable.
Impacts to the Smoky Mountain evening primrose and Higgins biscuitroot.	Negligible to minor over both the short and long terms.	Negligible.
WILDLIFE		
Impacts to mule deer movement during migrational periods along Interstate-15 and U.S. Hwy. 89.	Negligible to minor over both the short and long terms. Highway deer mortalities would be irretrievable.	Negligible to minor. Deer mortality would be irretrievable.
Impacts to wildlife habitat and productivity in the Smoky Mountain area.	Minor over the short term, negligible over the long term. Temporary habitat and productivity losses would be irretrievable.	Negligible. Habitat loss would be irretrievable.
Impacts to wildlife in the Smoky Mountain area from increased human presence.	Minor to moderate over the short term, minor over the long term. Mortality and reduced productivity would be irretrievable.	Negligible to minor. Wildlife mortality would be irretrievable.
Impacts to the ferruginous hawk, golden eagle, peregrine falcon, and other raptors in the Warm Springs Project area.	Minor over both the short and long terms. Mortalities would be irretrievable.	Negligible. Mortalities would be irretrievable.
Impacts to the Mexican spotted owl in the Smoky Mountain area.	None to minor over both the short and long terms.	None to negligible.

Table 4-17 — Summary of Impacts by Alternative for the Warm Springs Project — (Continued)

Impact Topic	Alternative 1	Alternative 2
WILDLIFE (Con.)		
Impacts to the desert tortoise in the Moapa and Hurricane areas.	Minor over the short term, negligible to minor over the long term. Tortoise mortality would be irretrievable.	Negligible to minor. Tortoise mortality would be irretrievable.
TRANSPORTATION		
Impacts to open road traffic flow in the Warm Springs Project area.	Minor to moderate over both the short and long terms. Potentially significant along U.S. Hwy. 89, Utah Route 59, Utah Route 17, I-15.	Negligible to moderate. Potentially significant along I-15 and Utah Route 9.
Impacts to traffic flow at intersections in the Warm Springs Project area.	Minor to moderate over both the short and long terms. Potentially significant at intersections of U.S. Hwy. 89A and Arizona Route 389; Utah Route 59 and Utah Route 9; Utah Route 9 and I-15; Utah Route 9 and Utah Route 17; and I-15 and Utah Route 56.	Minor to moderate. Potentially significant at intersections of U.S. Hwy. 89A and Arizona Route 389; Utah Route 59 and Utah Route 9; Utah Route 9 and I-15; Utah Route 9 and Utah Route 17; and I-15 and Utah Route 56.
Impacts to highway infrastructure in the Warm Springs Project area.	Minor to moderate over both the short and long terms. Potentially significant along Utah Routes 17, 56, 59, and Hidden Valley Road.	Minor to moderate. Potentially significant along Utah Routes 17, 56, 59, and Hidden Valley Road.
Impacts to public safety along highways in the Warm Springs Project area.	Moderate to major over both the short and long terms. Potentially significant along I-15, Utah Route 9, Utah Route 59, and U.S. Hwy. 89.	Moderate to major. Potentially significant along I-15, Utah Route 9, Utah Route 59 and U.S. Hwy. 89.
Impacts to structural integrity and stability of county roads in the Smoky Mountain area.	Minor over the short term, negligible over the long term.	Negligible.
NOISE		
Impacts from noise generated along the roads in the Warm Springs Project area.	Minor to moderate over both the short term, minor over the long term.	Minor.
Impacts from noise generated in the Iron Springs and Moapa areas.	Negligible over both the short and long terms.	Negligible.
Impacts from noise generated in the Smoky Mountain area.	Minor over both the short and long terms. Potentially significant along the Warm Creek/Benchtop Road.	Negligible.

Table 4-17 — Summary of Impacts by Alternative for the Warm Springs Project — (Continued)

Impact Topic	Alternative 1	Alternative 2
SOCIOECONOMICS		
Impacts to employment, population, personal income, and business activity in the Warm Springs Project area.	Moderate to major over both the short and long terms. Potentially significant in Big Water and Kanab, Utah; and Fredonia, Arizona.	Moderate to major.
Impacts to local government fiscal resources in the Warm Springs Project area.	Moderate to major over the short term, moderate over the long term. Significant in Kanab, Big Water, and Kane County. Potentially significant in Fredonia, La Verkin, Toquerville, and Hurricane.	Moderate. Potentially significant in Kane County, Kanab, Big Water, and Fredonia or Hurricane.
Impacts to State and Federal fiscal resources.	Minor to moderate over the short term, minor over the long term. Significant in Utah.	Negligible to minor. Potentially significant in Utah.
Impacts to housing availability in the Warm Springs Project area.	Moderate over both the short and long terms. Potentially significant in Page and Toquerville.	Minor to moderate.
Impacts to public safety agencies in the Warm Springs Project area.	Moderate over both the short and long terms.	Minor to moderate.
Impacts to public schools in the Warm Springs Project area.	Major over the short term, minor over the long term. Significant in Kane County. Potentially significant in Washington County.	Minor to moderate. Potentially significant in Kane County and in Utah.
Impacts to water and sewer systems in the Warm Springs Project area.	Minor to moderate over both the short and long terms. Potentially significant in Page and Toquerville.	Minor. Potentially significant in Page and Toquerville.
Impacts to regional quality of life from population growth in the Warm Springs Project area.	Moderate to major over both the short and long terms. Potentially significant in Fredonia, Big Water, and Kanab.	Moderate.
Impacts to regional quality of life from traffic growth in the Warm Springs Project area.	Moderate to major over the short term, moderate over the long term. Significant in Hurricane, La Verkin, and Toquerville.	Minor to moderate. Potentially significant in Hurricane, La Verkin, and Toquerville.
Impacts to residential property values from population and traffic growth in the Warm Springs Project area.	Minor to moderate over both the short and long terms. Potentially significant in Page, Hurricane, and Toquerville.	Minor. Potentially significant in Hurricane and Toquerville.

Table 4-17 — Summary of Impacts by Alternative for the Warm Springs Project — (Continued)

Impact Topic	Alternative 1	Alternative 2
SOCIOECONOMICS (Con.)		
Impacts to socioeconomic conditions.	Minor to moderate over both the short and long terms. Potentially significant in Kane County and Kanab, Utah, and Fredonia, Arizona.	Negligible to minor.
AIR QUALITY		
Impacts to air quality in the Smoky Mountain, Iron Springs, and Moapa areas.	Minor over the short term, negligible to minor over the long term.	Negligible to minor.
Impacts to air quality along the roads in the Warm Springs Project area.	Minor over the short term, negligible to minor over the long term.	Negligible to minor.
VISUAL RESOURCES/AESTHETICS		
Impacts to visual resources/aesthetics in the Smoky Mountain area.	Minor to moderate over the short term, minor over the long term.	Minor.
Impacts to visual resources/aesthetics in the Smoky Mountain area along the Warm Creek Road.	Minor and permanent. Irretrievable commitment of visual resource.	Minor.
Impacts to visual resources/aesthetics in the Smoky Mountain area along the route of the Benchtop Road.	Moderate and permanent. Irretrievable commitment of visual resource.	Negligible.
Impacts to visual resources/aesthetics in the Smoky Mountain area along the route of the 138-kV power transmission line.	Minor to moderate over the short term, negligible over the long term.	Negligible.
Impacts to visual resources/aesthetics in the Iron Springs, Moapa, and Hurricane/Fredonia areas.	Negligible over both the short and long terms.	Negligible.

Table 4-17 — Summary of Impacts by Alternative for the Warm Springs Project — (Continued)

Impact Topic	Alternative 1	Alternative 2
RECREATION		
Impacts to dispersed recreational opportunities in the Smoky Mountain area.	Minor to moderate over both the short and long terms.	Minor.
Impacts to recreational use and management of the Glen Canyon NRA from use of the Warm Creek Road.	Moderate over the short term, minor over the long term.	Negligible to minor.
WILDERNESS		
Impacts to the potential wilderness designation of the Wahweap and Burning Hills Wilderness Study Areas.	Negligible to minor both over the short and long terms.	Negligible.
Impacts to wilderness characteristics in the Smoky Mountain area.	Minor to moderate over both the short and long terms.	Minor.
CULTURAL RESOURCES		
Impacts to prehistoric and historic resources in the Warm Springs Project area.	Minor and permanent. Loss of NRHP-eligible prehistoric or historic sites would be irretrievable.	Negligible and permanent. Potentially significant if an NRHP-eligible site is damaged/destroyed. Loss of a prehistoric/historic site would be irretrievable.
Impacts to undiscovered prehistoric and historic resources in the Warm Springs Project area.	Minor and permanent. Potentially significant if undiscovered sites are destroyed. Loss is irretrievable.	Negligible and permanent. Potentially significant if an NRHP-eligible site is damaged/destroyed. Loss of a prehistoric/historic site would be irretrievable.
Impacts to Native American cultural and religious concerns in the Warm Springs Project area.	Minor and permanent. Potentially significant if unidentified Native American cultural/religious sites are destroyed. Loss of Native American cultural/religious site would be irretrievable.	Negligible and permanent. Potentially significant if a Native American cultural/religious site is damaged/destroyed. Loss of a Native American religious/cultural site would be irretrievable.
Indirect (secondary) impacts to prehistoric and historic resources in the Warm Springs Project area due to increased levels of activity.	Minor and permanent. Potentially significant if NRHP-eligible sites are disturbed. Loss of a prehistoric/historic site would be irretrievable.	Negligible and permanent. Potentially significant if an NRHP-eligible site is damaged/destroyed. Loss of a prehistoric/historic site would be irretrievable.

CONSULTATION AND COORDINATION, PUBLIC PARTICIPATION AND REVIEW

CHAPTER 5

5.1 CONSULTATION AND COORDINATION

A variety of Federal, State, and local agencies, interest groups, and private entities have been contacted concerning the proposed Warm Springs Project. Andalex Resources, Inc. (Andalex), began contacting the various entities that could be affected by the proposed Project as early as 1988. The Bureau of Land Management's (BLM's) active involvement with the Project began soon after the initial rights-of-way applications were filed in October 1989, determining in May 1990 that an environmental impact statement (EIS) should be prepared. The Office of Surface Mining Reclamation and Enforcement (OSM) and the Utah Division of Oil, Gas, and Mining (Utah DOGM) became actively involved with the Project soon after the initial permit application package for the Smoky Hollow Mine was filed in February 1991. OSM agreed to formally share the responsibilities of joint lead, and Utah DOGM and the National Park Service (NPS) agreed to become formal cooperating agencies in the preparation of the EIS in July 1991. Since that time, the lead and cooperating agencies have worked closely in the identification of important issues and the preparation of the EIS. A formal memorandum of understanding (MOU) between BLM, OSM, NPS, and Utah DOGM concerning the preparation of the EIS was signed on August 30, 1993. In addition to a large number of agencies, groups, and individuals that provided input concerning the Project and the EIS during the various scoping activities, a variety of agencies and private entities provided additional input that was used by the Agencies during the preparation of the EIS. They are discussed below.

5.1.1 Federal Agencies

The U.S. Army Corps of Engineers (Bountiful, Utah; Phoenix, Arizona; and Reno, Nevada) and the U.S. Environmental Protection Agency (San Francisco, CA) provided input concerning Federal wetland/waters of the United States identification and the Section 404 permitting process, and helped the Agencies inspect Wahweap Creek and Warm Creek in the Smoky Mountain area, and California Wash near Moapa, Nevada, for permitting requirements.

The U.S. Fish and Wildlife Service (Salt Lake City, Utah; Phoenix, Arizona; and Reno, Nevada) provided input regarding threatened and endangered plant and animal species in the areas of potential impact from the Project and assisted in the biological assessment and determinations of effect concerning those species.

The U.S. Forest Service (Flagstaff, Arizona, and Cedar City, Utah) provided input regarding permitting requirements and the identification of lands near Flagstaff and Williams, Arizona, that could have been available for use as a unit-train loadout facility for the Project. Subsequent decisions by the Applicants eventually eliminated the need for a loadout in those areas. The U.S. Forest Service office in Fredonia, Arizona, was also contacted regarding potential impacts in the vicinity of the proposed truck maintenance facility.

5.1.2 State and Regional Agencies

The Utah, Arizona, and Nevada Departments of Transportation (DOT) provided extensive research and data on highway conditions, traffic counts, and levels of service that were used during the evaluation of mining-related traffic issues.

The Utah and Nevada Divisions of Air Quality provided information and analysis concerning air quality issues at various Project locations (e.g., the mine, the loadouts, and along the haul route).

The Utah and Nevada State Historic Preservation Officers (SHPOs), the Utah State Historical Society/Division of State History, and the Southern Nevada Site Survey Regional Office/Harry Reid Center for Environmental Studies with the University of Nevada at Las Vegas provided extensive research and data with regard to cultural and historical resource values at various Project locations that were used during the evaluation of cultural and historical issues.

The Utah State School and Institutional Trust Lands Administration (TLA) provided input concerning TLA concerns in the Smoky Mountain area.

The Utah Department of Natural Resources, Water Rights Division (DNR), provided input concerning water appropriation, State wetland/waters of the United States identification, and the Utah Section 404 permitting process, and helped the Agencies inspect Wahweap Creek and Warm Creek in the Smoky Mountain area for permitting requirements.

The Utah, Arizona, and Nevada Divisions of Wildlife Resources (DWR) provided input regarding threatened and endangered plant and animal species in the areas of potential impact from the Project and assisted in the biological assessment and determinations of effect concerning those species. Utah DWR provided extensive research and data with regard to wildlife habitat and species in the Smoky Mountain area that were used during the evaluation of mining-related wildlife issues.

The Utah Resources Development Coordinating Committee (RDCC) provided input concerning development issues associated with the proposed Project.

The Utah Governor's Office of Planning and Budget (Utah GOPB) provided extensive research and data with regard to social and economic factors in the area that were used during the evaluation of mining-related issues. They provided the Agencies access to the background data and computer program used in the preparation of the fiscal economic report on the Project that was prepared for the Governor of Utah (Utah GOPB 1993a).

5.1.3 Local Agencies

Representatives from the various cities, towns, and counties potentially affected by Project activities provided input concerning the identification of local needs and concerns that were used during the evaluation of mining-related social and economic issues. Where necessary, they helped the Agencies identify potential permitting requirements within their jurisdiction. In the case of Fredonia and Hurricane, they also helped the Agencies identify suitable locations near those communities for use in the hypothetical analysis of truck maintenance facilities. These agencies included:

Big Water City Council - Big Water, Utah
Clark County Board of County Commissioners - Las Vegas, Nevada
Clark County Comprehensive Planning Board - Las Vegas, Nevada
Fredonia City Council - Fredonia, Arizona
Hurricane City Council - Hurricane, Utah
Iron County Board of County Commissioners - Cedar City, Utah
Iron County Planning and Zoning Commission - Kanab, Utah
Kanab City Council - Kanab, Utah
Kane County Board of County Commissioners - Kanab, Utah
Kane County Planning and Zoning Commission - Kanab, Utah
Moapa Town Advisory Board - Moapa, Nevada
Washington County Board of County Commissioners - St. George, Utah
Washington County/Southern Utah Corridor Task Force - St. George, Utah

The Daughters of Utah Pioneers Museum (Salt Lake City, UT) and the Museum of Northern Arizona, Anthropology Department (Flagstaff, AZ), provided research and data with regard to cultural and historical resource values at various Project locations that were used during the evaluation of cultural and historical issues.

5.1.4 Tribal Councils

Elected officers or leaders from 21 Native American tribes or tribal groups were contacted, and many provided input concerning the identification of local needs and concerns that could be used during the evaluation of mining-related social and economic issues. These included:

Blue Mountain Dine' Tribe - Blanding, Utah
Cedar City Band of the Paiute Tribe - Cedar City, Utah
Goshute Indian Tribe - Ibapah, Utah
Havasupai Tribe - Havasupai, Arizona
Hopi Tribe - Kykotsmovi, Arizona
Hualapai Tribe - Peach Springs, Arizona
Kaibab Paiute Tribe - Fredonia/Pipe Springs, Arizona
Kanosh Band of the Paiute Tribe - Kanosh, Utah
Koosharem Band of the Paiute Tribe - Richfield, Utah

Moapa Paiute Tribe - Moapa, Nevada
Navajo Nation - Window Rock, Arizona
Northwestern Band of the Shoshoni Nation - Blackfoot, Idaho
Shivwits Paiute Tribe - Moapa, Nevada
Shoshone Bannock Tribe - Fort Hall, Idaho
Skull Valley Goshute Tribe - Grantsville, Utah
Southern Paiute Tribe - Tuba City, Arizona
Southern Ute Tribe - Ignacio, Colorado
Ute Mountain Ute Tribe - Towoac, Colorado
Ute Indian Tribe - Fort Duchesne, Utah
White Mesa Ute Council - Blanding, Utah
Zuni Tribe - Zuni, New Mexico

5.1.5 Issues-Oriented Organizations/Special Interest Groups/Business

The public lands in the Smoky Mountain area are well known to people over a wide area, including but not limited to the southern Utah, northern Arizona, southeastern Nevada study area, other parts of Utah, and elsewhere in the United States. This is because of the range of opportunities represented within the area, from natural resources and their potential for economic development to aesthetic and environmental resources and their potential for conservation. Therefore, local and nonlocal residents sometimes join issues-oriented organizations whose focus of attention includes the study area. Potential events involving the study area, such as the proposed Warm Springs Project, then attract the attention of these organizations. Some issues-oriented organizations have supported the proposed Project. Others have opposed it. Representatives from the various organizations who have expressed interest in Project activities provided input concerning the identification of local/State/National needs and concerns that were used during the evaluation of mining-related issues. Examples include:

Five County Association of Governments
Grand Canyon Trust
National Parks and Conservation Association (NPCA)
Southern Utah Wilderness Alliance (SUWA)
Utah-Arizona Action Team
Utah Association of Counties
Utah Chapter of the Sierra Club
Utah Public Education Coalition
Wilderness Society

5.2 PUBLIC PARTICIPATION

5.2.1 Formal Scoping

BLM and OSM (the Agencies) announced their decision to prepare the Warm Springs Project EIS and the initiation of formal scoping activities in a "Notice of Intent" published in the July 14, 1992, issue of the *Federal Register* (57 FR 31207). An initial description of the Project and a preliminary timetable were included to encourage interested parties to provide oral and/or written comments on the scope of the EIS analysis.

The Agencies held six formal scoping meetings to allow the public in the southern Utah, northern Arizona, and southeastern Nevada area an opportunity to provide oral statements. About 188 people attended these meetings, held in Page, Arizona (August 17); Kanab, Utah (August 18); Hurricane, Utah (August 19); Salt Lake City, Utah (August 24); Cedar City, Utah (August 25); and Moapa, Nevada (August 26). An additional informational meeting requested by the Grand Canyon Trust was held in Flagstaff, Arizona, on October 29, 1992. Thirteen people attended that meeting.

Written comments from the public were formally accepted between July 14, 1992, and November 15, 1992. In order to accommodate a request by the Grand Canyon Trust, the initial 60-day scoping period (ending on September 15) was extended an additional 60 days. Nearly 900 letters were received from the public during the 120-day comment period. The received statements/comments assisted the Agencies in defining the scope of issues and concerns that needed to be evaluated in the EIS.

5.2.2 Scoping Followup

The Agencies released a summary of the formal scoping activities, including the seven public scoping meetings and the 2,900-plus comments received over the course of the 120-day comment period, in February 1993. The summary provided information on the size of the scoping response, number of responses relative to the resource value, and consolidated public issues organized both by Project component (e.g., Project design, alternatives) and/or by the specific resource value (e.g., water resources, transportation). In an effort to encourage continued participation by the public, the Agencies announced that they would continue to accept and consider all public input throughout the entire period of EIS preparation. A total of 902 copies of the summary was mailed to the interested public on March 5, 1993.

A second informational and status summary was released by the Agencies in January 1994. This summary provided information on the status of the EIS analysis, explained the delays in the preparation of the draft EIS, and provided a discussion on the scoping process and how it was being used during preparation of the EIS. That discussion was included to explain to the public how their input would be used in the EIS and at what periods in the process they would be able to comment on the EIS. A total of 1,017 copies of the status summary was mailed to interested parties on January 14, 1994.

5.2.3 Formal Scoping - Round 2

The Agencies announced their intent to reopen formal scoping activities concerning the Warm Springs Project EIS in the July 10, 1995, issue of the *Federal Register* (60 FR 35561). In an effort to resolve issues that developed as a result of the previous scoping activities, Andalex revised the permit application packages (PAPs) for the Smoky Hollow Mine involving the proposed size and life of the mine. An updated description of the Project and specific information on the new limits of the proposed mine were provided to encourage interested parties to provide oral and/or written comments pertaining to any additional environmental concerns that may have needed to be addressed in the EIS.

An information and status summary was released by the Agencies prior to publication of the July 10, 1995, *Federal Register* notice. This summary provided additional information on the status of the EIS analysis, explained the continuing delays in the preparation of the draft EIS, and provided a copy of the text that would appear in the *Federal Register* notice. A total of 1,087 copies was mailed to interested parties on July 6, 1995.

Seven open-house/public scoping meetings were held throughout the southern Utah, northern Arizona, and southeastern Nevada area to allow the interested public an opportunity to learn more about the changing scope of the EIS analysis and to provide oral statements. About 320 people attended these meetings, held in Cedar City, Utah (August 8); Hurricane, Utah (August 9); Salt Lake City, Utah (August 10); Moapa, Nevada (August 14); Kanab, Utah (August 15); Page, Arizona (August 16); and Flagstaff, Arizona (August 17). Written comments from the public were formally accepted between July 10 and September 5, 1995. Over 120 letters were received from the public during the 60-day comment period. The received statements/comments assisted the Agencies in further defining the scope of issues and concerns that needed to be evaluated in the EIS.

5.2.4 Public Involvement Promoted by Andalex

A variety of Federal, State, and local agencies, interest groups, and private individuals have been contacted by Andalex since the permitting process for the Smoky Hollow Mine began. Between 1988 and 1996, company representatives contacted over 2,500 people and held more than 500 meetings to provide their explanation of the proposed Project and resolve as many issues and concerns as early in the process as possible. Although these contacts were not made by the Agencies as part of the formal scoping process for the EIS, they did afford the interested public additional opportunities to become familiar with the various components that would eventually make up the Warm Springs Project. As a result of these initial contacts by Andalex, many of these groups and individuals were more active in their participation during the formal EIS scoping activities conducted by the Agencies.

5.2.5 The Draft EIS

This draft of the Warm Springs Project EIS represents the Agencies' current understanding of the proposed Project, the pertinent issues associated with its development and operation, and the potential impacts that could result. Numerous issues/topics regarding the Applicants' proposals were identified during scoping activities. Many of these issues/topics were evaluated as part of the impact analysis section of the EIS in Chapter 4. Those issues/topics not formally addressed are discussed in Chapter 2, Section 2.2 (Other Alternatives Considered), and Section 5.3 of this chapter (Public Issues Considered But Eliminated From Detailed Analysis) along with the Agencies' rationale for not including them in the analysis.

Interested individuals are encouraged to provide oral and/or written comments on the adequacy of the impact analysis, as well as on the adequacy of the Agencies' responses to those comments or alternatives not considered to be "deserving of further study" (Chapter 2, Section 2.2, and Chapter 5, Section 5.3). Public comment will be accepted for at least 60 days from the release of this draft EIS to the public.

The Agencies intend to hold a series of seven public meetings throughout the southern Utah, northern Arizona, and southeastern Nevada area to provide interested public an opportunity to make oral statements regarding this draft of the EIS. Written comments on the draft EIS can be submitted to the Agencies at any time during the 60-day comment period. Details (dates, locations, addresses, etc.) have been included in both the transmittal letter that came with this EIS and the formal "Notice of Availability" published in the *Federal Register*.

The draft EIS is available for public review at:

- The BLM offices in Salt Lake City (324 South State, Suite 301), Cedar City (176 East DL Sargent Drive and 365 South Main Street), St. George (225 North Bluff Street), and Kanab (318 North 100 East), Utah; and in Las Vegas, Nevada (4765 Vegas Drive).
- The OSM offices in Denver, Colorado (1999 Broadway, Suite 3410) and in Albuquerque, New Mexico (505 Marquette NW, Suite 1200).
- The NPS offices in Page, Arizona (691 Scenic View Drive).
- The Utah DOGM offices in Salt Lake City, Utah (355 West Temple, 3 Triad Center, Suite 350).

Although numbers are limited, additional copies of the draft EIS may be obtained for a limited time by writing either BLM or OSM at the Kanab, Utah, or Denver, Colorado, addresses listed above.

5.2.6 The Final EIS

The Agencies will release a final EIS on the Warm Springs Project that will contain revisions to and clarifications within the text of this draft EIS. All public comments received during the formal 60-day comment period will be summarized, and specific responses from the Agencies will be prepared. Public comments on the adequacy of the draft version of the EIS will be carefully considered and used by the Agencies during preparation of the final EIS, in much the same way that the scoping comments were used in preparation of the draft. The impact analysis will be reevaluated on the basis of any new information received and will be reworked or updated accordingly. The list of issues not considered by the Agencies to be "deserving of further study" will be reevaluated and reworked or updated, as well.

After the Agencies publish the final EIS, the Secretary of the Interior and the BLM Authorized Officer(s) must make a decision whether to approve or disapprove the Project. They can make this decision no sooner than 30 days following publication of EPA's *Federal Register* notice of the availability of the Agencies' final EIS.

5.3 PUBLIC ISSUES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Several issues were identified by the public during scoping activities for this EIS that are not being addressed for a variety of reasons. The President's Council on Environmental Quality (CEQ) is very specific when it directs Federal agencies to reduce excessive paperwork by "using the scoping process, not only to identify significant environmental issues deserving of study, but also to deemphasize insignificant issues, narrowing the scope of the environmental impact statement process accordingly" (CEQ, 1978, 40 CFR §1500.4(g)). The Agencies evaluated every issue that was raised by the public during scoping activities and grouped them into impact topics. For various reasons, a few of these topics were identified as beyond the scope of this document and/or not requiring detailed analysis in the EIS. Those topics, along with the rationale for not analyzing them in detail, follow.

5.3.1 Issues Concerning Threatened or Endangered Wildlife or Plant Species Protected by the Endangered Species Act

The Endangered Species Act of 1973, as amended, offers Federal protection to plant and animal species listed by the U.S. Fish and Wildlife Service (USFWS) as endangered or threatened (Chapter 3, Section 3.5.2, Threatened and Endangered Species). Section 9 of the Act prohibits the "taking," or harming, harassing, or killing of a wildlife species. Section 7 is applicable to Federal land and requires that all Federal agencies ensure that any action they authorize, fund, or carry out does not jeopardize the continued existence of a listed species or adversely modify its critical habitat. Section 10 of the Act allows an incidental take permit to be issued for listed species occupying private land. This permit is usually in accordance with an approved Habitat Conservation Plan (HCP) to prevent the "taking" of a species as defined in Section 9 of the Act.

Federal agencies follow a mandatory process, defined in Section 7(c), for the early identification of potential conflicts and the resolution of those conflicts. This process includes: (1) a request for a "threatened and endangered species list" as part of the informal consultation between the Federal agency and USFWS, (2) preparation of a "Biological Assessment" (BA) by the Federal agency, and (3) USFWS review. If, on the basis of the BA, the Federal agency makes a finding of "no effect" or "not likely to adversely affect" and USFWS concurs, then the process is finished. If a "may affect" finding is made by either the Federal agency or USFWS, then formal consultation is initiated, and USFWS will issue a formal biological opinion (BA) on whether the proposed action would jeopardize the continued existence of the species. If appropriate, the biological opinion would identify the incidental take number, reasonable and prudent measures, and applicable terms and conditions relative to the proposed project. Compliance with those terms is required prior to proceeding with the actual project, if, in turn, it is approved by the authorizing Federal agency.

With regard to the proposed Warm Springs Project, the Agencies initiated informal consultation with USFWS on March 27, 1992, by requesting a formal species list covering the Project area. USFWS responded on May 6, 1992, and again on June 16, 1993, with a list containing the names of 12 listed/candidate species (both plants and animals) potentially present within the area that would be occupied by one or more elements of the proposed Warm Springs Project. Endangered or threatened species on that list included: the peregrine falcon, the Mexican spotted owl, the Utah prairie dog, the desert tortoise, the Siler pincushion cactus, and the Kanab ambersnail. Species identified by USFWS as candidates for Federal listing included: the ferruginous hawk, the loggerhead shrike, the spotted bat, the pygmy rabbit, the Smoky Mountain evening primrose, and the Atwoods penstemon.

Formal and informal scoping activities associated with this EIS prompted the Agencies to expand the list of species being evaluated for potential impacts to include eight additional listed/candidate species that, although not officially on the USFWS species list, could be present in the Project area. Listed species included: the bald eagle, the woundfin, the Moapa dace, the Virgin River/Moapa chub, the California condor, and the southwestern willow flycatcher. Candidate species included: the Higgins biscuitroot and the MacNeil sooty wing skipper.

Initial evaluations of the listed species identified a potential "may affect" finding for the desert tortoise in the Moapa area of Nevada. The Agencies subsequently requested formal consultation with USFWS on September 11, 1992, and prepared a BA on the desert tortoise with respect to impacts that could be expected as a result of implementing the Moapa unit-train loadout part of the proposed Project. USFWS released their Biological Opinion for that species on December 24, 1992, concurring with the "may affect" finding, but identifying incidental take numbers, terms and conditions, and reasonable and prudent measures that would allow the Moapa unit-train loadout proposal to proceed but still protect the tortoise.

The Agencies have continued to request updated species lists on a regular basis to ensure that no new species were identified. The most recent response from USFWS (date) indicated that the species list that had been submitted on June 16, 1993, was still accurate, except that the loggerhead shrike subspecies present in the Western United States had been removed from the Federal Candidate List.

A BA for the entire Warm Springs Project was prepared by the Agencies and submitted to USFWS in February 1995 (BLM and OSM, 1995a). USFWS responded with comments and suggestions for improvement, and a revised BA was submitted in [November 1995] (BLM and OSM 1995b). The BA contained the Agencies evaluation of the potential impact of the Warm Springs Project on each of the 19 remaining species of those identified above. In addition to the analysis of impacts and Agency finding as to whether or not the Project would adversely affect the continued existence of the species, the BA discussed the known distribution, habitat requirements, endangerment factors, and life history of each sensitive species relative to the proposed Project. This included updating the pertinent information and impact evaluation for the desert tortoise from the 1992 biological evaluation. As a result of these efforts, the Agencies were able to make the following determinations;

- The proposed Project would not affect the continued existence of 13 of the 19 species of concern.
- Project activities "may affect" the desert tortoise near Moapa, Nevada.
- In order to identify any effects, additional surveys would be required prior to initiating surface disturbance activities to determine the presence or absence of the peregrine falcon, the Mexican spotted owl, the ferruginous hawk, the Smoky Mountain evening primrose, the Higgins Biscuitroot, and the desert tortoise near Hurricane, Utah.

USFWS reaffirmed their Biological Opinion on May 31, 1995, in which they concurred with the Agencies' findings, including the updated "may affect" determination for the desert tortoise near Moapa, Nevada. USFWS also updated the incidental take numbers, terms, and conditions, and reasonable and prudent measures that would allow the Warm Springs Project to proceed but still protect the tortoise near Moapa. The terms identified by USFWS have been incorporated, with cooperation from the Applicants, in Appendix A as design features of the proposed Warm Springs Project (Appendix A, Section A.3.5.3.2, Desert Tortoise Habitat). Owing to the lack of detailed survey data, USFWS reserved a final determination of effect for the peregrine falcon, the Mexican spotted owl, and the desert tortoise near Hurricane, Utah. Final consultation (formal and/or informal) for these listed species will be completed by the Agencies prior to initiating actual surface disturbance activities. USFWS expressed appreciation to the Applicants for the commitment to also conduct additional surveys for the ferruginous hawk, the Smoky Mountain evening primrose, and the Higgins biscuitroot (all candidate species) prior to initiating surface disturbance activities.

Many commenters expressed concern that critical provisions of the Endangered Species Act would be ignored by the Applicants or the Agencies during the EIS and the Project review processes. They felt that threatened or endangered species would be destroyed by Project activities. As discussed above, the Agencies have fulfilled all of their responsibilities and made every effort to comply with the Act. The remaining three threatened and three candidate species of concern that could be affected by the Project are discussed in detail in Chapter 3 of this EIS (Sections 3.5.2, Vegetation, and 3.6.5, Wildlife). Potential impacts to these species from proposed Project activities, as modified by Agency/Applicant enhancement measures and by USFWS requirements, are identified and evaluated in Chapter 4 (Sections 4.5, Vegetation, and 4.6, Wildlife). Those issues raised by the public that dealt with any or all of the remaining federally listed or candidate species have been eliminated from further analysis by the Agencies; no additional impacts to these species have been identified.

5.3.2 Issues Concerning the Implementation of the EIS Process and Preparation of the EIS

Many comments suggesting that the EIS address several of the Agencies' decisions with regard to the EIS process and how it was being implemented for the Warm Springs Project were evaluated. These included decisions to (1) not hold up the impact analysis process until local land use planning processes were complete and the feasibility of the Project was more certain; (2) not prepare an EIS on an annual basis during Project implementation; (3) not hold additional scoping meetings in Phoenix, Las Vegas, Los Angeles, San Francisco, or Denver; (4) not use professional facilitators during scoping meetings; (5) not allow additional public input on which comments are important for the impact analysis prior to the draft EIS; (6) not allow unlimited access to the third-party contractor; (7) not let either special interests or local opinion influence the analysis; and, (8) not allow affected parties to receive advance copies of the draft EIS. Commenters also expressed concern that the EIS team would spend only 3 weeks in the actual writing of Chapters 3 and 4.

The Agencies considered all of the concerns expressed by the public and have made every effort to make this EIS and the EIS process as open and unbiased as possible. In most cases, changes to accommodate a commenter's request were impossible, given the time, workforce, and regulatory constraints. In other cases, the Agencies felt that the current process was more than adequate to accomplish the goals of the program and that the suggested changes were unnecessary. Regardless, evaluation of these topics in the EIS would not be appropriate.

5.3.3 Issues Concerning the Ability of Federal, State, and Local Agencies to Regulate Coal Mining and Mining-Related Activities

The ability of Federal, State, and local agencies to properly carry out their duties in the evaluation of the Warm Springs Project was a concern of a few commenters. They felt that the impact analysis and decision processes were tainted by a bias in favor of the applicants. They felt that agency personnel at all levels were circumventing environmental laws and guidelines in order to get the project started as soon as possible. They suggested the possible unethical involvement of employees or their relatives with Andalex or one of the other Applicants. They questioned the technical expertise of those people evaluating the impacts of the Project, as well as their willingness and ability to regulate the development of public resources, now and in the future.

The purpose of an EIS is to evaluate a proposed action and disclose its potential for impacts to the human environment to the public and to the Authorized Officer for use during the decisionmaking process. In this particular case, the Agencies have made every effort to conduct a fair and unbiased evaluation of the Applicants' proposals. A team of resource specialists has been assembled from personnel at BLM, OSM, NPS, and Utah DOGM to ensure that each agency's concerns are adequately evaluated. In addition, private third-party contractors have been retained to support the efforts of the Agencies and provide additional expertise and independent analysis. (A complete list of the individuals who contributed to the EIS effort and their qualifications has been included in Chapter 6 of the EIS.) Terms of their contract specifically restrict contact by the contractors with any of the parties affected by an Agency decision (the Applicants, members of environmental groups, etc.), further ensuring an untainted evaluation of impacts. It would be inappropriate for the Agencies to evaluate issues related to the ability of some or all of the agencies to regulate coal mining or any of the other proposed activities in this document.

5.3.4 Issues Concerning Coal Leasing and the Administration of Those Leases by the Federal Government

Several commenters raised issues concerning the coal leasing process, terms and conditions of existing leases, terms and conditions of future leases, due diligence requirements for lease development, and lease administration (including suspension of diligence requirements, bonding/fiscal responsibility, types and frequency of inspections, enforcement powers, reclamation potential, reclamation monitoring, and measures of reclamation success).

Coal leasing, in the Smoky Mountain area, the State of Utah, and Nationally, has been the subject of a large number of previous land use planning and EIS documents (Section 1.5, Scope of the EIS Analysis). Andalex holds valid leases, first issued in the mid-1970s and readjusted in 1986, and has followed all the rules and complied with all the conditions required by the regulations. Federal and State administration of these leases, as well as the proposed development of the leases, is controlled by a large number of Federal and State regulations. Issues associated with coal leasing and/or coal lease administration are beyond the scope of this EIS. (The role of Federal and State agencies in Project approval can be found in Appendix D. Associated topics are discussed in Sections 5.3.3, Issues Concerning the Ability of Federal, State, and Local Agencies to Regulate Coal Mining and Mining-Related Activities, and 5.3.8, Issues Concerning Land Use Planning Decisions in the Smoky Mountain Area.)

5.3.5 Issues Concerning the Status of the National and World Coal Markets and the Economic Viability of the Warm Springs Project

Many commenters requested that the EIS address their concerns that there is no demand or market for the coal being produced at the Smoky Hollow Mine, now or in the future. They questioned whether Andalex would be able to find a niche in that market, given the anticipated competition from existing American, Australian, and Chinese coal companies that are already supplying coal to the Southwest and to the Pacific Rim markets targeted by Andalex. And, if they were able to establish a foothold in those markets, what would happen to the companies, and their employees, that would be displaced. Commenters also questioned the profitability of mining coal at the Smoky Hollow Mine when compared to the costs of facility construction, underground mining equipment, and coal haulage. They questioned the energy balance of the Project and the continued viability of coal as an energy source, and pointed out the current drop in coal prices. They suggested that firm markets be established before considering the development of coal reserves in the Smoky Mountain area.

The purpose of an EIS is to evaluate a proposed action and disclose its potential for impacts to the human environment to the public and to the Authorized Officer for use during the decisionmaking process. Private economic decisions to proceed, or not proceed, with a particular investment are the responsibility of the private company or companies proposing the action. An evaluation of Andalex's ability to mine coal economically and to eventually compete in the National and international coal markets is inappropriate for this EIS. Given that energy, whether in the form of coal, electricity, or diesel fuel, has an economic value, the issue of the energy balance of the Warm Springs Project is essentially an issue of economic viability. If the energy (value) contained in the coal produced does not exceed the energy (and other monetary input) used to mine and transport it to a final consumer, the Project would not be economically viable. As discussed above, this economic evaluation is made by the applicants (Andalex and others) and not by the Agencies. Thus, a detailed economic and energy balance was deemed to be outside the scope of this EIS.

Supply, demand, and production issues related to domestic and foreign markets that could be impacted by the Federal Coal Leasing Program have been evaluated, along with other environmental issues associated with the leasing and subsequent development of Federal coal in the United States, by the U.S. Department of the Interior in previous documents (Section 1.5, Scope of the EIS Analysis). As directed by CEQ, the Agencies have "tiered" this EIS to these earlier program documents/EISs to "focus on the issues which are ripe for decision and exclude from consideration issues already decided or not yet ripe" (CEQ, 1978; 40 CFR 1500 to 1508). To clarify this point for the impact analysis, the Agencies have made several assumptions concerning this matter (Section 4.1, Assumptions of the Impact Analysis): "impacts to coal supply and demand (regional or otherwise) are beyond the scope of this EIS" and "labor, equipment, and/or market shortages/surpluses would not materially change projected levels of development."

5.3.6 Letters of Support or Opposition

Many letters received by the Agencies included statements of either support for, or opposition to, one or more elements proposed in the Warm Springs Project. Some commenters cited essential resource development and the potential for new jobs and revenues as reasons for their support. Others cited improper profits to private and/or foreign companies, destruction of wilderness and biodiversity values, air and water pollution, and public safety as reasons for their opposition. Many merely expressed support for, or opposition to, the Project.

The public is welcome to comment on the desirability of a proposal anytime during the preparation and/or review of an EIS; however, such comments do not necessarily help focus the scope or detail of either the analysis or the topics discussed in the document. Such comments are not pertinent for discussion in this impact analysis document; however, they are pertinent for the Authorized Officer(s) review and use at the time a decision is made. All comments on the desirability or inadvisability of the Warm Springs Project will be considered during the preparation of the various Records of Decision.

5.3.7 Issues Concerning Requests for Specific Baseline Inventories or Field Studies

A number of commenters requested that specific baseline inventories or field studies be conducted prior to preparing the EIS. These included ethnographic and cultural resource studies, recreation use studies, vegetation, and wildlife studies, and contour mapping at the minesite. They asked for a listing of all ongoing scientific studies in the project area and for descriptions of the specific methodologies for vegetation and wildlife inventories. Some of the requests for vegetation studies included sampling plant populations, preparing voucher collections, identifying species no longer found in the area, discussing the suitability of the area for species that were not located, conducting isozyme electrophoresis or nuclear DNA analysis, establishing a seed bank, and determining seed production, dispersal, and germination. Requested wildlife studies included determining species diversity, population trends, and identifying species that no longer occur in the area. The qualifications of the people conducting the studies and their ability to sample populations at the appropriate time of the year were questioned, as was the appropriateness of the methodologies that were to be used.

All issues concerning the data needed for the EIS and the collection of new data using various methodologies were carefully considered by the Agencies. Certain data were subsequently collected. After review, preliminary analysis of impacts, and further review, the Agencies concluded that other data collection efforts were not necessary to accurately evaluate the impacts of the proposals. These issues were then eliminated from further analysis. (A complete list of the individuals who contributed to the EIS effort and their qualifications has been included in Chapter 6 of this EIS.)

5.3.8 Issues Concerning Land Use Planning Decisions in the Smoky Mountain Area

Many commenters were concerned that past and future land use planning decisions concerning the leasing of coal would have a detrimental effect on other resources in the Smoky Mountain area. They expressed concern that development operations for the Smoky Hollow Mine or any of the other proposed activities would open the area up for additional mining, mining-related activities, or other development. The possibility of additional coal development by Andalex or some other company, as well as possible coalbed methane, oil and gas, uranium, or other development was identified. They questioned whether a balance could be established between mineral or other resource development and the protection of other treasured resources, such as wildlife, wilderness, and tourism. They suggested that this area could be declared unsuitable for coal mining and that existing leases could be bought out or exchanged.

The overall management of public lands and resources, including grazing, wildlife, recreation, wilderness, mineral, or other development in southern Utah (as examples), have been or will be the subject of other EISs prepared by BLM, NPS, or others. The public will have the opportunity to comment on these other management plans and decisions as they are developed and proceed through the various land use planning and NEPA processes. Thus, they are beyond the scope of this document.

The major cumulative development activities that currently exist or are proposed in the project area in the foreseeable future are described in Appendix B of this EIS. The cumulative impacts of these projects combined with the Warm Springs Project are analyzed in Chapter 4 wherever appropriate. Potential future developments that have not yet reached the proposal stage were generally deemed to be too speculative to include in the cumulative impact analysis; however, such projects would require applications, environmental analyses, and permitting from various Federal, State, and local agencies, if and when they were to move forward. If any of the potential future developments that are discussed in Appendix B move forward during the life of the Warm Springs Project, and if they are subject to Federal authorization, they, too, would go through the NEPA process prior to implementation. Potential future development that was not related to the proposed Project and that was not likely to occur in the reasonably foreseeable future was determined by the Agencies to be beyond the scope of the EIS analysis. (See Section 1.5, Scope of the EIS Analysis.)

5.3.9 Issues Related to the Various End Uses of Coal

Many people have expressed concern over the environmental impacts that could develop as a result of using the coal produced at the Smoky Hollow Mine. They point out studies that implicate the burning of coal at powerplants around the world in the debate over acid rain and global warming. They suggest that this EIS should evaluate the impacts of those powerplants and their by-products (fly ash, sulfur oxides, nitrogen oxides, particulates, etc.) on the air quality, wildlife, water quality, vegetation, visual, and social/economic resources of those affected areas.

The end use for the coal that would be mined at the Smoky Hollow Mine has not been determined. The Agencies are aware that Andalex is investigating a number of potential domestic and foreign markets. Ultimate end use locations would depend on a variety of market forces. End use impacts would be entirely speculative and are beyond the scope of this EIS. Further, the end use impacts of coal burning have been considered in various programmatic EIS and approval documents (Section 1.5, Scope of the EIS Analysis) and would be analyzed in detail in any site-specific EISs or air quality permit reviews associated with new powerplant construction or other combustion facilities. Thus, these issues were considered but eliminated from further analysis in this EIS.

5.3.10 Safety Issues Associated With the Mining of Coal

Many commenters, influenced by stories concerning the mining of coal over the past 100 years, expressed concern for the safety of both the workers and the public who might come into contact with coal mining activity related to the Smoky Hollow Mine. These concerns ran the gamut from unplanned mine cave-ins to black lung disease to mine fires and the smoke that could spread over the entire region.

As mentioned above, the purpose of this EIS is to disclose the potential for the Warm Springs Project to impact the human environment. The Agencies are also responsible for deemphasizing insignificant issues. All mine operators are required to comply with those Federal and State regulations applicable to their operations. Mining regulations covering worker health and safety, mine inspection, and enforcement actions are promulgated and implemented by the Mine Safety and Health Administration. These and other regulations would be in place as part of the regulatory framework within which the Warm Springs Project would operate. Inspections by personnel from a variety of Federal and State agencies would be conducted on a regular basis to ensure compliance. The low probability of these types of problems actually developing as a result of Project activities suggests that any impacts would be insignificant and unnecessary to discuss further. An evaluation of the rules and regulations that govern mine safety, air quality, or other such concerns would be inappropriate for this EIS.

5.3.11 Issues Concerning the Ability of Andalex to Operate a Coal Mine

Several commenters felt that the EIS should evaluate Andalex, and their ability to safely and environmentally operate a coal mine. They suggested that Andalex's history of safety violations, environmental violations, and labor disputes at their other corporate mines in Kentucky should disqualify them from being allowed to mine in southern Utah. Their statements are supported by their belief that Andalex has purposely overlooked environmental concerns and refuses to receive input from environmental organizations.

The purpose of an EIS is to evaluate a proposed action and disclose its potential for impacts to the human environment to the public and to the Authorized Officer for use during the decisionmaking process. Federal and State regulations require that Andalex's past record with environmental compliance be evaluated as a factor in the final decision to approve or disapprove the permit to mine coal. It would be inappropriate for the Agencies to evaluate those issues in this document.

5.3.12 Issues That Are Not Related to the Warm Springs Project, as Described in Appendix A

Certain issues were raised that are not part of the Warm Springs Project as it is being proposed by Andalex and the other Applicants. These include concerns with strip mining at the minesite, construction of a new landing strip or airport, harvesting timber for use as mine shoring, Kane County development plans for the Kaiparowits Plateau, transbasin water transfers for Cedar City, Native American land claims, and construction of a new community near the minesite. When issues were not specifically related to the Warm Springs Project or to a project that had a reasonable expectation to go forward, they were eliminated from further analysis as being beyond the scope of this document. (A detailed description of the project and its various components can be found in Appendix A of this EIS. A description of those projects considered in the cumulative analysis can be found in Appendix B.)

5.3.13 Issues Concerning the Trade-Off Between Benefits and Costs

A number of commenters requested a comparison of the benefits of the Warm Springs Project versus the cost of the Project. Since these concerns were usually presented as a pair of issues, they have been summarized below in the same format.

- Benefits of mining versus additional costs (road repair, social costs).

- Economic values (jobs, taxes) versus intrinsic values (wilderness experience).

- Increase in jobs and income versus burden on infrastructure, services, and intrinsic value of the wilderness experience.

All the individual issues mentioned above are analyzed in Chapter 4 of the EIS; however, trade-offs among resource elements have not been discussed. The purpose of an EIS is to evaluate a proposed action and disclose its potential for impacts to the human environment to the public and to the Authorized Officer. While consideration of trade-offs can become part of the decisionmaking process, it is inappropriate during the evaluation of potential environmental impacts of the alternatives. The Authorized Officer(s) will consider trade-offs between economic and social values in preparing the various Records of Decision. However, there is no requirement under either NEPA or the BLM/OSM regulations to conduct a cost/benefit analysis and make a decision accordingly. For these reasons, these issues were not carried forward for detailed analysis.

5.3.14 Issues Concerning Specific Mitigation Measures

A number of measures for the mitigation of impacts were suggested by commenters. Suggested measures that dealt with the transportation system covered: the design of the access road to the mine, the construction of climbing lanes on all hills, improvements specific to Hurricane Hill, truck route and bypass design around Hurricane and Kanab, having Andalex pay for highway maintenance and improvement, and the use of truck fees and taxes for safety improvements. Recommended wildlife mitigation included reducing hunting permits for the Paunsaugunt Mule Deer Herd, acquiring grazing permits and allocating the forage to wildlife, and developing offsite mitigation for effects in the Project areas. Recommended socioeconomic mitigation encompassed hiring local workers, including Native Americans, job training for local workers, using union labor, and improved benefits for miners. Visual screening of Project facilities was also mentioned as a mitigation measure.

All suggested mitigation measures were carefully considered by the Agencies and evaluated against anticipated impacts to specific resources. In some cases, the suggested mitigation was already part of the proposed action, as described in Appendix A. In other cases the anticipated impact did not warrant the mitigation that was suggested. In such cases, the measure was not considered further.

5.3.15 Issues Concerning Specific Resource Impacts

Commenters identified a number of specific issues involving potential impacts that could, in fact, occur as a result of mining or mining-related activity but were determined to be insignificant for the purpose of this analysis and not deserving of further study. Specifically,

- Several commenters expressed concerns about the potential for impacts to geological formations and unique features, including lava tubes, the Fiftymile Mountain Complex, the old Spanish/Mormon Trail, and other potentially sensitive features from mining-related activity and from natural seismic hazards.

- Commenters raised water-related questions concerning the effects of mining-related use of pesticides, herbicides, fertilizers, and dust suppressant chemicals on the water quality at Lake Powell, as well as those of coal dust, fuel, and hazardous material spills on the public highways in the region. They asked about the potential for aquifer mixing and for arsenic in potable water.

- A few commentors questioned the likelihood of success in restoring native vegetation communities, expressing concern about the sources of the seed that would be used during reclamation. They questioned future seed production, dispersal, and germination of native plants. They expressed concern for bees, moths, and other species which have an integral role in the pollination of certain plant species.

- Commenters asked about mule deer, pronghorn, and desert bighorn sheep critical habitat range in the Smoky Mountain area, the possible loss of thermal or protective cover, and the potential for wildlife drowning in sedimentation ponds and for birds striking powerlines. They asked how powerline and road construction might affect the fish hatchery near Big Water and how aerial nest surveys might affect nesting raptors.

- The 24-hour operation of mining-related loading facilities prompted questions about the visual impacts to visitors and viewers within regional National Parks and Monuments and to observatories in the area, particularly from night lighting. Additional traffic in the region prompted questions about the potential for additional litter along highways.

As mentioned above, the purpose of this EIS is to disclose the potential for the Warm Springs Project to impact the human environment. Since the Agencies are also responsible for deemphasizing insignificant issues and narrowing the scope of the EIS process (CEQ 1978, 40 CFR §1500.4(g)), every issue raised by the public was carefully considered. After review, preliminary analysis of impacts, and further review, the Agencies concluded that any impacts associated with these issues would be minimal and would not affect the overall evaluation of the proposals. These issues were eliminated from further analysis.

The low probability of problems developing as a result of some noncompliance with Federal or State regulations suggests that those impacts would also be insignificant and unnecessary to discuss further. Equipment operators are required to comply with Federal and State regulations applicable to their operations. These regulations would be in place as part of the regulatory framework within which the Warm Springs Project would operate. Inspections by personnel from a variety of Federal and State agencies would be conducted on a regular basis to ensure compliance.

5.4 REVIEW OF THE EIS

This EIS has been mailed to all parties who have expressed an interest in receiving it. Although numbers are limited, additional copies of the EIS may be obtained for a limited time by writing either BLM or OSM at the Kanab, Utah, or Denver, Colorado, addresses listed on the cover sheet. Copies of the EIS were mailed to the following Federal, State, and local agencies, libraries, tribes, organizations, businesses, and individuals.

5.4.1 Federal Agencies

[Insert from Mailing List]

5.4.2 Other Federal Groups

[Insert from Mailing List]

5.4.3 Federal Legislators

[Insert from Mailing List]

5.4.4 State Agencies

[Insert from Mailing List]

5.4.5 Other State Groups

[Insert from Mailing List]

5.4.6 State Legislators

[Insert from Mailing List]

5.4.7 Universities and Colleges

Insert from Mailing List]

5.4.8 County Agencies

[Insert from Mailing List]

5.4.9 Local Agencies

[Insert from Mailing List]

5.4.10 Regional Agencies

[Insert from Mailing List]

5.4.11 Native American Tribes

[Insert from Mailing List]

5.4.12 Organizations

[Insert from Mailing List]

5.4.13 Industries and Businesses

[Insert from Mailing List]

5.4.14 Individuals

[Insert from Mailing List]

PREPARERS AND CONTRIBUTORS

CHAPTER 6

6.1 INTRODUCTION

This EIS has been prepared as a joint effort between BLM and OSM (the Agencies). They are jointly responsible for management of the EIS process, including facilitating public involvement and preparation of the EIS. BLM is the responsible administrative lead agency. NPS and Utah DOGM, as other agencies possessing special expertise or jurisdiction by law, are formal cooperating agencies in the preparation of the EIS. As such, they are responsible for participating in the EIS scoping process and providing specific comments on those aspects of the impact analysis within their expertise or under their jurisdiction.

The Applicants' proposals, including the reasonable alternatives, have been evaluated through an interdisciplinary analysis and review by representatives from the lead and cooperating Agencies. Interdisciplinary participation has also been provided by private consultants working under the direction of BLM and OSM.

The names, areas of responsibility, and qualifications of individuals who have prepared and/or contributed to the EIS follow.

6.2 LEAD AGENCIES

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Secondary Education Certification, Earth Sciences, Utah State University, 1980;
Experience: 5 years private industry, 9 years Utah DOGM.

James D. Smith — Geology, Hydrology.
B.S., Geophysics, University of Utah, 1972;
M.S., Geology, Brigham Young University, Utah, 1984;
Experience: 17 years private industry, 4 years Utah DOGM.

Wayne H. Western — Mine Engineering.
B.S., Geology, University of Utah, 1979;
B.S., Mining Engineering, University of Utah, 1984;
M.S., Mining Engineering, University of Utah, 1984;
Experience: 8 years private industry, 5 years Utah DOGM.

6.4 CONTRACTORS

6.4.1 ENSR Consulting and Engineering, Inc.

Jon D. Alstad — Soils, Vegetation, Threatened and Endangered Species.
A.A., Liberal Arts, Golden Valley Lutheran College, Minnesota, 1982;
B.S., Animal Science, North Dakota State University, 1984;
M.S., Range Science, North Dakota State University, 1987;
Experience: 4 years university, 8 years consulting.

Nancy W. Beauprez — Technical Editing (Interim), Operations Coordinator.
B.S., Journalism, University of Colorado, Boulder, 1971;
M.Ed., Adult & Higher Education/English Composition, Montana State University, 1990;
Studies in Secondary Education, Colorado State University, 1994-1995.
Experience: 2 years private industry, 13 years university, 4 years consulting.

William R. Berg — Geology, Mineral Resources, Water Resources, Soils, Paleontology.
B.S., Geology, Colorado State University, 1976;
M.S., Geology, University of Wyoming, 1980;
Experience: 1 year State government, 8 years private industry, 8 years consulting.

Karen M. Caddis-Burrell — EIS Project Management.
B.A., Physical Geography/Journalism, Eastern Washington University, 1980;
B.S., Resource Management/Conservation Education, Colorado State University, 1987;
Experience: 4 years private industry, 10 years consulting.

Tracey J. Capps — Publications Coordinator (Interim).
B.S., Recreational Resource Management, Colorado State University, 1992;
Experience: 3 years consulting.

Philip D. Hackney — Soils, Vegetation, Threatened and Endangered Species.
B.S., Botany, Colorado State University, 1972;
Graduate Studies in Soils/Range Ecology, Colorado State University, 1974-1976;
Experience: 1 year USFS, 20 years consulting.

Andrew C. Ludwig — EIS Project Management.
B.S., Zoology, University of Michigan, 1969;
M.S., Zoology, University of Michigan, 1971;
M.S., Resource Planning and Conservation, University of Michigan, 1973;
Experience: 22 years consulting.

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B.S., Electrical Engineering, Colorado State University, 1992;
Experience: 1 year USDA-ARS, 1 year State government, 2 years consulting.

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Certificate, Business, Gallatin County Vo-Tech, Montana, 1972;
Experience: 5 years university, 17 years consulting.

Lori A. Nielsen — Wildlife, Vegetation, Threatened and Endangered Species.
B.S., Wildlife Ecology, Oklahoma State University, 1982;
Experience: 1 year university, 10 years consulting.

Robyn R. Otteman - Publications Coordinator.
B.S., Business Administration, Kearney State College, 1990;
Experience: 4 years (various), 5 years consulting.

Scott J. Patti - EIS Management Support.
B.S., Natural Resource Management/Fisheries Biology, Colorado State University, 1984:
Experience: 1 year USFS, 2 years private industry, 9 years consulting.

Robert C. Sanz — Wildlife, Vegetation, Threatened and Endangered Species.
B.S., Zoology, Colorado State University, 1975;
Experience: 22 years consulting.

Vincent R. Scheetz — Air Quality.
B.S., Mathematics, Physics, Regis University, 1964;
Graduate Studies in Meteorology, San Jose State College, California, 1967-68;
M.S., Systems Management, University of Southern California, 1970;
Graduate Studies in Atmospheric Science, Colorado State University, 1974;
Experience: 5 years USAF, 5 years university, 18 years private industry, 16 years consulting.

Drew Sheesley — EIS Management Support.
B.S., Biology, Colorado State University, 1989;
Experience: 6 years consulting.

William J. Theisen — Land Use, Noise, Recreation (Interim).
B.S., Natural Resources, University of Michigan, 1978;
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Experience: 5 years local government, 8 years consulting.

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B.A., English, University of Alberta, 1987;
M.L.I.S., Library and Information Science, University of Western Ontario, 1988;
Experience: 4 years university, 1 year private industry, 1 year consulting.

6.4.2 Centennial Archaeology, Inc.

Wade E. Miller — Paleontology.
B.S., Geology, Brigham Young University, Utah, 1960;
M.S., Geology/Paleontology, University of Arizona, 1963;
Ph.D., Paleontology, University of California, Berkeley, 1968;
Experience: 28 years university, 23 years consulting (concurrent with other position).

Jeffrey S. Paradis — Cultural Resources Support.
B.S., African Studies, Friends World College, New York, 1992;
Experience: 3 years consulting.

Kenneth R. Weber — Cultural Resources.
B.A., Social Science, University of Northern Colorado, 1965;
M.A., Cultural Anthropology, University of Oregon, 1968;
Ph.D., Cultural Anthropology, University of Oregon, 1972;
M.B.A., Organization Management and Human Resources, University of Colorado, 1981;
Experience: 4 years university, 5 years MMS, 2 years USCCR, 21 years consulting.

Christian J. Zier — Paleontology, Cultural Resources.
B.A., Anthropology/Archaeology, University of Colorado, Boulder, 1972;
M.A., Anthropology/Archaeology, University of Colorado, Boulder, 1976;
Ph.D., Anthropology/Archaeology, University of Colorado, Boulder, 1981;
Experience: 1 year NPS, 19 years consulting.

6.4.3 Continental Graphics

Shepherd [Mi?] Miller - Responsibility?
[Qualifications/education/experience still to come]

6.4.4 EDAW, Inc.

J. Craig Taggart — Visual Resources.
B.S., Zoology, Northern Arizona University, 1970;
M.L.A., Landscape Architecture, Iowa State University, 1974;
Experience: 3 years BLM, 18 years consulting.

6.4.5 Felsburg, Holt & Ullevig

Charles M. Buck — Transportation.
B.S., Civil Engineering, University of Colorado, Denver, 1990;
Experience: 5 years consulting.

Robert W. Felsburg, P.E — Transportation.
B.S., Civil Engineering, Pennsylvania State University, 1970;
M.S., Civil Engineering, Pennsylvania State University, 1972;
Experience: 23 years consulting.

Lawrence C. Lang — Transportation.
B.S., Civil Engineering, Colorado State University, 1990;
M.S., Engineering, University of Texas, Austin, 1992;
Experience: 4 years consulting.

6.4.6 Hammer, Siler, George Associates

Ronald A. Dutton — Socioeconomics.
B.S., Economics, University of Wyoming, 1974;
M.S., Economics, University of Wyoming, 1976;
Experience: 2 years private industry, 18 years consulting.

6.4.7 Kathol and Company

Jennifer A. Kathol — Socioeconomics.
B.S., Natural Resource Economics, Colorado State University, 1977;
Experience: 16 years consulting.

6.4.8 McMath Graphics

Steve McMath - [Responsibility?]

6.4.9 Planning Information Corporation

George F. Blankenship — Socioeconomics.
B.A., Anthropology, University of Nebraska, 1970;
B.A., Social Work, Colorado State University, 1978;
M.A., Urban and Regional Planning, University of Colorado, Denver, 1980;
Experience: 16 years consulting.

Lloyd E. Levy — Socioeconomics.
B.A., History, Colorado State University, 1974;
M.B.A., Finance, University of Colorado, Denver, 1986;
Experience: 9 years consulting.

Andra Schmidt — Socioeconomics Support.
B.A., English, University of Northern Colorado, 1970;
Experience: 9 years State government, 8 years consulting.

Suzette M. Thieman — Socioeconomics Support.
B.S., Land Use, Metropolitan State College, Denver, 1994;
Experience: 2 years consulting.

6.4.10 Red Dog, Inc.

Alan W. Czarnowsky — Mine Engineering.
B.S., Mining Engineering, Colorado School of Mines, 1974;
Experience: 6 years private industry, 16 years consulting.

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DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

CHAPTER 8

$\mu g/m^3$: Micrograms per cubic meter.

AAQS: Ambient Air Quality Standards. The ambient air quality is the prevailing condition of the atmosphere at a given time; the outside air. Regulatory standards for concentration levels of a specified pollutant in the outside air over a specified averaging time period within a given area.

AASHTO: American Association of State Highway Transportation Officials.

Above-grade crossing: Railroad route that runs via an overpass or bridge above a motor vehicle route.

Acre-foot, acre-feet: A unit for measuring volume, equal to the quantity of water or other material required to cover 1 acre of land surface to a depth of 1 foot, or a volume of 43,560 cubic feet, or 325,851 gallons.

ACSR: Aluminum conductor, steel-reinforced (in relation to power conductors on high-voltage powerlines).

Active preference: The currently authorized livestock grazing use on public lands in an allotment, measured in animal unit months (AUMs) of forage.

A.D.: Anno Domini (in the year of our Lord, in relation to dates).

ADT: Average Daily Traffic. The volume of traffic on a roadway, measured as a one-way trip between points (a round trip is two one-way trips).

Agencies, the: BLM and OSM, the Federal agencies primarily responsible for preparation of the EIS for the Warm Springs Project.

AIME: American Institute of Mining and Metallurgical Engineers.

AIRFA: American Indian Religious Freedom Act of 1978.

Alluvial: Pertaining to the material or the processes associated with transportation or deposition of material by the action of flowing water.

Andalex: Andalex Resources, Inc.

ANFO: Ammonium nitrate fuel oil, used as a blasting compound.

Angle of draw: In mining, the angle between the limit line and a vertical reference line drawn from the edge of the mine area. The angle of draw is used to calculate the limit of subsidence activity beyond the boundaries of the mined area and is expressed in degrees from vertical above the edge of the mined area.

Annuals: Plants that complete their life cycle and die in 1 year or less.

ANSI: American National Standards Institute.

Anticline: A geologic unit of folded strata that is convex (flexed upward). In a simple anticline, beds forming the opposing limbs of the fold dip away from its axial plane.

AO: Approval Order (in relation to air quality permitting in Utah).

Aquifer: A water-bearing layer of permeable rock, sand, or gravel. A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to conduct groundwater and yield large quantities of water to wells and springs.

Arizona DOT: State of Arizona, Department of Transportation.

ARPA: Archeological Resources Protection Act of 1979.

Assistant Secretary: The Assistant Secretary of the Interior for Land and Minerals Management.

ASTM: American Society for Testing and Materials.

At-grade crossing: An intersection of railroad and motor vehicle routes at ground level.

ATC: Authority to Construct (in relation to air quality permitting in Nevada).

Authorized Officer: Any person authorized by the Secretary of the Interior, or his representative, to administer Federal regulations.

AUMs: Animal unit months. The measurement of the privilege of grazing one animal for one month. The amount of forage needed to sustain one cow, one cow with a calf less than 6 months of age, one horse, five sheep, two elk, five deer, or nine antelope for a month. Generally considered to be 900 to 1,000 pounds of air-dry forage.

BA: Biological Assessment. An evaluation conducted in accordance with the legal requirements under Section 7 of the Endangered Species Act (16 U.S.C. 1 536(c)) for major Federal construction projects. The purpose of the assessment and resulting document is to determine whether the proposed action is likely to affect any threatened or endangered species.

Backfilling and grading: The operation of refilling an excavation and finishing the surface.

Bench face: The surface of an excavated area at some point between the material being mined and the original surface of the ground on which equipment can be set, moved, or operated.

Berm: An earthen structure, generally several feet high, which acts as a barrier to make it difficult for a vehicle to cross, or which redirects the flow of traffic or water. A mound of stable material placed at the outside bottom of a topsoil or material pile to help hold the pile in position.

B.C.: Before Christ (in relation to dates).

BLM: U.S. Department of the Interior, Bureau of Land Management.

BOM: U.S. Department of the Interior, Bureau of Mines.

Bond release: Return of a performance bond to a mine operator after the regulatory agency has inspected and evaluated the completed reclamation operations and determined that all regulatory requirements have been satisfied.

Borrow areas or fill areas: Places where earth material is removed or added for construction purposes.

Borrow materials: Soil or rock dug from one location to provide fill at another location.

B.P.: Before present (in relation to dates).

Broadcast seeding: Scattering seed on the surface of the soil.

Btu/lb: British thermal unit per pound. A measure of the heat intensity (energy) required to raise the temperature of one pound of water one degree Fahrenheit.

ca.: Circa, or about (in relation to time, or dates).

CAA: Clean Air Act of 1955, as amended.

Catchment: A reservoir or basin developed for flood or sediment control or for water management associated with livestock and/or wildlife.

CDP: County Development Plan.

CEQ: Council on Environmental Quality, Executive Office of the President. An advisory council to the President established by the National Environmental Policy Act of 1969. The Council reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

CFR: Code of Federal Regulations. A codification of Federal documents published by the Office of the *Federal Register*, National Archives and Records Administration.

cfs: Cubic feet per second.

Chain pillars: Pillars of coal between longwall panels in an underground mine, designed to crush during planned subsidence events.

CHAS: Comprehensive Housing Affordability Strategy.

Coal loadout: Area/facility where coal is loaded onto some form of transport for delivery to market.

Coal preparation plant: A facility where coal is sized, cleaned, and prepared for transport.

Coal refuse pile: Storage mound of coal waste material.

Coal reserves: The quantity of recoverable coal that is calculated to lie within given boundaries.

Coal resources: Total coal deposits, regardless of whether they can now be mined or recovered. Identified resources are resources whose location, grade, quality, and quantity are known or estimated from specific geologic evidence.

Coal rider seam: Thin, unmovable seam of noncoal rock, closely above a thicker, minable coal body, normally only a few inches thick.

Coal waste: All the coal refuse from a mine.

COE: U.S. Department of Defense, Army Corps of Engineers.

Compressional recovery: As overburden rocks flex downward into the mined area during the subsidence event, they are acted on by tensile stress, which can cause elongation and cracking. As the mining face extends away from a point, the area of tensile stress moves away as well. As settling occurs, overburden rocks are acted on by compressional stress, which can cause shortening and closing of tensional phase cracks. Compressional recovery is the return of the rock column to its approximate state of premining stress and strain.

Continuous miner: A self-propelled machine with a continuous excavating drum, used to extract coal from the face in room-and-pillar mining without the use of cutting machines, drills, or explosives. It also loads that coal into cars or conveyors.

Crepuscular: The twilight periods of dusk and dawn (in relation to animals, active during twilight).

Crushed coal: Irregular fragments of coal crushed to smaller sizes after mining.

dB: Decibel. A unit measure of sound.

dBA: Decibel measurement on the "A-weighting" scale. A decibel adjusted (weighted) to reflect the relative loudness of sounds most sensitive to human ears.

Deformation zone: The uppermost zone of subsidence-related deformation that can develop above a mined area. The overburden rocks in this zone sag downward without major fracturing; thus, their lateral continuity is maintained. The rocks can pull apart or separate along bedding planes. The deformation zone generally extends from the top of the fractured zone to the ground surface.

Disturbed area: Surface acreage that would be actively disturbed by proposed mining or mining-related activities. An area where vegetation, topsoil, and/or overburden is removed, or, upon which topsoil, spoil, or waste is placed as a result of mining or mining-related activities.

Diurnal: Relating to or occurring in the daytime.

Drill seeding: A mechanical means of planting and covering seed in relatively narrow rows.

E.: East (in relation to legal land-tract descriptions of property).

Effluent limitations: Regulatory standards that apply to the discharge or outflow of water from ground or subsurface storage.

EIS: Environmental Impact Statement. An analytical document that portrays potential impacts to the human environment of a particular course of action and its reasonable alternatives as required by Section 102(2)(C) of the National Environmental Policy Act (NEPA).

EPA: U.S. Environmental Protection Agency.

Ephemeral stream: A stream that flows only briefly in direct response to rainfall or snowmelt events, has no baseflow, and whose channel is, at all times, above the water table.

Evaporation pond: An impoundment area where water is retained and allowed to evaporate.

Exploration holes: Boreholes drilled during the search for mineral deposits.

Eyrie: The nest of a bird, generally a raptor, on a cliff or mountain top.

Federal land(s): Any land, including mineral interests, owned by the United States [40 CFR 700.5].

FLPMA: Federal Land Policy and Management Act of 1976, as amended (Public Law 94-579). An Act which gives BLM legal authority to establish public land policy, to establish guidelines for administering such policy and to provide for the management, protection, development, and enhancement of the public lands.

Fractured zone: The intermediate zone of subsidence-related deformation that can develop above a mined area. Overburden rocks in this zone fracture and deform as they sag downward into the mined area but still maintain their lateral continuity. Rocks can pull apart or separate along bedding planes. The fractured zone can extend upward above the mined area to a height that is 50 times greater than mining height.

Fragmented zone: The zone of subsidence-related deformation that can develop immediately above and within a mined area. Overburden rocks in this zone fragment, cave, and rotate as they collapse into the mined area. The fragmented zone can extend upward above the mined area to a height that is 10 times greater than mining height.

Full-seam recovery: During mining, an entire section of the coal seam is dislodged by mechanical mining methods, and the coal is separated from the rock outside the mine by the cleaning plant.

Garkane: Garkane Power Association, Inc.

GMP: General Management Plan. A written land use plan that outlines the National Park Service decisions and strategies for management of the resources in a particular area.

Groundwater: Subsurface water that is in the zone of saturation. The top surface of the groundwater is the "water table." The source of water for wells, seepage, and springs.

Groundwater, confined: Groundwater that is under pressure. Its upper limit is the bottom of a bed of distinctly lower hydraulic conductivity than that of the material in which the confined water occurs.

Groundwater, perched: Unconfined groundwater separated from an underlying body of groundwater by an impervious, unsaturated zone.

Groundwater, unconfined: Groundwater that is not under pressure. Generally used to describe water that does not rise above the level at which it is first found, at the time it is found. Seasonal changes in both unconfined and confined water levels can occur as a result of variations in recharge and discharge.

Grubbing: Removing vegetation and other material from a surface area prior to mining or mining-related disturbance.

Habituation: To become accustomed to, or used to, something; acclimate.

Harrowed: Cultivated and smoothed soil done with an implement equipped with spikes, teeth, or disks.

HCP: Habitat Conservation Plan. A written and officially approved plan for a specific geographic area which identifies wildlife habitat and related objectives, establishes the sequence of actions for achieving objectives, and outlines procedures for evaluating accomplishments.

Head of slope: Upper part or limit of an incline (in relation to the excavation or fill of material).

HUD: U.S. Department of Housing and Urban Development.

IBLA: U.S. Department of the Interior, Board of Land Appeals.

IFTA: International Fuel Tax Agreement.

Involved area: Surface and/or underground acreage controlled by one of the project proponents to facilitate the construction and operation of one or more elements of the proposed Warm Springs Project.

IPP: Intermountain Power Project.

Iron County: Iron County Board of Commissioners, Iron County, Utah.

Kane County: Kane County Board of Commissioners, Kane County, Utah.

Kern River: Kern River Gas Transmission Company.

kV: Kilovolt. A unit measure of electricity, equal to 1,000 volts.

LADWP: Los Angeles Department of Water and Power.

Ldn: Day-night average sound level. The 24-hour, time-weighted annual average, or average dBA.

LDS: Church of Jesus Christ of Latter-Day Saints, or Mormon Church.

Life of mine: Length of time from permitting to final bond release during which mine-related activities can occur and coal can be extracted.

Life-of-mine area: The 24,659 acres of Federal and State land that could be impacted by operations at the proposed Smoky Hollow Mine during the mine life.

Longwall mining: A method of coal mining whereby most of the coal is mined and the roof is allowed to cave in behind the miners as work progresses.

Longwall panel: The vertical face that is left intact during coal mining as longwall mining work progresses toward the boundary of the mine.

LOS: Level of service. A qualitative measure of traffic operations, defined in terms of six levels of driver comfort and delay, ranging from LOS "A" (best) to LOS "F" (congested).

LMU: Logical mining unit.

Magnitude: A quantity characteristic of the total energy released by an earthquake. Commonly defined using the Richter magnitude scale.

Mine, the: The proposed Smoky Hollow Mine.

Mine yard: The central part of the surface facilities complex where most of the surface activities for the mine would take place.

Mine life, the: The 54-year operational life of the proposed Smoky Hollow Mine, from premining construction and development through bond release after final reclamation.

Mining area: The 12,141 acres of the Smoky Hollow life-of-mine area above the proposed underground mining activities. It includes the area of actual coal removal and that area of potential subsidence due to the 30-degree angle of draw predicted for this mine.

Mitigation: The lessening of a potential adverse effect by applying appropriate protective measures or adequate scientific study. Activities in the affected environment that avoid, minimize, reduce, eliminate, replace, or rectify the impact of a proposed action or practice.

MLA: Mineral Leasing Act of 1920, as amended.

MMS: U.S. Department of the Interior, Minerals Management Service.

MNA: Museum of Northern Arizona.

Moapa Valley: Moapa Valley Telephone Company, Inc.

Monocline: Stratum or geologic beds that dip for an indefinite or unknown length in one direction and that do not apparently form sides of ascertained anticlines or synclines.

mph: Miles per hour.

Mtmt: Million truck miles traveled.

Mve: Million vehicles entering the Project facility.

Mvmt: Million vehicle miles travelled.

N.: North (in relation to legal land-tract descriptions of property).

MW: Monitoring well.

NAAQS: National Ambient Air Quality Standards.

NAGPRA: Native American Graves Protection and Repatriation Act of 1990.

NE: Northeast (in relation to legal land-tract descriptions of property).

NEPA: National Environmental Policy Act of 1969, as amended. An act to establish a National policy for the environment, to provide for the establishment of a Council on Environmental Quality, and for other purposes. It requires Federal agencies to carefully consider the environmental consequences of agency actions; document environmental analyses and subsequent decisions appropriately, efficiently, and cost-effectively; and involve interested individuals, organizations, and agencies in the decisionmaking process.

Net swell factor: "Net swell factor," or "bulking factor," is the volumetric increase of fragmented rocks relative to their undisturbed and in-place volume. The bulking factor is controlled by the size and shape of broken rocks, geometry of the cave zones, contact stresses among rock fragments, and relative strengths of affected rocks.

Nevada DOT: State of Nevada, Department of Transportation.

NHPA: National Historic Preservation Act of 1966, as amended.

Nocturnal: The period of night between dusk and dawn (in relation to animals active by night).

NPCA: National Parks and Conservation Association.

NPS: U.S. Department of the Interior, National Park Service.

NRA: National Recreation Area.

NRHP: National Register of Historic Places.

NW: Northwest (in relation to legal land-tract descriptions of property).

ORV: Off-road vehicle. Any motorized vehicle capable of, or designed for, travel on or immediately over land, water, or other natural terrain.

OSM: U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement.

Overburden: Material of any nature that overlies a mineral deposit, excluding topsoil.

Overton: Overton Power District.

Pacific Rim: Foreign countries along the western rim of the Pacific Ocean.

PAP: Permit application package.

Particulate emissions: Finely divided solid or liquid particles discharged into the air in the form of dust, smoke, fumes, mist, spray, or fog. Generally considered to be pollutants.

Passerine: The largest order of birds, including most songbirds, that perch.

PDES: Pollutant Discharge Elimination System.

Peak-hour traffic: The morning and evening "rush" hours when traffic is at its heaviest, usually between 7 and 8 a.m. and 5 and 6 p.m.

Perched water table: Groundwater contained above an impermeable bed and underlain by an impervious unsaturated zone. (See groundwater, perched.)

Perennial stream: A stream that flows continuously throughout the year.

Perennials: Plants that live longer than 2 years.

Permanent seed mixes: Blends of seeds used to revegetate an area during final reclamation.

PM_{10}: Particulate matter less than 10 microns in size. An air quality measurement standard.

Portal: The surface entrance to a mine, particularly to a tunnel or adit.

Postmining land use: The specific use or management-related activity to which a disturbed area is restored after completion of mining and reclamation.

Postmining topography: The relief and contour of the land that remains after mining has been completed.

Potentiometric surface: An imaginary surface representing the total head of groundwater and defined by the level to which water will rise in a well. A water table is a potentiometric surface.

ppm: Parts per million. A unit of gaseous or liquid measurement, often used to identify the amount of particulates in air or water; 1 ppm = 1 mg/L (liquid) = 1 $\mu g/m^3$ (gaseous).

Private land(s): Any land, including mineral interests, under private ownership that does not have Federal or State interest.

Project: The whole of an action, which has a potential for resulting in a physical change in the environment.

Project area: The 26,496 acres of private, State, and Federal land that comprise the operational limits of the proposed Warm Springs Project.

Project, the: The proposed Warm Springs Project, including the Smoky Hollow Mine, its power, communication, and loadout facilities, the Fredonia/Hurricane truck maintenance facility, and the Warm Creek/Benchtop Road.

PSD: Prevention of significant deterioration. The process incorporated in the Clean Air Act which places emission limitations on specified new or modified sources. PSD regulations are intended to limit deterioration of air quality that is currently cleaner than National ambient air quality standards.

PTA: Parent-Teacher Association.

Public land(s): Lands (surface and mineral estate) owned by the United States and administered by the Bureau of Land Management.

R.: Range (in relation to legal land-tract descriptions of property).

Radial stacker: A machine used to stack coal in a radial arc for storage purposes.

Raise boring: In mining, it is the process of drilling (boring) a raise (vertical shaft) from the bottom up. First a vertical hole is drilled from the surface down into the mine workings. The cutter heads (boring machine) are brought into the underground mine workings. The rotary table (rotating mechanism) is placed over the hole at the surface, and the cutter heads are connected to the rotary table by a long pipe. As the cutting heads are rotated and pulled upward, earth is cut and falls back into the underground mine workings where it is hauled out to the surface or placed somewhere else in the mine.

Raptors: Birds of prey with sharp talons and strongly curved beaks (e.g., hawks, owls, vultures, eagles).

Reclaim system: A system of tunnels and conveyor belts built beneath the coal storage pile for moving the coal out of the pile and onto transport units (trains or trucks).

Reclaim tunnel: A tunnel used to retrieve coal from storage above.

Recoverable coal reserves: The amount of coal that can actually be recovered from the demonstrated reserve base. (See coal reserves.)

Revegetation: The reestablishment and development of self-sustaining plant cover following land disturbance. The enhancement of natural processes by human assistance through seedbed preparation, reseeding, and mulching.

Ripping: The act of mechanically breaking compacted soils or rock into pieces small enough to be economically transported by other equipment, such as a scraper or dozer.

Riprap: A layer of broken rock, cobbles, boulders, or fragments of sufficient size and thickness placed on the face of a dam, on streambanks, or on other land surfaces to protect them from the erosive forces of wind or flowing water.

RMP: Resource Management Plan. A written land use plan that outlines BLM decisions and strategies for management of the resources in a particular area, replacing the management framework plan in the BLM's planning system.

ROM: Run-of-mine. Raw, unprocessed coal, or other mineral material, as it is delivered from the mine by mine cars, skips, or conveyors, prior to treatment (separating, crushing, and/or cleaning).

Room-and-pillar mining: A method of coal mining that involves mining out rooms and leaving pillars of coal for overhead support.

ROW: Right-of-way. The legal right for use, occupancy, or access across land or water areas for a specified purpose or purposes. Also, the lands covered by such a right.

S.: South (in relation to legal land-tract descriptions of property).

Salvaging depth: The distance below land surface from which soil material can be retrieved.

Scoria (clinker): Baked and fused rock resulting from the natural in-place burning of coal deposits.

SDW: Safe drinking water.

SE: Southeast (in relation to legal land-tract descriptions of property).

Sediment: Unconsolidated solid material that comes from weathering of rock and is carried by, suspended in, or deposited by water or wind.

Sedimentation pond: A structure, such as a barrier, dam, or excavated depression, that slows down runoff for the purpose of allowing sediment to settle out.

Seep: An extensive line or surface seam where water emerges from the ground, as contrasted with a spring where water emerges from a localized spot.

SHPO: State Historic Preservation Officer. The official appointed by a given State's Governor to lead that State's historic preservation program and review all actions that affect the State's National Register Sites.

Sigurd line: The existing Utah Power and Light Company, 230-kV powerline running from the Glen Canyon Powerplant to central Utah, near the town of Sigurd.

SMCRA: Surface Mining Control and Reclamation Act of 1977, as amended (Public Law 95-87). An Act to provide for the cooperation between the Secretary of the Interior and the States with respect to the regulation of surface coal mining operations, the acquisition and reclamation of abandoned mines, and other related purposes.

SME-AIME: Society of Mining Engineers, American Institute of Mining and Metallurgical Engineers.

Soil horizon: A distinct layer of soil, approximately parallel to the land surface, and different from adjacent, genetically related layers in physical, chemical, and biological properties or characteristics.

SPCC Plan: Spill Prevention Control and Countermeasure Plan.

State land(s): Any lands, including mineral interests, owned by a given State.

Strain: Deformation resulting from an applied force. In mining, strain is one type of subsidence-related deformation caused by the downwarping of overburden rocks into the mined area. Horizontal strain is the ratio of the change in length of the ground surface to its original length that is caused by curvature. This can be extended (defined as positive) or shortened (described as negative). Surface strain caused by subsidence is one of the primary causes of damage to structures at the surface.

Strata: A single sedimentary geologic bed or layer, of any thickness, that is made up of similar rock types.

Stratabound: A mineral deposit confined to a single layer, bed, or stratum.

Subsidence: Sinking or settlement of the land surface, due to any of several processes but frequently from the removal of groundwater or mineral deposits. As commonly used, the term relates to the vertical downward movement of natural surfaces, although small-scale horizontal displacement also may be present.

Surface facilities complex: The 59-acre area of the proposed Smoky Hollow life-of-mine area that contains the various surface facilities necessary to service the underground mining operation.

SUWA: Southern Utah Wilderness Alliance.

SW: Southwest (in relation to legal land-tract descriptions of property).

Syncline: A geologic unit of folded strata that is concave (flexed downward). In a simple syncline, beds forming the opposing limbs of the fold dip toward its axial plane.

T.: Township (in relation to legal land-tract descriptions of property).

TD: Total depth (in relation to wells drilled for water or for oil and gas).

TDS: Total dissolved solids. The dry weight of dissolved material, organic and inorganic, contained in liquid.

Temporary seed mixes: Blends of seeds used to revegetate an area for a limited period of time prior to final reclamation.

Tensile strain: A normal stress that tends to pull apart materials on opposite sides of a real or imaginary plane. (See strain.)

Tilt: In mining, tilt (or change of slope) is one type of subsidence-related deformation caused by the downwarping of overburden rocks into the mined area. Tilt is the change of vertical displacement with respect to unit horizontal distance of the original ground surface. Tilt caused by subsidence is one of the primary causes of damage to structures at the surface.

Toe of slope: Bottom portion or limit of an incline (in relation to the excavation or fill of material).

Topsoil/subsoil stockpile: Soils that are removed prior to mining and gradually accumulated for reclamation and revegetation once mining is completed.

ton: A unit measure of weight. A short ton, or net ton, is equal to 2,000 pounds; a long ton, or British ton, is equal to 2,240 pounds; a metric ton equals about 2,205 pounds. Short tons are avoirdupois weights pertaining to commodities sold by weight.

tph: Tons per hour.

Trust land(s): Any lands within the State of Utah, including mineral interests, owned by the Utah School and Institutional Trust Lands Administration (TLA).

TSP: Total suspended particulates. The dry weight of particulate material (dust, smoke, fumes, mist, spray, or fog) suspended in the air.

TSS: Total suspended solids. The dry weight of undissolved material, organic and inorganic, suspended in liquid.

TVA: Tennessee Valley Authority.

U.S. West: U.S. West Communications, Inc.

Underburden: Material of any nature, consolidated or unconsolidated, that underlies a mineral deposit.

Union Pacific: Union Pacific Railroad Company.

Unit-train: A train containing a standard number of cars, ranging from 80 to 110, that are loaded, moved, and unloaded as a single unit. Each car holds about 100 tons of material, for a total of about 8,000 to 11,000 tons being moved in each unit-train.

UP&L: Utah Power and Light Company.

USAF: U.S. Department of Defense, Air Force.

USDA-ARS: U.S. Department of Agriculture, Agricultural Research Service.

USDOI: U.S. Department of the Interior, Office of the Secretary.

USFS: U.S. Department of Agriculture, Forest Service.

USFWS: U.S. Department of the Interior, Fish and Wildlife Service.

USU: Utah State University, Logan, Utah

Utah DAQ: State of Utah, Department of Environmental Quality, Division of Air Quality.

Utah DNR: State of Utah, Department of Natural Resources, Division of Water Rights.

Utah DOGM: State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining.

Utah DOT: State of Utah, Department of Transportation.

Utah DSLF: State of Utah, Department of Natural Resources, Division of State Lands and Forestry.

Utah DWR: State of Utah, Department of Natural Resources, Division of Wildlife Resources.

Utah GOBP: State of Utah, Governor's Office of Planning and Budget.

Utah Rules: The R-645 Coal Mining Rules for the State of Utah.

Utah TLA: State of Utah, School and Institutional Trust Lands Administration.

vpd: Vehicles per day.

VRM: Visual Resource Management. The systematic means to identify visual values, establish objectives which provide the standards for managing those values, and evaluate the visual impacts of proposed projects to ensure that objectives are met.

W.: West (in relation to legal land-tract descriptions of property).

Warm Springs Project: The proposed Smoky Hollow Mine, together with the associated facilities necessary to both operate the mine and deliver the produced coal to market, and planned improvements to the Smoky Mountain Road System. (See the Project.)

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. (See groundwater.)

Wildcat: Applied to a mine or well dug to test unproven mineral resources in areas far from previous production.

Wildlife habitat: A geographical area that can provide for the key activities of wildlife. All elements of a wild animal's environment necessary for completion of its life cycle, including food, cover, water, and living space.

WSA: Wilderness Study Area. A roadless block of public lands which BLM has determined may possess the wilderness qualities described in the Wilderness Act of 1964. WSAs were established in order to study the suitability of the areas for possible designation as wilderness by Congress. BLM protects each WSA's wilderness qualities until Congress decides whether or not the WSA will be designated as wilderness.

APPENDICES

SUMMARY DESCRIPTION OF THE PROPOSED WARM SPRINGS PROJECT

APPENDIX A

A.1 INTRODUCTION

Andalex Resources, Inc. (Andalex), with cooperation from the Garkane Power Association, Inc. (Garkane), the Utah Power and Light Company (UP&L), the Overton Power District (Overton), the U.S. West Communications Company (U.S. West), the Moapa Valley Telephone Company, Inc. (Moapa Valley), the Union Pacific Railroad Company (Union Pacific), the Iron County Board of Commissioners (Iron County), and a private bulk-carrier transport company, proposes to develop the Smoky Hollow Mine and the facilities necessary to operate the mine and deliver the coal to market. In addition, the Kane County Board of Commissioners (Kane County) proposes to implement planned improvements to the county road system in the Smoky Mountain area. The Smoky Hollow Mine would be a new underground coal mine located in south-central Utah, about 6 miles north of the Glen Canyon National Recreation Area (NRA), 13 miles northeast of the town of Big Water, and 15 miles north of the Arizona/Utah State line (Figure 1-1). The proposed mining operation would convert the inactive Missing Canyon Coal Mine into a full-scale underground mining facility. (Specific details on the inactive Missing Canyon Coal Mine are included in Appendix B.) Coal from the Smoky Hollow Mine, averaging about 2.5 to 3.0 million tons of crushed coal per year, would be hauled by contractor-supplied trucks over county, State, and Federal roads to new unit-train loadout facilities near Cedar City, Utah, and Moapa, Nevada, and to developing markets in the region. Once loaded on the rail, produced coal would be delivered to developing markets in the Southwestern United States and in foreign countries along the western rim of the Pacific Ocean (the Pacific Rim). The proposed Smoky Hollow Mine, the associated facilities necessary to both operate the mine and deliver the coal to market, and the planned improvements to the Smoky Mountain road system are collectively being identified as the Warm Springs Project (the Project).

The Warm Springs Project would have seven elements: (1) the proposed Smoky Hollow Mine, (2) a proposed 138-kV power transmission line extending from an existing powerline southeast of Big Water to the mine, (3) a proposed microwave communication system that would serve the mine, (4) either the Warm Creek Road, an existing, county-maintained road passing through a corner of the Glen Canyon NRA requiring reconstruction and realignment, or the Benchtop Road, a new county road that would be constructed over Nipple and Tibbet Benches, (5) a proposed unit-train loadout facility adjacent to the Union Pacific Railroad right-of-way west of Cedar City, Utah, near Iron Springs, (6) a proposed unit-train loadout facility adjacent to the Union Pacific Railroad right-of-way southwest of Moapa, Nevada; and (7) a proposed truck maintenance facility near either Fredonia, Arizona, or Hurricane, Utah. The mine, the majority of the powerline, the microwave communication system, and the Warm Creek/Benchtop Road would be located in eastern Kane County, Utah. The remainder of the powerline would be located in Coconino County, Arizona. The coal loadout facilities would be located in Iron County, Utah, and Clark County, Nevada. The truck maintenance facility would be located in either Coconino County, Arizona, or Washington County, Utah. (Land tract legal descriptions for each Project element are included in Table A-1.)

The proposed Warm Springs Project, including the mine, the 138-kV power transmission line, the microwave communication facilities, the unit-train loadout facilities, the truck maintenance facility, and the Warm Creek Road, would involve 26,496 acres of private, Utah School and Institutional Trust Lands Administration (Utah TLA), and Federal lands. If the Benchtop Road were constructed rather than reconstructing and realigning the Warm Creek Road, the Project would involve 26,453 acres. Proposed facilities throughout the Project

Table A-1 — Legal Land-Tract Descriptions of the Proposed Warm Springs Project

SMOKY HOLLOW MINE

Township 40 South, Range 3 East, Salt Lake Meridian, Utah: sections 25 through 28, and 33 through 35;
Township 40 South, Range 4 East, Salt Lake Meridian, Utah: section 31;
Township 41 South, Range 3 East, Salt Lake Meridian, Utah: sections 1, 3 through 5, 8 through 15, 17, 23 through 25, and 36; and
Township 41 South, Range 4 East, Salt Lake Meridian, Utah: sections 5 through 10, 16 through 21, and 29 through 32.

138-KV POWER TRANSMISSION LINE[1]

Township 41 South, Range 3 East, Salt Lake Meridian, Utah: sections 25, 35, and 36;
Township 41 South, Range 4 East, Salt Lake Meridian, Utah: sections 19 and 30;
Township 42 South, Range 2 East, Salt Lake Meridian, Utah: sections 24 through 26, 34, and 35;
Township 42 South, Range 3 East, Salt Lake Meridian, Utah: sections 2 through 5, 7, 8, and 18;
Township 43 South, Range 2 East, Salt Lake Meridian, Utah: sections 3, 10, 14, 15, 23, 26, 35, and 36;
Township 44 South, Range 2 East, Salt Lake Meridian, Utah: sections 1 and 12;
Township 41 North, Range 7 East, Gila and Salt River Meridian, Arizona: section 3; and
Township 42 North, Range 7 East, Gila and Salt River Meridian, Arizona: sections 33 and 34.

MICROWAVE COMMUNICATION SYSTEM[1]

Township 41 South, Range 3 East, Salt Lake Meridian, Utah: section 24;
Township 42 South, Range 3 East, Salt Lake Meridian, Utah: section 29; and
Township 43 South, Range 2 East, Salt Lake Meridian, Utah: section 11.

SMOKY MOUNTAIN ROAD SYSTEM (WARM CREEK ROAD)[1]

Township 41 South, Range 3 East, Salt Lake Meridian, Utah: sections 24, 25, and 36;
Township 41 South, Range 4 East, Salt Lake Meridian, Utah: sections 7, 8, 18, 19, and 30;
Township 42 South, Range 3 East, Salt Lake Meridian, Utah: sections 1, 12, and 13;
Township 42 South, Range 4 East, Salt Lake Meridian, Utah: sections 18 through 20, 29, and 32;
Township 43 South, Range 2 East, Salt Lake Meridian, Utah: sections 11 through 13;
Township 43 South, Range 3 East, Salt Lake Meridian, Utah: sections 9, 10, 12, and 14 through 18; and
Township 43 South, Range 4 East, Salt Lake Meridian, Utah: sections 5 through 7.

SMOKY MOUNTAIN ROAD SYSTEM (BENCHTOP ROAD)[1]

Township 41 South, Range 3 East, Salt Lake Meridian, Utah: sections 24, 25, and 32 through 36;
Township 41 South, Range 4 East, Salt Lake Meridian, Utah: sections 7, 8, 18, 19, and 30;
Township 42 South, Range 2 East, Salt Lake Meridian, Utah: sections 11, 12, 14, 23, 26, and 35;
Township 42 South, Range 3 East, Salt Lake Meridian, Utah: sections 5 through 7; and
Township 43 South, Range 2 East, Salt Lake Meridian, Utah: sections 2 and 11.

IRON SPRINGS (CEDAR CITY) UNIT-TRAIN LOADOUT[2]

Township 35 South, Range 12 West, Salt Lake Meridian, Utah: sections 18 through 20.

MOAPA UNIT-TRAIN LOADOUT[2]

Township 15 South, Range 65 East, Mt. Diablo Meridian, Nevada: section 13; and
Township 15 South, Range 66 East, Mt. Diablo Meridian, Nevada: sections 4, 5, 7, 8, 10, and 15 through 18.

TRUCK MAINTENANCE FACILITY (FREDONIA)[3]

Township 41 North, Range 2 West, Gila & Salt River Meridian, Arizona: section 8.

TRUCK MAINTENANCE FACILITY (HURRICANE)[3]

Township 41 South, Range 13 West, Salt Lake Meridian, Utah: section 31.

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[1] Figures include the entire right-of-way for this element (including that part inside the Smoky Hollow Mine life-of-mine area).
[2] Figures include the entire element, including all associated rights-of-way.
[3] Figures are hypothetical for the purpose of this analysis: the actual location of this facility would be selected by the specific contractor chosen to provide the truck haul and maintenance service.

area would disturb about 1,390 acres (1,347 acres if the Benchtop Road were constructed). The surface effects of underground mining (subsidence) within the Smoky Hollow life-of-mine area could appear on an additional 12,141 acres. (A detailed summary of acreage figures for each Project element is included in Table A-2.)

The life of the proposed Smoky Hollow Mine would be about 54 years (the mine life): 1 to 2 years for premining development, equipment installation, and limited coal recovery and delivery; 40 years to recover and deliver about 100 to 120 million tons of coal; 2 years to complete necessary postmining reclamation activities; and 10 years to obtain final bond release (Chapter 1, Table 1-2). A total of 450 people could eventually be permanently employed on the Project. An additional 227 temporary jobs would be associated with the various construction activities (Chapter 1, Table 1-3). To the extent possible, positions would be filled by employees hired locally from within the Project area. Andalex expects to provide extensive on-the-job training programs in order for workers to develop the required mining-related skills.

A.2 SUMMARY DESCRIPTION OF THE PROJECT ELEMENTS

A.2.1 SMOKY HOLLOW MINE

A.2.1.1 Introduction

Andalex proposes to develop the Smoky Hollow Mine to recover about 100 to 120 million tons of coal contained in Federal coal leases U-087805, U-087806, U-087807, U-087828, U-087833, U-087834, U-087835, U-092140, U-092141, U-096486, U-096494, U-096495, U-096497, and U-0101142; and State of Utah coal leases ML-19656, ML-19678, and ML-19786. The life-of-mine area for the proposed mine (Figure A-1) would involve 24,659 acres of State and Federal lands (Table A-2). About 202 of these acres would be disturbed by Project-related construction activities. Project-related subsidence could affect 12,141 of these acres. Average production from the mine would be about 2.5 to 3.0 million tons per year; however, production rates may fluctuate between 2.0 and 3.0 million tons per year in response to mining conditions, unavailability of equipment, marketing, and/or worker productivity. Full production should be reached by a gradual buildup during the first years of mining.

About 59 acres of the life-of-mine area would be devoted to a surface facilities complex to support the underground mining operation. The facility would disturb about 52 acres; 14 of these acres were previously disturbed by the now inactive Missing Canyon Coal Mine during the mid-1970s. In addition, about 150 acres would be disturbed by ventilation facilities, exploratory drilling, topsoil borrow activities, and associated temporary road construction; 5 of these acres were previously disturbed by an abandoned airstrip on Smoky Mountain.

Up to 12,141 acres of the life-of-mine area above the proposed underground mining activities could experience some surface subsidence. (A complete discussion of subsidence and the mechanisms

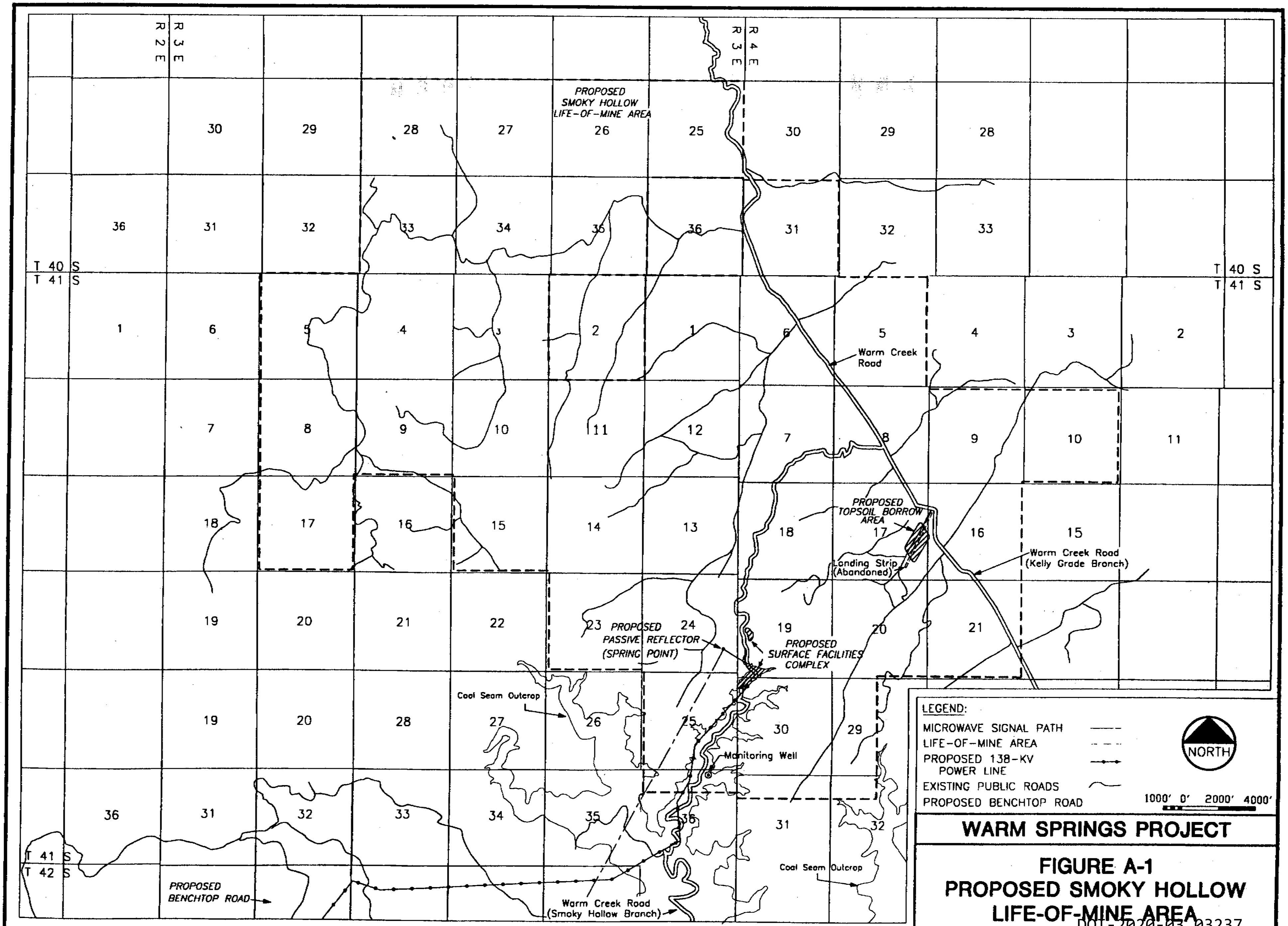
Table A-2 — Acreage Data for the Proposed Warm Springs Project

	Total Acreage	Disturbed Surface Acreage			Surface Mineral Ownership		
		Total	New	Existing	Private	State	Federal
SMOKY HOLLOW MINE							
Mining area	12,141	150	145	5	0	678	11,463
Surface facilities complex	59	52	38	14	0	0	59
Other nonsubsidence	12,459	0	0	0	0	202	12,257
Potential subsidence	—	[1]12,141	[1]12,043	[1]98	[1]0	[1]67	[1]11,463
Total	24,659	202	183	19	0	880	23,779
138-KV POWER TRANSMISSION LINE							
Parallel ROW w/UP&L	65	18	18	0	0	6	59
Big Water-mine ROW*	148	38	38	t	0	21	127
Construction ROW**	29	19	13	6	0	4	25
Total	[2]242	75	69	6	0	31	211
MICROWAVE COMMUNICATION SYSTEM							
Smoky Hollow transceiver	t	t	t	0	0	0	t
Spring Point reflector	1	t	t	0	0	0	1
Mustard Point repeater	3	2	2	0	0	0	3
Big Water terminal	2	t	t	t	t	0	2
Total	5	2	2	t	t	0	[2]5
SMOKY MOUNTAIN ROAD SYSTEM (WARM CREEK)							
Formal ROW*	279	279	234	45	3	33	243
Construction ROW**	529	529	510	19	0	54	475
Total	808	808	744	64	3	87	718

Table A-2 —Acreage Data for the Proposed Warm Springs Project (Continued)

	Total Acreage	Disturbed Surface Acreage			Surface Mineral Ownership		
		Total	New	Existing	Private	State	Federal
IRON SPRINGS (CEDAR CITY) UNIT-TRAIN LOADOUT							
Primary loadout ROW	120	78	76	2	0	0	120
Powerline activities	4	2	1	1	0	0	4
Rail spur extension	2	2	1	1	2	0	t
Telephone ROW	2	1	1	0	0	0	2
County road upgrade	2	2	1	1	1	0	1
Total	[2]124	85	80	5	3	0	[2]121
MOAPA UNIT-TRAIN LOADOUT							
Primary loadout ROW	618	189	185	4	4	0	614
Powerline ROW	23	7	5	2	3	0	20
Telephone ROW	4	2	2	t	0	0	4
Total	[2]638	198	192	6	7	0	[2]631
TRUCK MAINTENANCE FACILITY (FREDONIA/HURRRICANE)							
Total	20	20	20	0	20	0	0
Project Total No. 1[3]	26,496	1,390	1,290	100	33	998	25,465
SMOKY MOUNTAIN ROAD SYSTEM (BENCHTOP)							
Formal ROW*	255	255	244	11	3	45	207
Construction ROW**	510	510	498	12	0	117	393
Total	765	765	742	23	3	162	600
Project Total No. 2[3]	26,453	1,347	1,288	59	33	1,073	25,347

[1]Potential subsidence acreage is for information only. Numbers are not used in the acreage totals for the Smoky Hollow Mine.
[2]Acreage figures include overlapping parcels and will not match totals shown.
[3]Total values for Project No. 1 are the sum of the six common elements (Smoky Hollow Mine, 138-kV power transmission line, microwave communication system, Iron Springs (Cedar City) unit-train loadout, Moapa unit-train loadout, and truck maintenance facility) plus the Warm Creek Road; total values for Project No. 2 are the sum of the six common elements plus the Benchtop Road.
t = Trace (Actual acreage is less than 0.5 acre).
* Formal ROW = The permanent ROW which would remain in place following construction.
** Contruction ROW = The area outside the formal right-of-way that is temporarily disturbed during construction and immediately reclaimed.



WARM SPRINGS PROJECT

FIGURE A-1
PROPOSED SMOKY HOLLOW LIFE-OF-MINE AREA

DOI-2020-03 03237

MARC 95 AD F GAassociated with the subsidence event are included in Appendix C.) About 98 acres in this potential subsidence area have been disturbed by roads and other previous land use activities.

At full production, operations at the Smoky Hollow Mine would employ 150 workers, including equipment operators, mechanics, electricians, technicians, and administrative personnel (Chapter 1, Table 1-3). In addition, about 50 workers would be employed over a 12- to 24-month period to complete facility construction activities.

A.2.1.2 Surface Facilities Complex

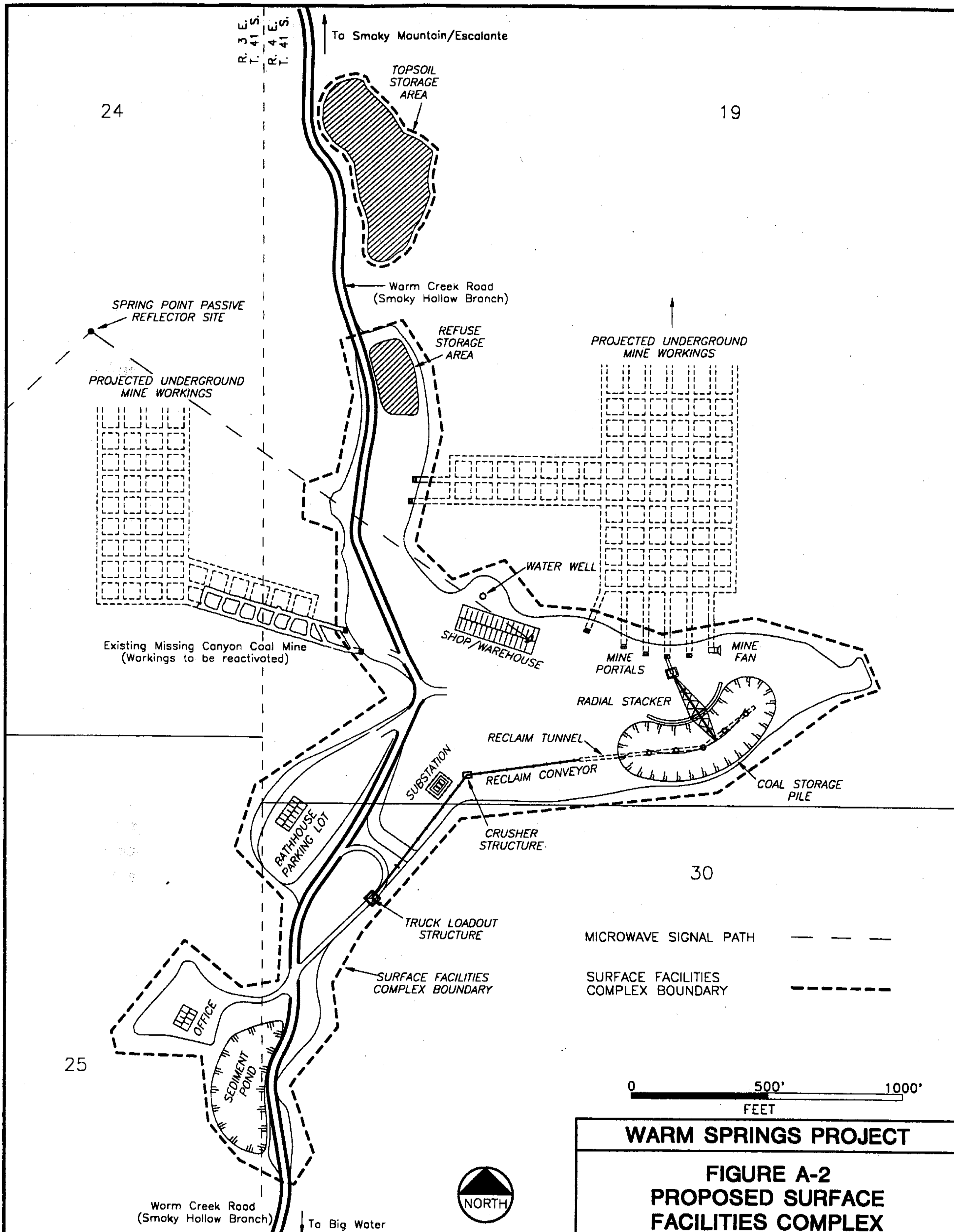
The majority of the surface facilities for the proposed mine would be located on Federal land in the SW¼ of section 19 and the NW¼ of section 30 in the southern part of the life-of-mine area (T. 41. S., R. 4 E.; Figure A-1). The primary function of these facilities would be to support the underground mining activities and to facilitate the stockpiling, crushing, and loading of the coal produced from the mine. Most activity would take place in the central part of the complex known as the mine yard (Figure A-2). All the facilities located within the surface facilities complex would be painted to blend with the earthen colors of the shales, siltstones, and sandstones of the surrounding environment (e.g., neutral, gray or tan). All facility lighting would be shielded and directed downward to minimize the potential for night glow. All facilities would be heated with electric space heaters.

Construction engineering for the mine yard area would be designed to balance cut-and-fill material as much as possible so that base material would be available from within the construction area. Granular borrow and untreated base course material would come from suitable sources in the disturbance area or from existing gravel sources in the Big Water area.

A.2.1.2.1 Main Facilities Buildings

A combined shop/warehouse building, about 80 feet wide, 240 feet long, and 25 feet high, would be located in the north-central part of the mine yard, near the main mine portals. It would be constructed with a concrete floor and open-bay steel support structures. The shop would be equipped for the repair and maintenance of mining-related equipment and machinery. Parts and supplies for the operation would be warehoused in a separate part of the building. The east wing of the building would contain a "ready" area adequately sized to allow the employees to assemble before each working shift, collect their safety gear, and receive their work assignments prior to entering the mine. Space/offices would be provided for mine supervisory personnel and for safety training equipment and medical and first aid supplies.

A bathhouse, designed to serve 150 workers, would be constructed in the southwestern part of the mine yard. It would be a predesigned steel building, about 60 feet wide, 120 feet long, and 20 feet high, constructed similarly to the shop/warehouse building. Employees would park in the area adjacent to the bathhouse, then enter the bathhouse to change clothes for their shift. Showers and lockers would be available.



WARM SPRINGS PROJECT

**FIGURE A-2
PROPOSED SURFACE FACILITIES COMPLEX**

DATE: MARCH 1995 ACAD FILE: FIGA-2.DWG

A mine administration office to house the mine administration personnel, including management, engineering, accounting, and clerical staff, would be located near the southern end of the surface facilities complex. The office building would be about 40 feet wide, 70 feet long, and 20 feet high.

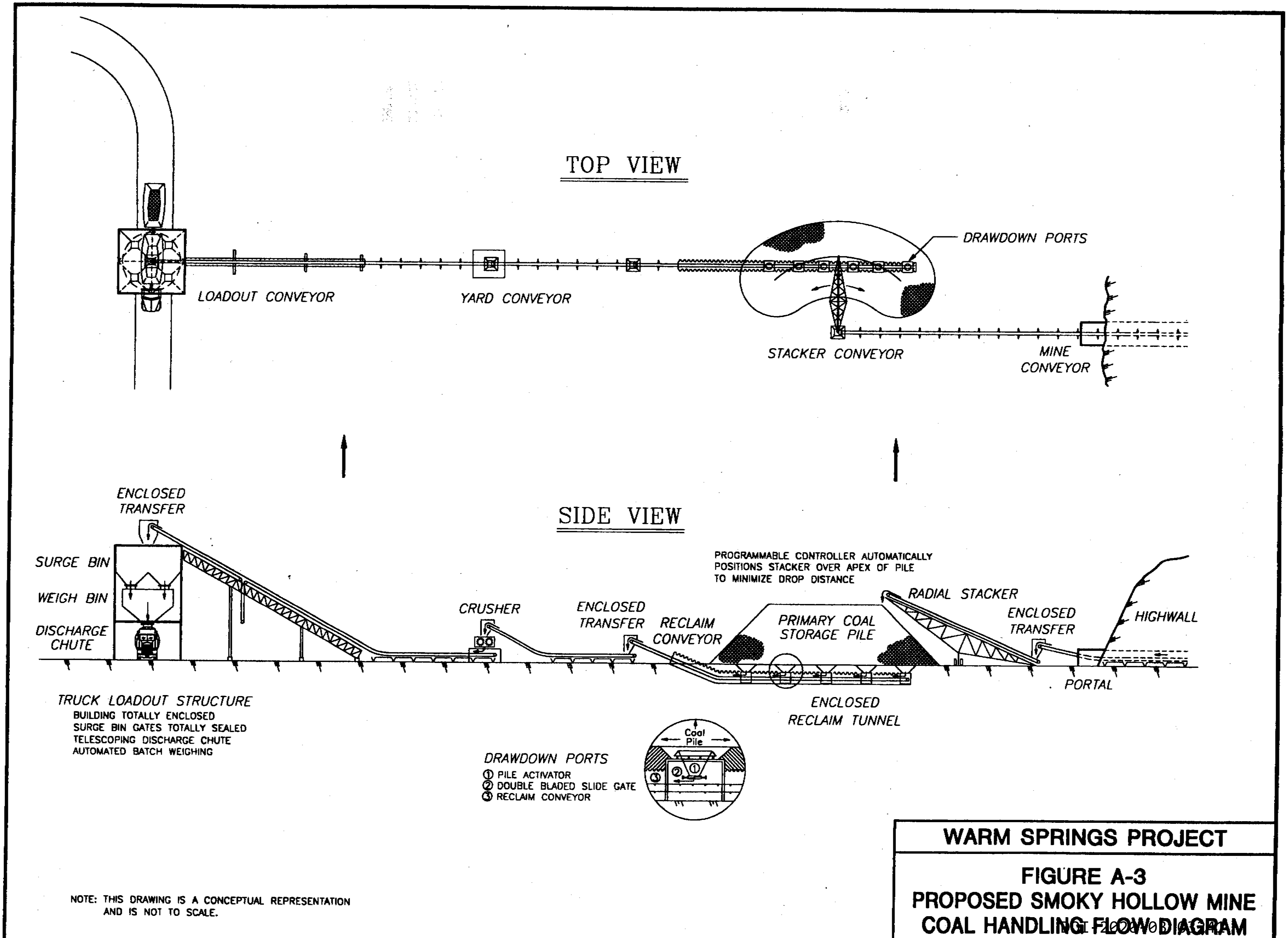
A.2.1.2.2 Coal Handling Facilities

Construction of the various support facilities for the mine would be expected to take 1 to 2 years to complete. During this time, coal production would be limited to portal face-up work or to minor production from the test mine for marketing and/or testing purposes. Initial production from the mine would consist of run-of-mine (ROM) coal until construction of all coal handling and loading facilities had been completed. During this initial start-up period, coal would be moved within the mine yard with front-end loaders and haul trucks. Once the surface facilities were operational, mine production buildup would begin. (Section A.2.1.4, Coal Removal).

Coal mined underground at full production would be conveyed to the surface by an underground mine conveyor system. Once on the surface, the coal would be transferred from the belt portal at the mine to the ROM stockpile, the crusher facility, and then to the truck loadout on a series of covered belt conveyors at rates of about 800 tons per hour (tph) (Figure A-3). A programmable controller would be used to automatically position the 300-foot-long radial stacker conveyor over the apex of the ROM coal stockpile while it is being built in order to minimize the drop distance of the coal. When built to its fullest extent, the open, kidney-shaped stockpile would have a length of about 500 feet and a height of about 85 feet and would provide about 100,000 tons of storage capacity.

Coal would be transferred from the ROM coal stockpile to the crusher facility by a 550-foot-long reclaim conveyor and a 350-foot-long yard conveyor. The crushing facility would be an open steel structure, about 26 feet wide, 60 feet long, and 40 feet high. It would contain scalping screens and two 250-horsepower hammermill crushers that would reduce the 8-inch x 0-inch ROM coal to a 2-inch x 0-inch final product. The entire crushing operation, including all the chutework leading to and exiting from the crushers, would be totally enclosed. Crushed product coal would be transferred by the loadout conveyor from the crusher to the truck loadout facility. No other coal processing activities (washing, etc.) are proposed. The loadout facility would be an enclosed steel structure, about 25 feet wide, 35 feet long, and 85 feet high, with an open truck-drive-through area. It would contain two large coal bins; a two-stage, automated, American Society for Testing and Materials (ASTM) sampling system; a control room; and all necessary hydraulic power components, motor control centers, starters, electrical switch gear, and computer equipment.

On command from the truck operator, coal from the 325-ton surge bin would fill the lower, 30-ton weigh bin until the predetermined batch weight had been obtained. Coal would leave the weigh bin and be loaded into the haul trucks through a telescoping chute that would be automatically positioned over the cargo trailers as the trucks move through the loadout. This batch/weigh/load process would be repeated for the rear trailer and then repeated again and again as additional trucks would arrive to be loaded (Section A.2.7.5, Haul Trucks). The entire batching and weighing process would be computer controlled. Weights recorded for each truckload would be accurate to within 0.1 percent of the actual weight and would be certified by the Utah Department of Agriculture, Division of Regulatory Services, Weights and Measures.



WARM SPRINGS PROJECT

FIGURE A-3
PROPOSED SMOKY HOLLOW MINE COAL HANDLING FLOW DIAGRAM

To contain fugitive dust, all conveyors outside the mine portal would be covered, and coal would be transferred from one conveyor to another within enclosed chutework at transfer structures. The radial stacker feeding the ROM coal stockpile would be designed to automatically position over the apex of the pile to reduce the drop distance and minimize particulate emissions. The transfer structure between the reclaim and yard conveyor would include a self-cleaning iron magnet and a metal detector to remove any metal before the coal reaches downstream equipment. A water-spray system would be installed on the reclaim conveyor to reduce dust in the coal before it reaches the crusher facility. Coal transfer within the truck loadout facility would be completely enclosed. The telescoping chute would minimize particulate emissions when the crushed coal is being loaded into waiting trucks. To minimize dust, work areas within the mine yard would be treated with chemical dust suppressants (e.g., magnesium chloride).

A.2.1.2.3 Ancillary Facilities

Ancillary facilities within the surface facilities complex would include fuel and lube oil storage, explosives storage, power transmission, and water supply and distribution. They would also include wastewater treatment, communications, fresh-air ventilation, solid-waste storage, refuse storage, and topsoil storage (Figure A-2). The public segment of the Smoky Hollow County Road would, however, be separated from the operational areas of the surface facilities complex to ensure that mine operations would not hinder public use of the road (Section A.2.4.4, Public Use of the Road). The operational parts of the surface facilities complex would be separated from the public road by embankments, fences, gates, barricades, or other effective means.

The fuel and lube oil storage system would be located in an unfenced area near the shop/warehouse building, convenient to both underground and surface operations. Grease and oil would be stored in sealed containers on an impervious surface, about 20 feet wide and 20 feet long, with a 10-foot-high, fire-resistant steel covering. Diesel fuel and unleaded gasoline would be stored separately in two aboveground, locked, 2,000- to 3,000-gallon steel tanks. Each fuel or lube oil storage facility would be installed within a bermed containment structure capable of adequately holding the entire volume of the largest tank.

Explosives used at the mine would include stick dynamite and electric blasting caps. A secured, but unfenced, explosives storage area would be located near the extreme eastern end of the mine yard, a minimum distance of 100 feet from the coal storage pile and the mine portals. Dynamite and blasting caps would be stored separately in two storage magazines, about 8 feet wide, 8 feet long, and 8 feet high. Storage magazines would be of steel construction with a wooden (spark-proof) interior lining. They would be locked at all times to restrict access to authorized personnel only.

Electric power used by mining equipment and coal handling facilities would be delivered to an electrical substation located in the central part of the mine yard by Garkane Power Association (Section A.2.2, 138-kV Power Transmission Line). Power would be reduced from 138 kV to 12,500 volts for distribution to the underground working sections of the mine. It would be further reduced from 12,500 to 480 volts for overhead distribution to the various surface facilities. The 480-volt overhead service would use 40-foot wooden poles, an aluminum conductor, steel-reinforced (ACSR) conductors, and steel static wires on post-mount insulators. The substation would include pad-mounted, three-phase, oil-cooled transformers, high-voltage disconnects, power factor capacitors, metering facilities, and isolation switchgear. The substation, about 100 feet wide and 150 feet long, would be enclosed in a locked, 8-foot-high chainlink fence to restrict access to authorized personnel only. No backup generator would be installed.

Water for the mine surface facilities and for the underground operation would be obtained from one or more wells drilled to a depth of about 2,500 feet into the Navajo Sandstone Aquifer. The primary well would be located near the shop/warehouse building at the north-central part of the mine yard. The other wells, if needed, would be drilled along the outer perimeter of the mine yard. Andalex currently holds water rights for the proposed mine supply wells. Water would be pumped through a buried, 4-inch-diameter metal pipeline to three 10,000-gallon metal storage tanks located near the mine portals. From the primary storage tanks, water would gravity-feed to three smaller 6,000-gallon storage tanks located near the shop/warehouse, bathhouse, and administrative buildings, respectively. All the water stored in the primary tanks would be treated (chlorinated), as necessary, to ensure an adequate potable water supply. Well water would also be used for dust suppression, construction, and other mine-related purposes. Pressurized water for fire prevention would be available throughout the surface facilities complex. The mining operation is expected to use as much as 550 acre-feet of water per year. The water supply and distribution system would be designed to furnish up to 350 gallons of water per minute for operational and potable water requirements at the mine. Potable water for personnel would be transported throughout the mine in small containers. Although it is not anticipated, any water that might be encountered in the underground workings would be stored in underground mine sumps to supplement overall mine water needs. Prior to completion of the water well(s), water would be trucked to the site from an approved local water source.

The wastewater system would include facilities for the collection and treatment of sewage and washwater. Sewage effluent flow at the mine during full production is estimated to be about 5,000 gallons per day. Wastewater would be treated in individual, approved, septic tank and drain-field systems located at each of the shop/warehouse, bathhouse, and administration buildings. Excess sewage solids would be periodically removed to an approved offsite disposal facility.

A private mine communications network would be installed throughout the mine operations area, including all underground-working sections of the mine and all major mechanical facilities on the surface. Telephone service would be available at the mine office and shop/warehouse buildings, the truck loadout facility, and at other key locations. The main telephone terminal would be located at the shop/warehouse building with buried telephone cable providing the outside communication access for the mine office building, the truck loadout facility, and other key locations. Where appropriate, both telephone distribution lines and mine communication distribution lines would be installed parallel to the mine's electric distribution network.

A microwave communication system would link the telephone service at the mine to the U.S. West Communications network in Big Water, Utah. (Specific details of the existing U.S. West system are included in Appendix B.) The microwave system would consist of a terminal facility within the surface facilities complex, a reflector station located on Spring Point above the surface facilities complex (Section A.2.1.3.1, Spring Point Microwave Reflector Station), a repeater station on Mustard Point, and a terminal linkage facility near Big Water (Section A.2.3, Microwave Communication System). The terminal facility at the mine would include a transceiver with a 6-foot parabolic antenna located on the roof of the shop/warehouse building.

- Radio signals originating at the mine would be directed to the Spring Point reflector station for transmittal to the Mustard Point and Big Water facilities.

Ventilation for the mine would primarily be provided by a 12-foot-diameter, variable-pitch axial-vane exhausting mine fan located in the northeastern part of the mine yard at the main entry portals. It would be capable of delivering up to 600,000 cubic feet of fresh air per minute throughout the mine, using the main mine entries in the portal area. When the mine expands to the western workings (Section A.2.1.4, Coal Removal), additional ventilation would be provided by similar fans installed near the old Missing Canyon Coal Mine portals on the western edge of the mine yard. The discharge opening of the mine fans would be enclosed within a meshed screen to restrict access. Power requirements for the mine ventilation system could approach 1,500 horsepower at full production. When the mine expands to the northern workings (Section A.2.1.4, Coal Removal), three or four vertical, air-intake shafts would be installed to provide adequate fresh air throughout the underground workings and serve as fresh-air escapeways for mine workers in the event of an emergency. Ventilation shafts are tentatively proposed in sections 7 and 21 of T. 41 S., R. 4 E.; in section 10 of T. 41 S., R. 3 E.; and in section 34 of T. 40 S., R. 3 E. Actual locations for these shafts would be determined as mine operations progress. These ventilation shafts, about 15-feet in diameter, would be raise-bored from the underground workings up to the surface. Excavated rock would be disposed of in underground storage areas within the mine. No ventilation equipment would be required on the surface, but the surface opening of each shaft would be grated and fenced to restrict access. Development activities on the surface would utilize existing roads as much as possible but could require as much as 100 to 200 feet of new, temporary access road at each site. Shaft development activities could disturb up to 7 acres.

Solid waste (garbage, construction, mining supply, and other debris) would be temporarily stored in specially designed containers (dumpsters) located in the vicinity of the underground mine portals. The mine would generate one or two commercial dumpsters full of common (i.e., nonhazardous) solid waste per week, and this would be taken to sanitary landfills in either Page or Fredonia. Waste paper, glass, wood, metal, and other such materials determined to be nonhazardous would be recycled as much as possible. Waste grease, lubricants, paints, and flammable liquids would be stored in steel drums near the shop/warehouse for periodic disposal at a licensed and bonded liquid-waste disposal facility. Materials determined to be hazardous, or those with specific handling requirements, would be disposed of according to appropriate State and Federal regulations.

A storage area for mine refuse, about 150 feet wide, 290 feet long, and 17 feet high, would be developed at the north end of the surface facilities complex. It would be designed to temporarily contain as much as 16,500 cubic yards of sand, silt, and minor coal fines removed from ditches, culverts, and the sediment pond. The material would be spread and compacted in successive layers, with the surface of the pile sloped to the outside to prevent water from collecting. Maximum outslopes would not exceed 2 horizontal feet to each 1 vertical foot (2:1). Diversion ditches, sized to convey drainage from a 100-year, 6-hour precipitation event, would be located around the perimeter of the pile to intercept and convey drainage to the sediment pond. The storage pile would be enclosed within a system of fences, berms, barricades, or other equally effective means to restrict unauthorized access. The refuse storage area would remain in place until the end of underground mining activities in year 41 or 42 of the Project. During final reclamation of the surface facilities complex, material in the refuse pile would be relocated to a permanent storage location adjacent to the regraded highwall of the mine portal area and then covered with a minimum of 4 feet of noncombustible material.

Topsoil material, salvaged during construction of the surface facilities complex, would be stored for future reclamation activities. Initial soil surveys indicate that as much as 65,000 cubic yards of soil material may be available. A single 3.5-acre topsoil stockpile would be placed north of the mine yard. The stockpile would remain in place until the end of underground mining activities in year 41 or 42 of the Project. During the life of the mining operation, stockpiled topsoil would be clearly identified and protected from water and wind erosion through the use of diversion ditches, seeding, and mulching (Section A.3.4, Reclamation Activities).

A.2.1.2.4 Stormwater and Sediment Control Facilities

A sediment and runoff impoundment structure (sediment pond) would be built at the south end of the surface facilities complex to collect and retain runoff from mine yard areas (Figure A-2). The drainage area that would contribute runoff to the pond would be about 118 acres. The 2-acre pond would have about 17 acre-feet of storage capacity to contain and treat runoff from disturbed areas during a 10-year, 24-hour precipitation event. The open-channel, concrete spillway would be designed to safely pass the excess runoff from a 100-year, 6-hour precipitation event. The pond would be dewatered, as necessary, through the use of a locked decant pipe that would allow inflow to accumulate and suspended solids to settle. Water would be discharged slowly after meeting Utah Pollutant Discharge Elimination System (PDES) limits. Average retention time would be greater than 24 hours. Sediment would be removed to the mine refuse storage area when the accumulation reached 60 percent of sediment storage capacity. Sediment powerline markers would be located in the bottom of the pond to monitor accumulation.

The existing, natural drainages from the surrounding, undisturbed areas would be routed under the surface facilities complex to ensure that the natural drainage and the disturbed area drainage remain separate. A main diversion culvert (at least 96 inches in diameter) would divert the natural flow from Smoky Hollow beneath the mine yard. Several 24- to 48-inch-diameter secondary culverts would divert the side canyon drainages beneath the mine yard and into the main diversion culvert. Diversion culverts would all be sized to carry routine runoff and safely handle runoff from a 100-year, 6-hour precipitation event.

Temporary diversion ditches (channels) would be used to route runoff around and through those areas being used to support mining-related activities. Additional temporary channels would be used to collect and intercept runoff from disturbed areas for routing to the sedimentation pond. Side ditches would be used along the roads, around the refuse and topsoil stockpiles, and along the embankments of the mine yard. All channels would be triangular-shaped and sized to safely carry the runoff from a 10-year, 6-hour precipitation event.

Temporary riprap, straw bales, or rock check dams would be placed in ditches and other drainages to reduce flow velocities and minimize erosion. Concrete liners, grouted riprap, and/or energy dissipators would be used in steeper sections where additional erosion protection may be required. Corrugated metal pipe or concrete culverts would be used at all diversion channel and natural drainage crossings (e.g., access and mine roads). All the culverts would be designed to safely carry water flow from a 10-year, 6-hour precipitation event.

All sediment control structures not necessary for postmining uses would be removed and the entire disturbed area scarified and reseeded (Section A.3.4, Reclamation Activities).

A.2.1.3 Other Support Facilities

A.2.1.3.1 Spring Point Microwave Reflector Station

The Spring Point mircowave reflector station would direct microwave signals between the transceiver facility at the mine and the Mustard Point repeater station (Sections A.2.1.2.3, Ancillary Facilities, and A.2.3.2, Microwave Facilities). It would be located about one-half mile northwest of the surface facilities complex on the rim of Spring Point in the SE¼ of section 24, T. 41. S., R. 3 E. (Figures A-1 and A-2). It would require a 50-foot by 50-foot site to contain a 6-foot by 8-foot metal reflecting board mounted on a 30-foot-high, galvanized-steel truss tower. The reflecting board would be painted a light, nonspecular color to maximize signal reflectivity and blend with the surrounding environment as much as possible. No power supply or permanent access would be needed to operate the station. Temporary access during construction would be via existing ancillary roads. Although the reflector station would involve 1 acre of Federal land, the construction activities would disturb less than 1 acre. Topsoil, when available, would be salvaged and respread around the completed facility. Temporary straw bale or filter fabric dikes would be used for sediment control during construction. The entire disturbed area, including the access road, would be scarified and reseeded (Section A.3.4, Reclamation Activities).

A.2.1.3.2 Topsoil Borrow Area

A borrow area for topsoil material would be developed, if necessary, on the flat benchland of Smoky Mountain in the SE¼ of section 17 (T. 41. S., R. 4 E.) for use during final reclamation activities at the surface facilities complex (Figure A-1). Borrow activities would disturb about 47 acres, including 5 acres previously disturbed by an aircraft landing field, now abandoned. Although as much as 139,000 cubic yards of suitable material (12 to 60 inches deep) may be available at this site, only the top 6 to 12 inches in those areas with the deeper soils would be removed, maintaining a reserve of as much as 70,000 cubic yards of topsoil for reclamation of the site. Topsoil from this area would not be needed until after completion of the underground mining activities and initiation of the final reclamation program. It would only be used if there were not enough soil material available for salvage during initial construction. Diversion ditches would be cut around the perimeter of the borrow area to divert undisturbed overland flow away from the borrow area. Temporary straw bale or filter fabric dikes would be used for sediment control during borrow activities. The entire disturbed area would then be scarified, reseeded, and fenced to exclude livestock as soon as possible after all topsoil removal activities were completed (Section A.3.4 Reclamation Activities).

A.2.1.3.3 Access Roads

The proposed mine complex would be accessible from the west and south by U.S. Hwy. 89, a two-lane paved road that serves southern Utah and northern Arizona (Chapter 1, Figure 1-1). Primary access to the surface facilities complex from the town of Big Water would be along either the existing, county-maintained Warm Creek Road or the proposed Benchtop Road (Section A.2.4, Smoky Mountain Road System).

Travel within the life-of-mine area would normally be limited to the 57+ miles of existing unpaved roads (Figure A-1), except when necessary for construction, maintenance, safety, and exploration work. Speed would be limited to 25 mph on all unpaved roads. All roads and parking areas within the surface facilities complex would receive regular applications of water or other approved dust suppressants (e.g., magnesium chloride).

Existing light-use roads would be used for mining-related activities, as necessary. Temporary roads would be constructed throughout the life-of-mine area for specific activities, such as exploratory drilling, hydrologic monitoring, construction, reclamation, and inspection. Formal construction or upgrade of these roads could disturb a width of as much as 15 feet. After completion of a specific activity, these roads would be reclaimed by backfilling any cuts and regrading any fills. The regraded surface would then be scarified and reseeded (Section A.3.4, Reclamation Activities).

A.2.1.3.4 Exploration Activities

Exploration boreholes would be drilled at various locations throughout the life-of-mine area (Figure A-1). About 60 additional boreholes, from the surface to the coal seams below, could eventually be drilled to provide additional quality and quantity information on the coal reserves for detailed mine planning as the underground mining activity progresses. These boreholes would supplement existing information retrieved from the 169 existing boreholes that were drilled throughout the life-of-mine area during project feasibility and planning activities over the last 30 years.

Each new borehole site would disturb about 1 acre and could require as much as 1,320 feet of new, temporary access road. Exploration activities would utilize existing roads as much as possible. All borehole drilling activities could be expected to disturb as much as 66 acres, and associated access development activities could disturb an additional 30 acres throughout the life-of-mine area. Borehole drilling activity at each site would be temporary, typically lasting 1 to 2 weeks per borehole.

Following completion of all boreholes, each hole would be cemented from the bottom to within 2 feet of the surface. Native materials would be used to fill the remainder of the hole. The entire disturbed area, including the access roads, would then be scarified and reseeded (Section A.3.4, Reclamation Activities).

A.2.1.3.5 Water Monitoring Facilities

One water monitoring well (MW-1) is located 1 mile south, downgradient from the surface facilities complex (Table A-3; Figures A-1 and A-2). The 200-foot-deep well was drilled in 1990 to collect groundwater quality and quantity baseline information for the permit application package (PAP). It would continue to be used to monitor groundwater information throughout the life of the mine. The 5-foot-wide, 10-foot-long drill pad and access disturbed less than 1 acre. Current access to the site is by foot along the bottom of the drainage. Following completion of all monitoring activities, the hole would be cemented from the bottom to within 2 feet of the surface. Native materials would be used to fill the remainder of the hole. The entire disturbed area, including the access road, would then be scarified and reseeded (Section A.3.4, Reclamation Activities).

Additional water monitoring wells could be developed throughout the mining area during the life of the mine. Many of these monitoring wells could use exploration boreholes converted to monitoring purposes (Section A.2.1.3.4, Exploration Activities). In addition, several shallow (300 feet) water monitoring wells would be drilled from inside the mine as the main entries are developed. No additional wells would be drilled from the surface for water monitoring purposes.

Thirty-one water monitoring sites are located throughout the Warm Creek drainage system (Wesses, John Henry, Smoky Hollow, and Warm Creek Canyons) to evaluate surface and groundwater characteristics. Fourteen of these sites are located in the bottom of the various drainages to evaluate surface runoff characteristics. The monitoring equipment at these sites consists of a 7-foot-long, 3-inch-diameter steel pipe with a concrete base buried 2 feet below the surface to record surface flow depth, and plastic/glass bottles either secured on the outside of the steel pipe or buried in the sand at the base of the pipe to collect water quality samples during runoff events. Nine of the drainage bottom sites (sites SS-1 through 7, SS-11, and SS-12; Table A-3) are located within the life-of-mine area. The other drainage bottom sites (sites SS-8 through 10, SS-13, and SS-14) are located outside the life-of-mine area. The 17 remaining monitoring sites are located at existing seeps and springs in the area. The monitoring equipment at these sites consists of small depressions and/or buckets to retain groundwater seepage for sample collection purposes. Ten of the seep/spring sites (sites S-1 through S-8, Upper Wesses Seep, and Wesses Spring) are located within the life-of-mine area, while the others (Tibbet Spring, Brett Spring, Tibbet Canyon Sandstone Seep, Needle Eye Water Spring, John Henry Spring, Clints Spring, and Drip Tank Spring) are located outside the life-of-mine area. Installation of the monitoring equipment at all of the sites disturbed less than 1 acre. Current access to the sites is by existing roads and by foot along the bottom of the drainages. Following completion of all monitoring activities, the pipes and buckets would be removed, and native materials would be used to fill any depressions. The entire disturbed area would then be scarified and reseeded (Section A.3.4, Reclamation Activities).

A.2.1.4 Coal Removal

Andalex would remove about 100 to 120 million tons of coal from the John Henry Member of the Straight Cliffs Formation during 40 years of coal mining at the Smoky Hollow Mine. Although coal production would eventually come from the the Brown, Purple, Blue, and Green seams of this formation, the majority of the

Table A-3 — Water Monitoring Sites for the Smoky Hollow Mine

Site Name	Location	Inside/Outside Mine Area
WELL SITES:		
Well MW-1	NE¼ section 36, T. 41. S., R. 4 E.	Inside.
DRAINAGE BOTTOM SITES:		
Site SS-1	NW¼ section 19, T. 41. S., R. 4 E.	Inside.
Site SS-2	SW¼ section 19, T. 41. S., R. 4 E.	Inside.
Site SS-3	NE¼ section 25, T. 41. S., R. 3 E.	Inside.
Site SS-4	SE¼ section 25, T. 41. S., R. 3 E.	Inside.
Site SS-5	NE¼ section 24, T. 41. S., R. 3 E.	Inside.
Site SS-6	SW¼ section 19, T. 41. S., R. 4 E.	Inside.
Site SS-7	NE¼ section 25, T. 41. S., R. 3 E.	Inside.
Site SS-8	NE¼ section 35, T. 41. S., R. 3 E.	Outside.
Site SS-9	SE¼ section 35, T. 41. S., R. 3 E.	Outside.
Site SS-10	NW¼ section 1, T. 42. S., R. 3 E.	Outside.
Site SS-11	NE¼ section 36, T. 41. S., R. 3 E.	Inside.
Site SS-12	SW¼ section 19, T. 41. S., R. 4 E.	Inside.
Site SS-13	NW¼ section 13, T. 42. S., R. 3 E.	Outside.
Site SS-14	SW¼ section 20, T. 42. S., R. 4 E.	Outside.
SEEP AND SPRINGS SITES:		
Site S-1	NW¼ section 20, T. 41. S., R. 4 E.	Inside.
Site S-2	NW¼ section 20, T. 41. S., R. 4 E.	Inside.
Site S-3	NE¼ section 14, T. 41. S., R. 3 E.	Inside.
Site S-4	NE¼ section 18, T. 41. S., R. 4 E.	Inside.
Site S-5	SE¼ section 14, T. 41. S., R. 3 E.	Inside.
Site S-6	NE¼ section 2, T. 41. S., R. 3 E.	Inside.
Site S-7	SW¼ section 1, T. 41. S., R. 3 E.	Inside.
Site S-8	NE¼ section 5, T. 41. S., R. 4 E.	Inside.
Brett Spring	SW¼ section 32, T. 41. S., R. 3 E.	Outside.
Clints Spring	SW¼ section 20, T. 41. S., R. 3 E.	Outside.
Drip Tank Spring	NE¼ section 24, T. 40. S., R. 3 E.	Outside.
John Henry Spring	NW¼ section 20, T. 41. S., R. 3 E.	Outside.
Needle Eye Water Spring	SW¼ section 4, T. 41. S., R. 4 E.	Outside.
Upper Wesses Seep	SE¼ section 5, T. 41. S., R. 3 E.	Inside.
Tibbet Canyon Sandstone Seep	NW¼ section 1, T. 42. S., R. 3 E.	Outside.
Tibbet Spring	NW¼ section 32, T. 41. S., R. 3 E.	Outside.
Wesses Spring	NW¼ section 9, T. 41. S., R. 3 E.	Inside.

coal would be removed from the Red seam during the first 5 to 10 years of mine development activities. Andalex would primarily use longwall methods to remove the coal, but room-and-pillar mining would also take place. (A complete discussion of room-and-pillar and longwall mining methods is included in Appendix C.) Room-and-pillar mining is generally defined as "a system of mining in which part of the coal is left in place as pillars for support." Longwall mining is defined as "a system of mining whereby most of the coal is mined and the roof over the worked out area is allowed to cave" (Stout 1980). Longwall methods would be used where possible within the mine. Room-and-pillar methods would be limited to the development of the portals, main entries, and longwall panels, and possibly for the economical recovery of those irregularly shaped areas too small for longwall mining. (See Figure A-4 for a map of longwall/room-and-pillar areas within the mine.) Construction of the surface facilities for the mine would take 1 to 2 years to complete. During this time, coal production would be limited to portal face-up work or minor production from the test mine for marketing and/or testing purposes. Up to 12,141 acres of the life-of-mine area above the proposed underground mining activities could experience some surface subsidence. This includes the area of actual coal removal and that area of potential subsidence due to the 30-degree angle of draw predicted for this mine.

Coal removal operations at the Smoky Hollow mine would be designed to produce and market a mine-run product (ROM coal). The coal contained within the seams identified for mining is of suitable quality to allow production of the mine-run product. However, coal around the outer edges of these seams becomes to thin (low coal height) to operate mining equipment and becomes diluted by increasing amounts of rock, both of which render this part of the seam economically unminable from a ROM coal quality aspect. Where the vertical separation between coal deposits is less than 100 feet, the deposit which has the greatest potential for safe development and maximum economic recovery is identified for mining. Underground access corridors (main entries within seams and rock slopes between seams) would be left intact to provide future access to thinner, lower quality coal deposits located beyond the longwall panels and other coal reserves that may be located beyond the limits of the primary coal deposit.

A.2.1.4.1 Coal Operations During Limited Production

Mine development during the first several years would involve the use of continuous miners to drive the main entries northward from the surface facilities complex, so that longwall panels could be developed in the reserves on the east side of Smoky Hollow. Seven main entries would provide the primary access into the minable coal reserves from portals located in the northeastern part of the mine yard (Figure A-2). Three of these entries would provide travelways for workers, materials, and ventilation (fresh air) intake. Another three entries would be used only for ventilation return. An isolated belt entry, located between the intakes and returns, would be used for the mainline conveyor belt to transport mined coal to the ROM stockpile outside the main portal. Three additional entries would be driven outward from the primary mains to allow access to the material storage yard on the north end of the surface facilities complex and for ventilation.

The mine would be developed so that the first longwall panel would begin in the Red seam in the southeast corner of the mine workings (panel marked "R-1"; Figure A-4). Longwall mining equipment would be installed in this area after the continuous miners completed the panel entries, about 18 to 24 months after starting initial development work on the main entries.

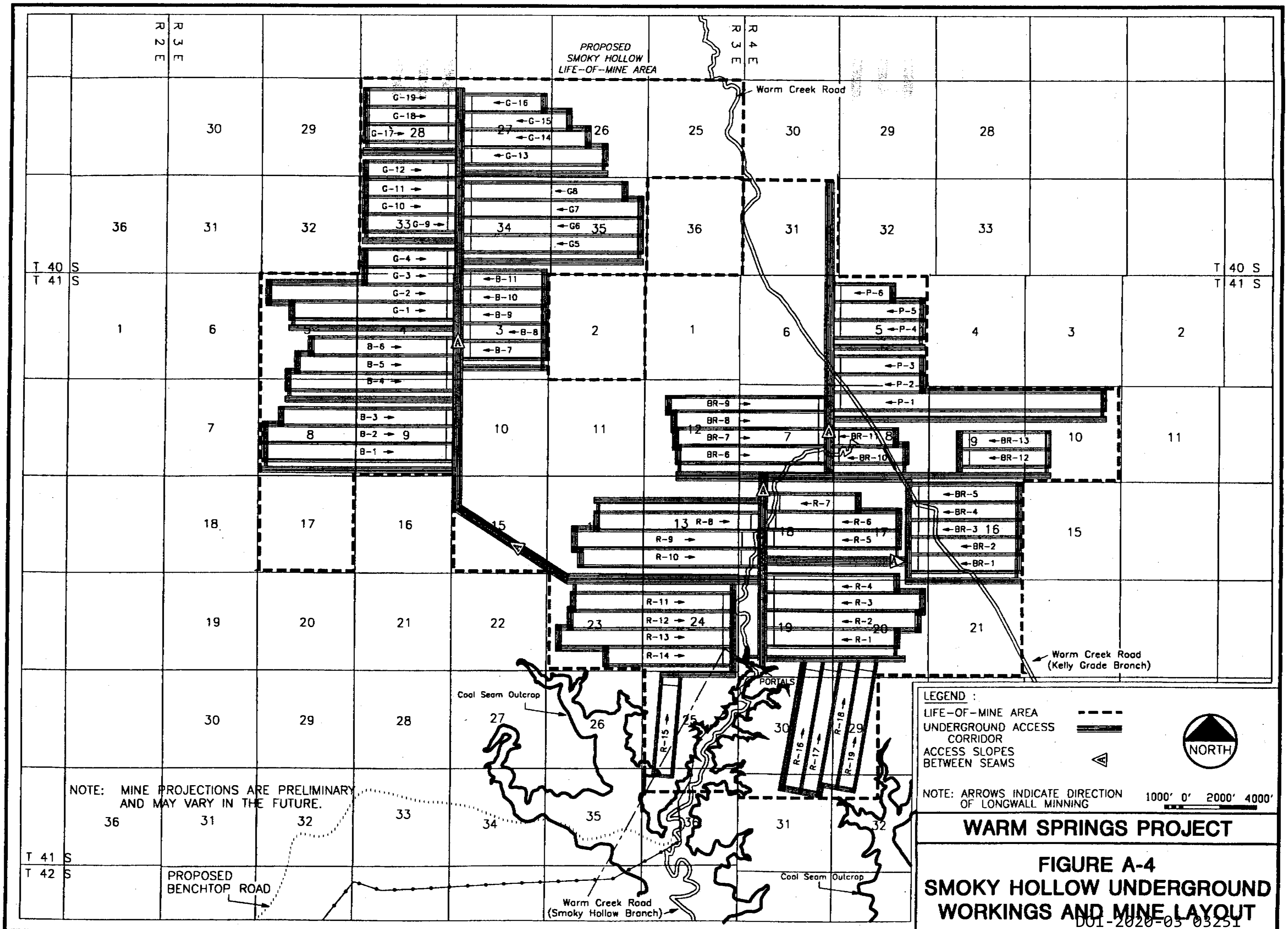


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FIGURE A-4
SMOKY HOLLOW UNDERGROUND WORKINGS AND MINE LAYOUT

DATE: MARCH 1995

During the first 1 to 2 years of limited production, coal removal would gradually increase to a projected rate of about 0.6 million tons per year. With a 24-hour workday and 240 production workdays per year, maximum production during this initial phase would require about 2,500 tons of ROM coal to be mined each day.

A.2.1.4.2 Coal Operations During Full Production

Full-scale coal production would begin after installation of the longwall mining equipment, about 18 to 24 months after initial development of the main entries. During the first several years of mining, longwall panels would be developed along the east side of the main entries. Mining activity, concentrating on the Red coal seam, would progress from one longwall panel to the next in a northward direction until reaching the edge of the Red seam (from the panel marked "R-1" through the panel marked "R-7"; Figure A-4). Coal reserves located in the Brown seam (about 25 feet below the Red seam) in the eastern part of the mine area would be developed during this same period (from the panel marked "BR-1" through the panel marked "BR-5"). This area would be accessed by a series of adjacent rock slopes driven from a main entry on the east edge of the Red seam reserves. Mining in the remainder of the Brown seam (those panels marked "BR-6" through "BR-13"), where coal is of lower quality, would be delayed until later in the life of the mining operations. These reserves would be accessed both from open mains in the original Brown seam workings and by a series of adjacent rock slopes driven from a main entry on the north edge of the Red seam reserves. Following the completion of coal extraction on the east side of the Red and Brown seam reserves, development and extraction would shift to the west side of the Red seam reserve. Beginning near the northern extent of the Red seam area, longwall panels would be developed along the west side of the original mains. Mining would again progress from one longwall panel to the next, but in a southward direction (from the panel marked "R-8" through the panel marked "R-14"; Figure A-4). Mining activity in the Red seam would wrap up with the development of longwall panels in the southwestern and southeastern parts of the life-of-mine area (those panels marked "R-15" and "R-16" through "R-19"; Figure A-4). Irregularly shaped areas on the extremities of the reserves that are not suited to longwall mining methods could be recovered by continuous miner equipment, using room-and-pillar methods, if mining and economic conditions allow. During recovery of the southwestern part of the life-of-mine reserves, the entries from the inactive Missing Canyon Coal Mine would be reactivated to provide additional ventilation and shorter access for workers and materials. Mined coal would continue to be removed by the main conveyor system along the centrally located main entries.

The proposed longwall panel design requires three entries on either side of the panel to allow for the intake of air and access, the conveyor belt (coal haulage), and the return air ventilation. Longwall panels would be 800 feet wide and up to 10,000 feet long. Two rows of 40-foot-wide by 80-foot-long chain pillars would be retained between the three entries, with 20-foot-wide crosscuts every 100 feet for access. Actual pillar dimensions could vary, based on experience, to ensure proper function and yielding. The chain pillars in the entries between the panels would be designed to yield, or crush out, as the adjacent panel is extracted. Longwall equipment would remove the full coal seam, from 7 feet thick up to 12 feet thick, where roof and floor conditions allow. Each panel would first be developed by the continuous miner equipment and then subsequently recovered by the longwall equipment. Upon completion of the panel, the longwall equipment would be moved to the next panel. During the first several years, each longwall panel would progress from east to west, from the eastern extremity of the reserve toward the main entries, located in the center of the reserve. After shifting to the west side of the reserve, each longwall panel would progress from west to east, from the western edge of the mining area toward the centrally located main entries.

Coal reserves in the Purple seam (about 50 feet above the Red seam) in the northeastern part of the mine area would be mined after reserves in the Red seam had been removed. These reserves would be accessed by a series of adjacent rock slopes driven from a main entry on the north edge of the Red seam reserves. Mining activity in the Purple seam would progress from one longwall panel to the next in a northward direction until reaching the edge of the Purple seam (from the panel marked "P-1" through the panel marked "P-6").

Coal reserves in the Blue seam (about 50 feet above the Red seam) in the northwestern part of the mine area would be removed in a similar manner after reserves in the Purple seam had been removed. After completion of a series of adjacent rock slopes driven from a main entry on the west edge of the Red seam reserves, mining would progress from south to north starting on the west side of the reserve (panel marked "B-1") and ending on the east side of the reserve (panel marked "B-11"). Mining activity in the northwestern part of the Smoky Hollow Mine would wrap up with the development of longwall panels in the coal reserves of the Green seam (about 80 feet below the Blue seam). These reserves would be accessed by a series of adjacent rock slopes driven from a main entry on the north edge of the Blue seam reserves. Mining would progress from south to north starting on the west side of the reserve (those panels marked "G-1" through "G-4"), shifting back and forth with the east side reserves (those panels marked "G-5" through "G-8," "G-9" through "G-12," and "G-13" through "G-16") until ending on the west side of the reserve (in those panels marked "G-17" through "G-19").

Barrier pillars would be left in place to protect main entries, outcrop exposures, and property boundaries. Additional barrier pillars would be left for support under the lower reaches of both Smoky Hollow Canyon and Wesses Canyon to protect main canyon drainage from subsidence. Subsidence activity would be monitored for surface expressions above mining activities (Section A.3.5.6.4, Subsidence). Warning signs would be posted and fences installed when necessary to protect the public if cracks or other hazards develop in or near either unmaintained or maintained roads, the abandoned Smoky Mountain landing strip, or other areas frequented by the general public. All surface expressions of subsidence would be regraded, scarified, and reseeded as soon as possible after subsidence activity ceases (Section A.3.4, Reclamation Activities).

Coal would be transferred from the mining sections (both room-and-pillar and longwall) to the ROM coal stockpile outside the main portal by using multiple conveyor belt installations that would form a network extending throughout the mine. The main conveyor leading to the surface facilities would operate at carrying capacities of about 2,500 tons of ROM coal per hour.

During the 40 years of full coal production, coal removal would increase from the initial rate of 0.6 million tons per year to an average rate of about 2.5 to 3.0 million tons per year. With a 24-hour workday and

240 production workdays per year, average production during full-scale operations would require about 10,500 to 12,500 tons of ROM coal to be mined each day.

A.2.2 138-kV POWER TRANSMISSION LINE

A.2.2.1 Introduction

Garkane Power Association, Inc. (Garkane), would provide electric power to the proposed mine through a new 21.7-mile, 138-kV power transmission line. (Specific details of the existing Garkane power system are included in Appendix B.) Proposed powerline activities would involve 242 acres of State and Federal lands, of which about 75 acres could be disturbed.

The first 6.5 miles of new powerline would parallel the existing Utah Power and Light Company (UP&L) 230-kV "Sigurd line" beginning at the tap point of the existing Garkane 138-kV line in Coconino County, Arizona, and extending to a point 0.25 mile southwest of Big Water (Chapter 1, Figure 1-2). (Specific details of the existing UP&L power system, including the Sigurd line, are included in Appendix B.) The 80-foot-wide right-of-way for this part of the line would involve 65 acres of State and Federal lands, of which about 18 acres could be disturbed by construction activities (Table A-2). The 80-foot-wide right-of-way for the remaining 15.2 miles of new powerline to the proposed mine and the associated temporary access road (construction) right-of-way would involve 177 acres of State and Federal land. Construction activities could disturb about 57 of these acres, 6 of which have already been disturbed by previous land use activities.

Garkane employees would operate and maintain the entire transmission line throughout the life of the proposed mine. However, about 16 workers would be employed to construct the facility over a 12-month period (Chapter 1, Table 1-3).

A.2.2.2 Power Transmission Facilities

The proposed powerline would tap into the existing Garkane 138-kV power transmission line just south of the Utah State line in the NW¼ of section 25 (T. 43 S., R. 2 E.). This tap point facility (switching station) would involve 2 acres of Federal land adjacent to the existing Garkane right-of-way. Manual disconnect switches and a 138-kV oil circuit breaker would provide isolation for the new service to the mine. The manual disconnects would be mounted on a 20-foot-tall, galvanized-steel frame with the oil circuit breaker resting on a concrete pad below. Metering/control equipment and storage batteries would be housed nearby in a steel building, about 12 feet wide, 20 feet long, and 10 feet high. The facility, about 200 feet wide and 250 feet long, would be enclosed within a locked, 8-foot-high chainlink fence to restrict unauthorized access. Construction activities would disturb less than 2 acres. The metering/control building would be painted to blend with the earthen colors of the shales, siltstones, and sandstones of the surrounding environment (e.g., neutral, gray or tan).

The first 6.5-mile segment of new powerline would parallel UP&L's 230-kV Sigurd line on the south side of U.S. Hwy. 89. The remaining 15.2-mile segment of the proposed powerline would leave the Sigurd line corridor and follow a north- and eastward alignment to the proposed mine, crossing U.S. Hwy. 89 about 0.6

mile west of Big Water in the W½ of section 10 (T. 43 S., R. 2 E.). After crossing U.S. Hwy. 89, the new powerline would continue over East Clark Bench west of Big Water, across Wahweap Creek northwest of the Utah Division of Wildlife Resources (DWR) Wahweap Warm Water Fish Culture Facility, and along the west flank of Haycock Point to the top of Nipple Bench. (Specific details of the Wahweap Warm Water Fish Culture Facility are included in Appendix B.) After crossing Nipple Bench, the line would cross Tibbet Canyon with a single 1,500-foot span, approximately 7,000 feet southeast of Tibbet Spring. After crossing Tibbet Bench, the line would drop into John Henry Canyon, span Warm Creek near its confluence with Smoky Hollow, and then follow Smoky Hollow to the proposed mine.

The proposed powerline would terminate in the central part of the surface facilities complex at an electrical substation that would step the original 138-kV voltage down to the 12.5-kV level required for mining operations (Section A.2.1.2.3, Ancillary Facilities).

The powerline would be constructed primarily with double-pole structures, using 60-foot wooden poles (western red cedar/Douglas fir) on 14-foot centers and underslung suspension bell insulators (Figure A-5). The span between pole structures would range from 400 to 700 feet, depending on the surface topography. Construction activities at each of the 142 structures would require a 30-foot-long by 100-foot-wide site. The line would utilize three 397-million circular mills, ACSR power conductors and two ⅜-inch steel shield wires. Three-pole angle and dead-end structures would be used where required for long-span applications, such as the Tibbet Canyon crossing and rimtop locations on Haycock Point (above Nipple Canyon) and Tibbet Bench (above John Henry Canyon). The standard aluminum-colored, ACSR power conductors are expected to become nonspecular, or nonreflective, from weathering within 6 months after installation. Insulators would be light gray in color to blend with the surrounding environment as much as possible. All structures would be raptor safe (Section A.3.5.3.4, Other Enhancements). Powerline markers, which are large, generally spherical, structures placed on the overhead static wire of a transmission line to improve visibility of the static wires and conductors, would be installed on all static wires over Tibbet Canyon.

A.2.2.3 Powerline Access

Primary access for construction purposes along the majority of the route would be provided by existing roads, particularly along the Sigurd line, in the East Clark Bench area west and south of Big Water, on top of Tibbet and Nipple Benches, and through Smoky Hollow. Where primary access presently exists, access to individual structure locations would be provided by a construction road along and within the 80-foot-wide right-of-way, or by branch access roads constructed from existing roadways.

Temporary access would be by overland travel where terrain permits. When necessary, temporary access roads would be constructed by backdragging with an end-loader or dozer or by grading with a road grader to the minimum extent required for use by four-wheel-drive construction equipment. Where rough terrain or the lack of other existing access occurs, formal access roads would be constructed. In many locations, separate branch roads involving sidehill excavations would be required to access individual structure sites. Newly constructed accessways outside the powerline right-of-way would be required along the intermediate benches north of Wahweap Creek to the base of Haycock Point, on Nipple and Tibbet Benches, and through Smoky Hollow. The temporary access road (construction) right-of-way would involve 29 acres, of which

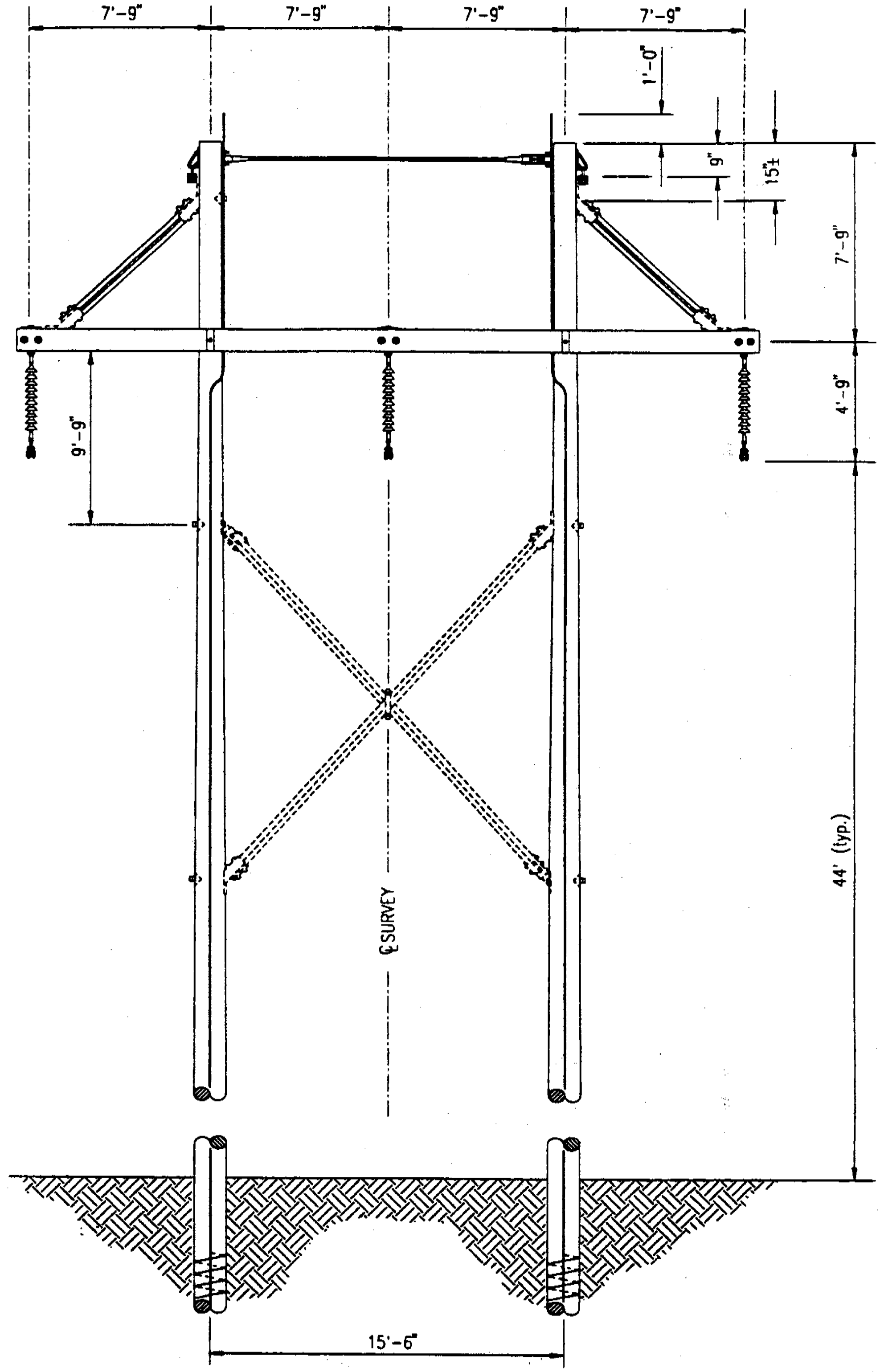

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FIGURE A-5
TYPICAL 138-KV
POWERPOLE STRUCTURE

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about 19 acres would be disturbed by construction activities. Access roads would seldom involve more than a 15-foot-wide disturbance.

Access would be retained along the powerline right-of-way for emergency purposes, but no permanent access roads would be maintained. Routine inspection and maintenance of the powerline would be performed by air (helicopter or airplane), by foot, or by all-terrain vehicles. Roads to sideslope locations would be water-barred. Berms would be constructed across the entrance to all access roads to discourage unauthorized vehicular access. Topsoil, when available, would be salvaged and respread around the pole structures and the access roads. Temporary straw bale or filter fabric dikes would be used for sediment control during construction. The entire disturbed area, including the access roads, would be scarified and reseeded (Section A.3.4, Reclamation Activities).

A.2.3 Microwave Communication System

A.2.3.1 Introduction

Andalex and/or U.S. West would install a microwave communication system to link the telephone service at the proposed mine to the existing U.S. West network in Big Water, Utah. (Specific details of the existing U.S. West Communications system are included in Appendix B.) The communication system would consist of a transceiver facility and reflector station at the proposed mine, a repeater station on Mustard Point, and a terminal linkage facility near Big Water (Chapter 1, Figure 1-2). Garkane would provide electric power to the proposed facility through the construction of about 250 feet of new 12.5-kV powerline. U.S. West would provide telephone service through the construction of about 300 feet of new buried cable. (Specific details of the existing Garkane power system and the existing U.S. West telephone system are included in Appendix B.)

Installation of the microwave communication system would involve 5 acres of private/county and Federal lands, of which about 2 acres would be disturbed by construction activities (Table A-2). The proposed transceiver facility would be located within the surface facilities complex at the proposed mine, and the reflector station would be located nearby, on the rim of Spring Point. Together, the transceiver facility and the reflector station would involve less than 2 acres of Federal land. Less than 1 acre would be disturbed at each location. The repeater station and an access road (about 2,500 feet long) located on Mustard Point, west of the proposed life-of-mine area, would involve 3 acres of Federal land, of which less than 2 acres would be disturbed (Chapter 1, Table 1-1). The terminal linkage facility, powerline, telephone line, and an access road (about 100 feet long), located adjacent to the Big Water city limits, would involve 2 acres of private and Federal land, of which less than 1 acre would be disturbed.

U.S. West or Andalex employees would operate and maintain the communication system throughout the life of the proposed mine. However, about two workers would be employed to construct the various facilities over a 12-month period (Chapter 1, Table 1-3).

A.2.3.2 Microwave Facilities

The Smoky Hollow transceiver facility would allow outside communication by providing the conversion between the telephone service available at the mine and the microwave system, sending and receiving microwave signals through the Spring Point reflector station. The transmission structure would be located on top of the shop/warehouse building located within the surface facilities complex (Section A.2.1.2.3, Ancillary Facilities).

The Spring Point microwave reflector station would direct microwave signals between the transceiver facility at the mine and the Mustard Point repeater station. It would be located within the life-of-mine area, in the SE¼ of section 24 (T. 41 S., R. 3 E.) (Section A.2.1.3.1, Spring Point Microwave Reflector Station).

The Mustard Point microwave repeater station would relay and amplify microwave signals between the Spring Point reflector and the Big Water terminal facility. This station would require a site about 100 feet wide and 100 feet long in the SW¼ of section 29 (T. 42 S., R. 3 E.) to contain a 30-foot galvanized-steel truss tower and an electrical/storage building within a secured chainlink fence (Figure A-6). The tower would support a 6-foot-diameter antenna facing the Spring Point reflector station and a 4-foot-diameter antenna facing the Big Water terminal linkage facility. The building, about 8 feet wide, 8 feet long, and 8 feet high, would be constructed out of concrete blocks and painted a neutral, gray or tan color to blend with the surrounding environment. The station would be solar-powered, using a bank of solar cells for power generation and suitably sized DC batteries for storage.

The Big Water terminal linkage facility would provide the conversion between the U.S. West telephone service available in Big Water and the microwave system, similar to that at the Smoky Hollow transceiver facility, sending and receiving microwave signals through the Mustard Point repeater station. This facility would require a site about 100 feet wide and 100 feet long in the SE¼ of section 11 (T. 43 S., R. 2 E.) to contain an equipment/control building with a 12-foot self-supporting, roof-mounted, galvanized-steel truss tower within a secured chainlink fence (Figure A-6). The tower would support a 6-foot-diameter antenna directed toward the Mustard Point repeater station (Figure A-7). The building, about 12 feet wide, 12 feet long, and 8 feet high, would house the plug connections between the microwave system and the U.S. West telephone circuits. It would be constructed with concrete blocks. The buried line for telephone service and the overhead line for electric service would both follow the existing utility corridor along the Warm Creek Road to the facility. The telephone line would extend from the existing U.S. West service, and the powerline would extend from the existing Garkane service, both of which are located at Ethan Allen Avenue in Big Water. A pole-mounted transformer outside the equipment building would provide usable 220 voltage for use at the facility. All power structures would be raptor-safe (Section A.3.5.3.4, Other Enhancements). All equipment at the facility, including the equipment building, would be painted a neutral, gray or tan color to blend with the surrounding environment.

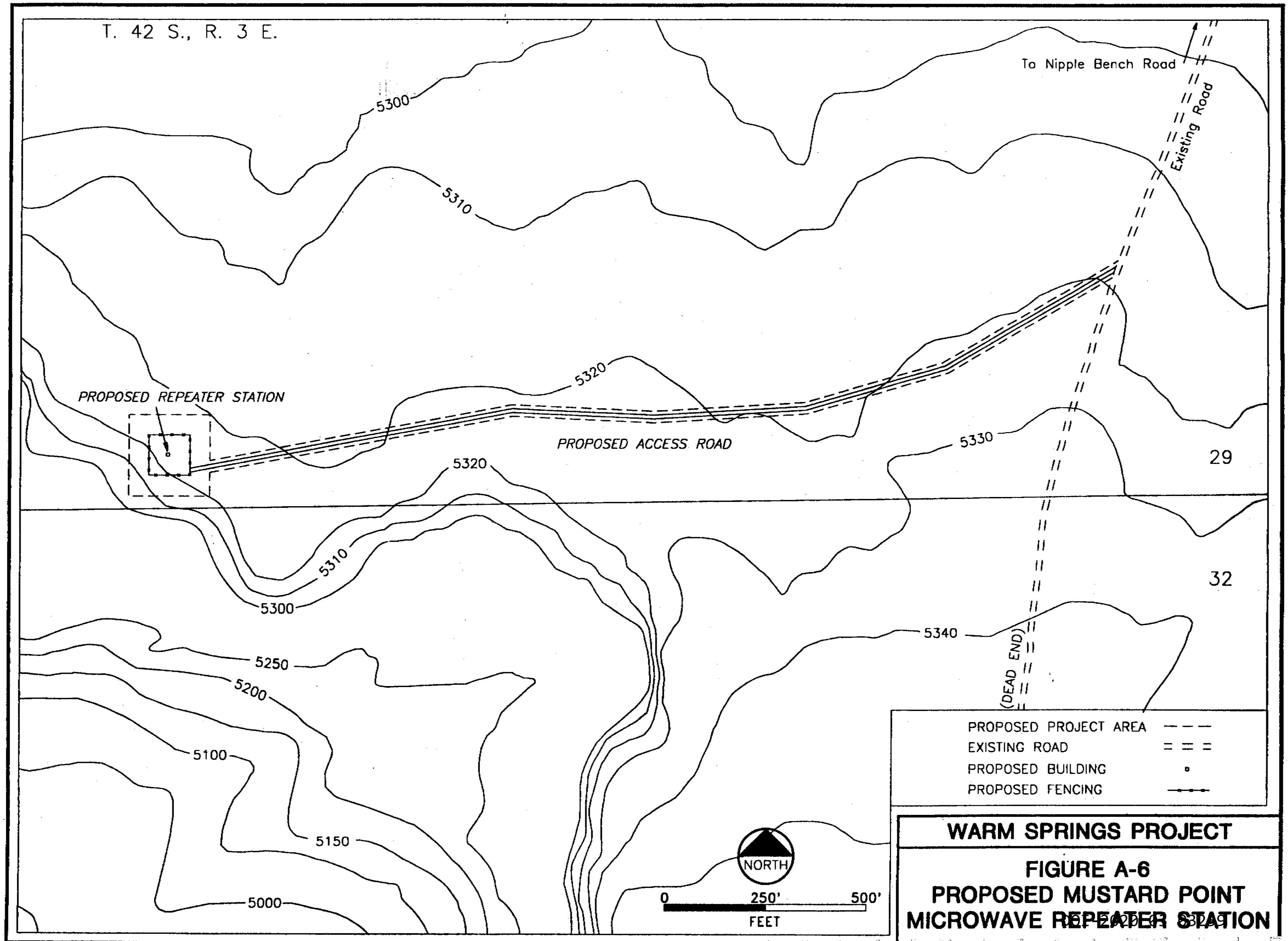

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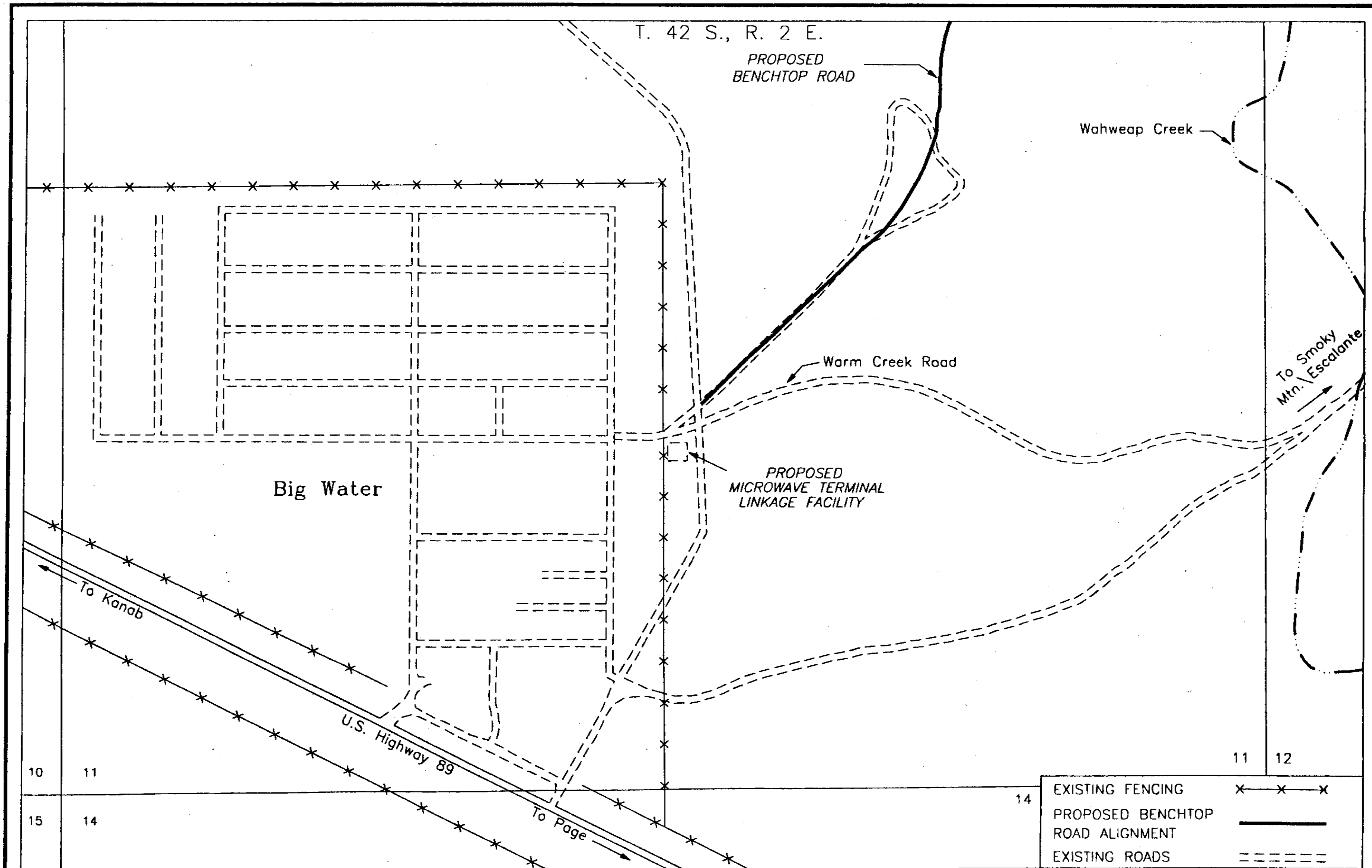
FIGURE A-6
PROPOSED MUSTARD POINT
MICROWAVE REPEATER STATION



WARM SPRINGS PROJECT

FIGURE A-7
PROPOSED BIG WATER TERMINAL LINKAGE FACILITY

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A.2.3.3 Access to Microwave Facilities

Temporary access during construction of the communication facilities would utilize existing ancillary roads as much as possible. An access road, about 2,500 feet long, would be constructed to the Mustard Point repeater site from existing roads in the area. An access road, about 100 feet long, would be constructed to the Big Water terminal facility from the county's existing Warm Creek Road adjacent to the site. Both roads would disturb an area about 15 feet wide, including borrow ditches, to allow for permanent, but limited, use. No gravel or other surface material would be applied. Topsoil, when available, would be salvaged and respread around the completed facility and along the access road. Temporary straw bale or filter fabric dikes would be used for sediment control during construction. The entire disturbed area, including the access road, would be scarified and reseeded (Section A.3.4, Reclamation Activities).

A.2.4 Smoky Mountain Road System

A.2.4.1 Introduction

The Kane County Board of Commissioners (Kane County) would "provide and maintain public road access into the Smoky Mountain area in fulfillment of its responsibilities to provide safe and convenient accommodation of traffic associated with the management and responsible utilization of public land resources within the County to benefit the interests of Kane County * * *. [They intend to provide this access] by constructing a new road segment (hereinafter referred to as the Benchtop Road) with the public road system or by reconstructing the existing Warm Creek County Road * * *. The existing Warm Creek Road originates in Big Water, traverses the Glen Canyon National Recreation Area, follows the canyons of Warm Creek and Smoky Hollow to the top of Smoky Mountain, then continues on as a through-road to Garfield County and Escalante [Figure 1-2]. The Benchtop Road would originate in Big Water, traverse the benches north of the National Recreation Area (thereby avoiding all lands administered by the National Park Service), and rejoin the existing County road system in Smoky Hollow. * * * Construction/reconstruction of the Smoky Mountain Road System (Benchtop/Warm Creek Roads) would constitute a vital link in the long-range plan for providing improved public transportation to eastern Garfield count (i.e., Escalante for the benefit of all residents of southern Utah. The Smoky Mountain Road System (Benchtop/Warm Creek Roads) would provide permanent and unrestricted access to State school trust lands and Federal public lands for multiple-use activities, such as recreation, hunting, rangeland and wildlife management, development of grazing, mineral, timber and water resources, tourism, scientific studies, and all other such public uses enjoyed under the rights of the public land laws of the United States, the State of Utah, and Kane County" (excerpts from the Resolution of the County Commission of Kane County, Utah; July 31, 1995). (Specific details of the Glen Canyon National Recreation Area (NRA) are included in Appendix E.) The Smoky Mountain Road system (Warm Creek and/or Benchtop Road) would be available to Andalex, or any other entity, for public access to the Smoky Mountain area and points beyond.

Reconstruction and realignment of about 24.7 miles of the Warm Creek Road would involve 808 acres of private, county, State, and Federal lands, all of which could be disturbed. This constitutes 744 acres beyond the 64 acres disturbed by previous construction and maintenance activities (Table A-2). About 6 acres of existing roadway in Warm Creek and Smoky Hollow Canyons would be abandoned. Rights-of-way for the

Benchtop Road, about 21.3 miles long, would involve 765 acres of private, county, State, and Federal lands. As with the Warm Creek Road, the entire 765 acres associated with the Benchtop Road could be disturbed by construction activities. This would involve 742 acres beyond the 23 acres already disturbed by previous construction and maintenance activities. About 2 acres of existing roadway in Smoky Hollow Canyon would be abandoned during construction of the Benchtop Road.

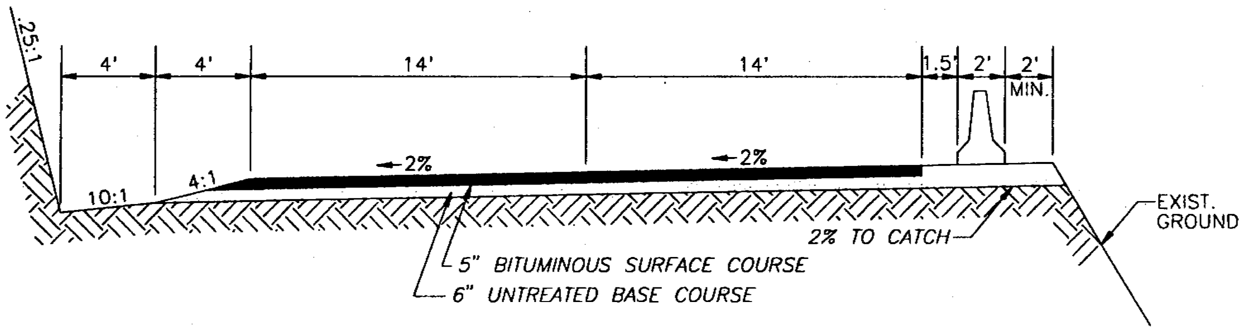
Kane County would maintain and improve the Warm Creek Road, and the Benchtop Road if it were constructed, as part of its regular road maintenance program, both during and after construction of Project-related facilities. However, about 40 workers would be employed for construction-related activities over a 24-month period (Chapter 1, Table 1-3).

A.2.4.2 Warm Creek Road

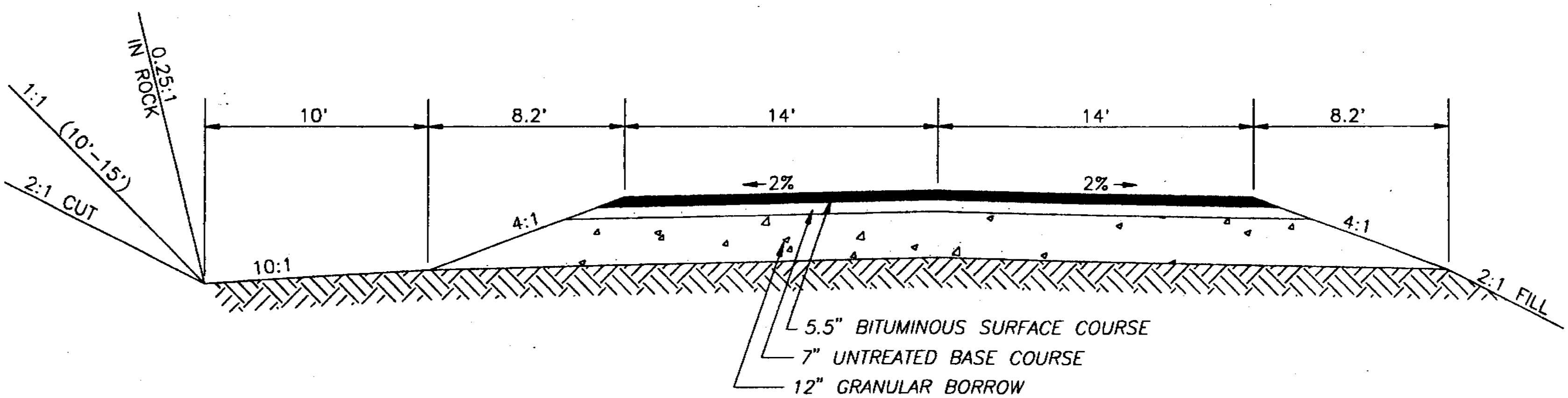
The existing Warm Creek Road would receive substantial reconstruction and realignment. The road originates at U.S. Hwy. 89 in Big Water and runs eastward along the base of Nipple Bench through 11.7 miles of the NRA. The road forks and leaves the NRA near Warm Creek. One branch continues eastward across Warm Creek and climbs to the top of Smoky Mountain along the "Kelly Grade." The other branch trends northward through the canyons of Warm Creek and Smoky Hollow, continuing through the proposed life-of-mine area to the top of Smoky Mountain. The roads join again on Smoky Mountain and continue 46 miles northward to Utah Route 12 in the town of Escalante in Garfield County.

Reconstruction activities would upgrade the existing roadway from Big Water through the proposed Smoky Hollow Mine site to the top of Smoky Mountain in order to meet Utah Department of Transportation (Utah DOT) and American Association of State Highway Transportation Officials (AASHTO) design standards. Reconstruction activities within the Glen Canyon NRA would also incorporate National Park Service (NPS) design standards. The road would have a 28-foot-wide, paved, all-weather surface (including two 12-foot-wide running lanes and two 2-foot-wide shoulders) and center/shoulder striping for traffic control and safety. Figure A-8 shows a typical cross-section of the road.

The reconstructed road would retain the existing entrance to U.S. Hwy. 89 and generally follow the existing alignment along Ethan Allen Avenue in Big Water, across Wahweap Creek outside Big Water, and along the Tropic Shale benches to Warm Creek. A two-lane, 200-foot-long bridge would be constructed across Wahweap Creek about 1.5 miles downstream from the Utah DWR Wahweap Warm Water Fish Culture Facility, utilizing prestressed concrete beams. (Specific details of the Wahweap Warm Water Fish Culture Facility are included in Appendix B.) Horizontal and vertical realignment of the existing road would be engineered to conform with AASHTO safety standards and provide adequate line-of-sight visibility. Reconstruction along the narrow corridor through the NRA would be superimposed over the existing road disturbance. No islands would be left between the existing and reconstructed road disturbances. Steep dips and rolls would be removed and tight horizontal curves would be widened and realigned. Reconstruction of the road beyond the NRA, through Warm Creek and Smoky Hollow Canyons, would involve more extensive realignment. About 2,300 feet of the Warm Creek drainage, involving three segments, would be realigned and riprapped to protect the new road from erosion during major flood events, where needed. Five bridges would be constructed in order to relocate the existing road up and out of the bottom



AREAS OF
ROCK SUBGRADE



AREAS OF
SUITABLE SUBGRADE

WARM SPRINGS PROJECT

FIGURE A-8
TYPICAL CONSTRUCION OF THE
PROPOSED SMOKY MOUNTAIN ROAD SYSTEM

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of the canyon drainages. These bridges would vary in length, from 100 to 300 feet, depending on the actual location. Each bridge would be constructed with prestressed concrete beams. About 2,200 feet of the Smoky Hollow drainage, involving three segments, would be realigned and riprapped, where necessary, to protect this segment of the new road from erosion during major flood events. Seven pipe culverts, ranging from 10 to 12 feet wide, would be installed in order to elevate this part of the road out of the drainage.

The reconstructed road would be engineered to balance cut-and-fill material as much as possible so that road base material would be available from within the construction right-of-way. In those areas where steep canyon topography prevents a balanced cut and fill, excess materials (including construction talus) would be placed in designated fill areas adjacent to the road. Granular borrow and untreated base course material would come from suitable sources in the disturbance area associated with road construction or from existing gravel sources in the Big Water area. The running surface of the road would be chip-and-sealed, resulting in a gray-colored surface that should blend with the surrounding environment. Corrugated metal pipe or concrete box culverts (about 120 total) would be installed in those drainage crossings not requiring a bridge. Culverts would be sized to carry routine runoff and safely handle runoff from either a 50-year, 6-hour precipitation event or a 25-year, 6-hour precipitation event, depending on the size of the drainage. Access points to other existing public roads, such as Crosby Canyon, Kelly Grade, and Tibbet Canyon, would remain open. Through traffic to Garfield County and the town of Escalante would be preserved.

The vertical and horizontal road alignment would be designed for low-speed travel. A 35-mile-per-hour (mph) speed limit would be posted throughout the route, with lower speed limits posted at any locations that have safety or resource management concerns. Guard rails or concrete barriers would be located where they are required along the route to meet AASHTO or Utah DOT safety standards. Road grades normally would not exceed 9 percent. The road would be designed to ensure that cut slopes were no greater than 2 horizontal feet to each 1 vertical foot (2:1) in areas of loose, unconsolidated material less than 10 feet high. Cut slopes in areas of loose, unconsolidated material between 10 and 15 feet high would be no greater than 1:1. Cuts in solid rock would be no greater than 0.25:1. Fill slopes would generally be designed to ensure that they were no greater than 2:1. Due to the nature of the surface material, those fill slopes within the Glen Canyon NRA would be no greater than 2.5:1. Dynamite and/or ammonium nitrate fuel oil (ANFO) and blasting caps would be used to remove solid rock where needed along the route. Fencing and cattle guards would be replaced in those locations along the road determined to be necessary for grazing management needs.

Temporary construction areas (staging areas) would be developed adjacent to the permanent road alignment as needed. The main staging area for the road reconstruction project (about 11 acres) would be located within the temporary construction right-of-way, immediately east of Big Water before the Warm Creek Road crosses Wahweap Creek. Some degree of excavation would be required in those staging areas used for material/supply laydown, water impoundments, gravel stockpiling, pioneer roads, and setup areas for crushing, screening, and hot-mix plants. Staging areas used for parking for construction personnel and equipment, equipment run-around lanes, culvert storage, water pipeline routes, field offices, and other light-construction uses would not require excavation. Water to meet construction needs would be obtained from a temporary sump placed in the subsurface gravels of Wahweap Creek. A submersible pump and perforated collection pipe would be located within the disturbance area associated with road construction activities. Up to 180 acre-feet of water could be needed each year during the 1- to 2-year construction/development period. Pumping patterns (times and durations) would be structured to ensure that adequate riparian and wildlife water is maintained downstream.

Topsoil, when available, would be salvaged and respread around the completed road and excavated staging areas in those areas not containing rock outcrops, rubble/talus, or boulders. Temporary straw bale or filter fabric dikes would be used for sediment control during construction. Areas that required excavation for staging purposes would be regraded to the approximate original contour. The disturbed area outside the actual maintained segment of the road, including temporary access roads and staging areas, would be scarified and reseeded. Areas of rock outcrop, rubble/talus, or boulders would not be reseeded. Staging areas that were not excavated would be backdragged, as needed, and then scarified and reseeded (Section A.3.4., Reclamation Activities).

A.2.4.3 Benchtop Road

The proposed Benchtop Road would branch off of the existing Warm Creek Road outside Big Water and trend north along the east side of Nipple Creek Canyon, continue over Nipple and Tibbet Benches, and descend into John Henry Canyon to Smoky Hollow. At Smoky Hollow, the road would rejoin the existing Smoky Hollow branch of the Warm Creek Road and continue through the proposed life-of-mine area to the top of Smoky Mountain.

This alignment would retain the existing road entrance to U.S. Hwy. 89 and generally follow the existing Warm Creek Road alignment through Big Water. After leaving Big Water, the new construction would trend north and span Wahweap Creek about 1 mile downstream from the Utah DWR Wahweap Warm Water Fish Culture Facility, on a two-lane, 200-foot-long, prestressed concrete beam bridge (Section A.2.4.2, Warm Creek Road). The road would then climb the intermediate benches between Wahweap Creek and the base of Haycock Point. From there it would continue north along a terrace on the east side of Nipple Creek Canyon, climbing to the top of Nipple Bench 1 mile southeast of Nipple Butte. The road would then run northeastward across Nipple Bench, crossing Tibbet Canyon about 2,300 feet southeast of Tibbet Spring.

After crossing Tibbet Canyon, the road would trend eastward across Tibbet Bench until reaching the rim of John Henry Canyon. At this point the road would descend along the southwestern flank of John Henry Canyon to the canyon bottom near the confluence of Warm Creek and Smoky Hollow. A two-lane, 200-foot-long, prestressed concrete beam bridge would be constructed across Warm Creek. The final 5.8-mile segment of the road through Smoky Hollow Canyon to the top of Smoky Mountain would involve the same extensive realignment, construction of drainage crossings, and channel realignment that would be required for the Warm Creek Road proposal in order to relocate the existing road out of the canyon drainage (Section A.2.4.2, Warm Creek Road). Access points to other existing public roads, such as Warm Creek and Tibbet Canyon, would remain open.

The Benchtop Road would be constructed according to the same Utah DOT and AASHTO design standards proposed for use with the Warm Creek Road reconstruction and realignment (Section A.2.4.2, Warm Creek Road). As with the Warm Creek Road proposal, horizontal and vertical alignment would be designed to conform with AASHTO safety standards and provide adequate line-of-site visibility, and the vertical and horizontal road alignment would provide for low-speed (35 mph or less) travel. The road would be engineered to balance cut-and-fill material as much as possible, except in those areas of steep canyon topography; topsoil, where available, would be salvaged; and granular borrow and untreated base course material would come from suitable sources in the disturbance area associated with road construction or from existing gravel sources in the Big Water area. The 28-foot-wide running surface of the road would be a paved, all-weather surface. Properly sized, corrugated-metal pipe or concrete box culverts would be installed in drainage crossings. The disturbed areas outside the maintained segment of the road would be stabilized and reseeded, except in those areas of rock outcrops, rubble/talus, or boulders. A main staging area for the road construction project (about 11 acres) would be located within the temporary construction right-of-way, immediately east of Big Water before the road crosses Wahweap Creek, and a temporary sump installation adjacent to Wahweap Creek would be used to meet construction water needs. Figure A-8 shows a typical cross-section of the road.

A.2.4.4 Public Use of the Road

The Smoky Mountain road system, including the Warm Creek and/or Benchtop Road, would be an integral part of the Kane County public road network, regardless of which route is used. Distinct and uninterrupted public access would be maintained on all Kane County roads, including that segment through the Smoky Hollow Mine site and beyond, throughout the life of the proposed mine. Kane County would continue to retain full jurisdiction over the road(s) in perpetuity, including the segment crossing the proposed Smoky Hollow life-of-mine area. The public road would be separated from the operational areas of the surface facilities complex by embankments, fences, gates, barricades, or other effective means. Mine or other commercial operations would not hinder public use of the road. Maintenance of the entire Smoky Mountain road system, including the Warm Creek Road, and the Benchtop Road if it were constructed, would be the responsibility of Kane County. Private ancillary roads within the surface facilities complex would be constructed and maintained by Andalex to provide access to the office, bathhouse, and shop/warehouse facilities (Section A.2.1.2.1, Main Facilities Buildings). Any damage to the Smoky Mountain road system from mining-related activities (including mining-related subsidence), identified through routine monitoring activities (Section A.3.5.6.4, Subsidence), would be immediately repaired by Andalex, in cooperation with Kane County.

A.2.5 Iron Springs (Cedar City) Unit-Train Loadout

A.2.5.1 Introduction

To deliver coal produced at the proposed mine, Andalex would construct a unit-train loadout adjacent to the Cedar City branch of the Union Pacific Railroad (Union Pacific) main line in the Iron Springs industrial iron mining district, about 10.7 miles west of Cedar City, Utah (Chapter 1, Figure 1-3). UP&L would provide electric power to the proposed loadout through a 1,700-foot extension of their existing 34.5-kV distribution line to the facility and a 1,300-foot realignment of their existing 12.5-kV distribution line that currently crosses the site. U.S. West would provide telephone service to the proposed loadout through a 3,000-foot underground service line extension. Union Pacific would provide rail access to the proposed loadout through the reconstruction and extension of an existing 600-foot siding adjacent to the facility. (Specific details on the existing UP&L power system, the existing U.S. West telephone system, and the existing Union Pacific rail system are included in Appendix B.)

The proposed Iron Springs unit-train loadout and its associated powerline and rail siding activities would involve 124 acres of private and Federal lands (Table A-2). Construction activities would disturb about 85 of these acres, 5 acres of which have been previously disturbed. About 100,000 tons of crushed coal could be stored in the primary stockpile at the loadout at any one time, but additional emergency storage could also be accommodated. About 2.5 to 3.0 million tons of coal would be transferred through this facility each year throughout the life of the proposed mine. Coal would be hauled by truck about 191 miles over county, State, and Federal roadways from the proposed mine to this loadout (Section A.2.7.6, Truck Haul).

Loadout activities could eventually employ 20 full-time workers throughout the life of the proposed mine, including equipment operators, mechanics, electricians, and supervisory personnel (Chapter 1, Table 1-3). Throughout the life of the proposed loadout, the operation and maintenance of the power distribution line and the rail siding would be the responsibility of UP&L and Union Pacific, respectively. In addition, about 57 workers would be employed to complete construction activities over an 18-month period.

A.2.5.2 Loadout Facilities

The Iron Springs unit-train loadout facility would include material handling and transloading facilities for crushed coal produced at the proposed mine (Figure A-9). Coal would be brought in by trucks, stockpiled in an orderly manner, and then reclaimed for loading into unit trains. No coal processing activities are proposed. The material handling facility would consist of conveyors, bins, coal stockpiles, stackers, and other related structures (Section A.2.5.3, Coal Handling Facilities and Operations). All buildings, storage tanks, and coal handling structures would be painted a neutral, gray or tan color to blend with the surrounding environment. All facility lighting would be shielded and directed downward to minimize the potential for night glow. The primary loadout right-of-way, including the main facility area, would involve 120 acres of Federal land, of which about 78 acres would be disturbed by construction activities. About 2 of these acres have been previously disturbed by iron-ore prospect pits and vehicle trails.

An office building and a shop building would be constructed in the southern part of the loadout site to support loadout activities. The office building, about 40 feet wide, 40 feet long, and 12 feet high, would accommodate the administrative functions of the operation. It would also include adequate showering facilities for the employees and a complete ASTM coal-testing lab equipped to determine Btu/lb, ash, moisture, and other parameters required for quality control. The shop building, about 100 feet wide, 60 feet long, and 30 feet high, would include several repair bays equipped with overhead cranes, sized to allow maintenance and overhaul of the mobile equipment used at the loadout, such as push dozers and front-end loaders. It would also include a warehouse to maintain an inventory of mechanical parts and consumable items used at the facility. Both buildings would be constructed of prefabricated metal with steel siding and concrete flooring.

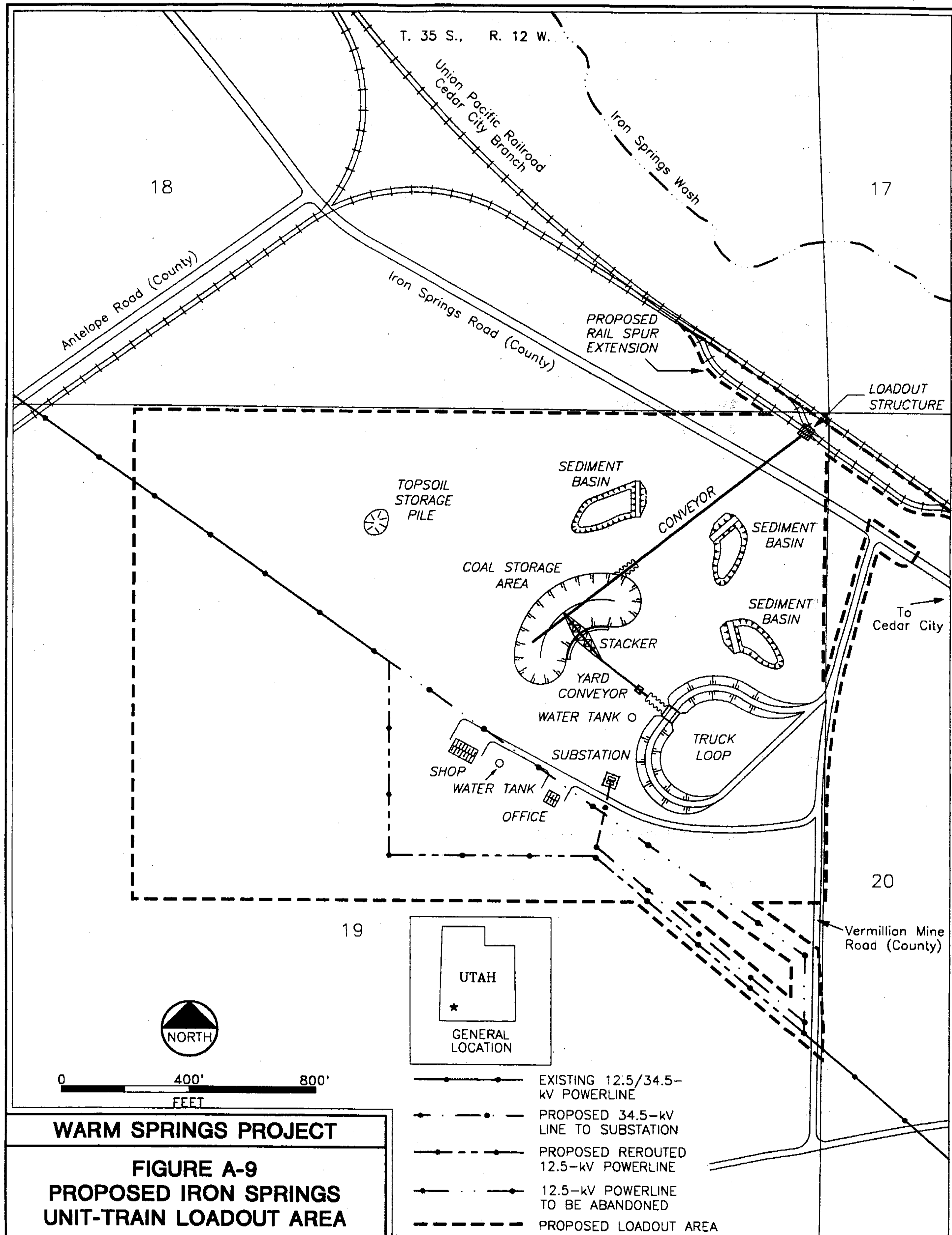

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FIGURE A-9
PROPOSED IRON SPRINGS UNIT-TRAIN LOADOUT AREA

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The fuel and lube oil storage system would be located in an unfenced area near the shop building, convenient to the loadout operations. Grease and oil would be stored in sealed containers on an impervious surface about 20 feet wide and 20 feet long, covered by a 10-foot high, fire-resistant steel covering. Diesel fuel and unleaded gasoline would be stored separately in two, aboveground, locked, 2,000-gallon steel tanks. Each fuel or lube oil storage facility would be installed within bermed containment structures capable of adequately holding the entire volume of the largest tank.

Power would be provided from the existing UP&L 34.5-kV power distribution line in the SE¼NE¼ of section 19 (T.35 S., R.12 W.). The existing 12.5-kV power distribution line that currently runs through the site would be realigned around the proposed coal handling facility. The majority of the new 1,700-foot, 34.5-kV line would be installed within the new 12.5-kV right-of-way for power delivery to the loadout. In this area, the 12.5-kV line would be relocated onto the new 34.5-kV poles. A set of high-voltage disconnects would tap the existing 34.5-kV line to provide power to an electrical substation that would be constructed in the southern part of the loadout site. The substation would provide both 4,160-volt and 480-volt power for use throughout the facility. It would consist of pad-mounted transformers, power factor capacitors, metering equipment, and isolation switch gear, secured within a 60-foot by 100-foot chainlink fenced enclosure to restrict unauthorized access. Single 40-foot wooden poles with ACSR conductors would be used for both the powerline to the loadout and the overhead distribution system within the loadout. All structures would be built according to an approved raptor-safe design (Section A.3.5.3.4, Other Enhancements). Temporary roads along the powerline rights-of-way would be scarified and reseeded after construction activities were completed (Section A.3.4, Reclamation Activities). Powerline activities would involve 4 acres of private and Federal lands. Construction of the new 34.5-kV power distribution line and the realigned segment of the existing power distribution line would disturb about 2 acres. In addition, less than 1 acre of existing right-of-way would be abandoned.

Telephone communication would be provided from the existing U.S. West communication line running through the loadout site adjacent to the Iron Springs Road. Buried telephone cable would originate at a telephone switching pedestal in the NE¼NE¼ of section 19 (T. 35 S., R. 12 W.). It would run south to the loadout office and north to the train loadout structure. A private loadout communications network would be installed throughout the operations area, including all working sections of the coal handling facility and all major mechanical facilities. Telephone service would be available at the office and shop buildings and at the train loadout facility. The line would involve 2 acres of Federal land within the loadout site; less than 1 acre would be disturbed by construction activities.

Water would be hauled from an approved potable water source and stored onsite in two 12,000-gallon steel tanks to meet the water requirements for the facility (about 3,000 gallons per day). One tank, located near the office building, would provide showering and domestic (potable) water for employees. The other tank, located near the stacker facility, would provide washdown water for cleaning the reclaim tunnels and water for dust control. Pressurized water would be available at various locations throughout the facility for fire prevention. Wastewater from showers and toilets would be treated and disposed of onsite in a septic tank/drain-field system adjacent to the office building. Excess sewage solids would be periodically removed to an approved offsite disposal facility.

Topsoil, when available, would be removed from all areas being disturbed by construction activities and stockpiled in the western part of the loadout right-of-way. The pile(s) would be located away from the operations area and revegetated to prevent loss from wind and water erosion.

Sediment control and impoundment structures (sediment ponds and ditches) would be designed to contain and treat all drainage and runoff from the disturbed areas of the loadout. Three or more sediment ponds, totaling about 4 surface acres, would be located in the northern part of the loadout facility. All diversion ditches and sediment ponds would be designed to contain and treat the runoff of a 10-year, 24-hour precipitation event. Accumulated sediment, along with any coal fines that may be present, would be removed and buried onsite.

A dedicated loadout spur, about 1,200 feet long, would be located on private and Federal land between the Union Pacific branch line tracks and the Iron Springs Road, immediately north of the loadout. The existing 600 feet of siding would be upgraded and extended to allow the unit-train to clear the Cedar City branch line during loading operations. Existing barbed-wire fencing would be relocated to prevent livestock from entering the main loadout area. Incoming trains would pull onto the Iron Springs branch of the main line, immediately west of the proposed loadout. They would back down the Cedar City branch until they cleared the entrance to the loadout spur, and then would pull forward onto the spur and through the loadout structure while being loaded. The loadout spur would involve 2 acres of private and Federal land within the existing Union Pacific right-of-way, of which less than 2 acres would be disturbed by construction activities.

Haul trucks and other traffic would access the loadout facility from Interstate-15 along Utah Route 56 and the existing Iron Springs and Vermillion Mine Roads (Section A.2.7.6, Truck Haul). About 200 feet of the Iron Springs Road would be widened to provide a paved turn lane for the loadout traffic, and about 1,100 feet of the Vermillion Mine Road would be upgraded. The trucks would reach the unloading station within the proposed loadout on a one-way, single-lane, 1,900-foot, dedicated loop road. The first 750 feet of the Vermillion Mine Road and the full length of the dedicated loop road would have paved, all-weather surfaces with 2-foot-wide shoulders. The remaining 350 feet of the Vermillion Mine Road, the access roads within the loadout, and the parking areas for the office and shop buildings would be graveled and chemically stabilized for control of fugitive emissions. Gravel would be obtained from commercial sources in the immediate area. Ditches and culverts would be installed, where necessary, to provide adequate drainage control for a 10-year, 6-hour precipitation event. Three-strand fence would restrict livestock from the operational part of the loadout facility. Access to the office and shop area would be controlled by locked gates. Long-duration parking of haul trucks would not be permitted. The upgraded county roads would involve 2 acres of private and Federal land within the existing county road rights-of-way; less than 2 acres would be disturbed by upgrade activities.

A.2.5.3 Coal Handling Facilities and Operations

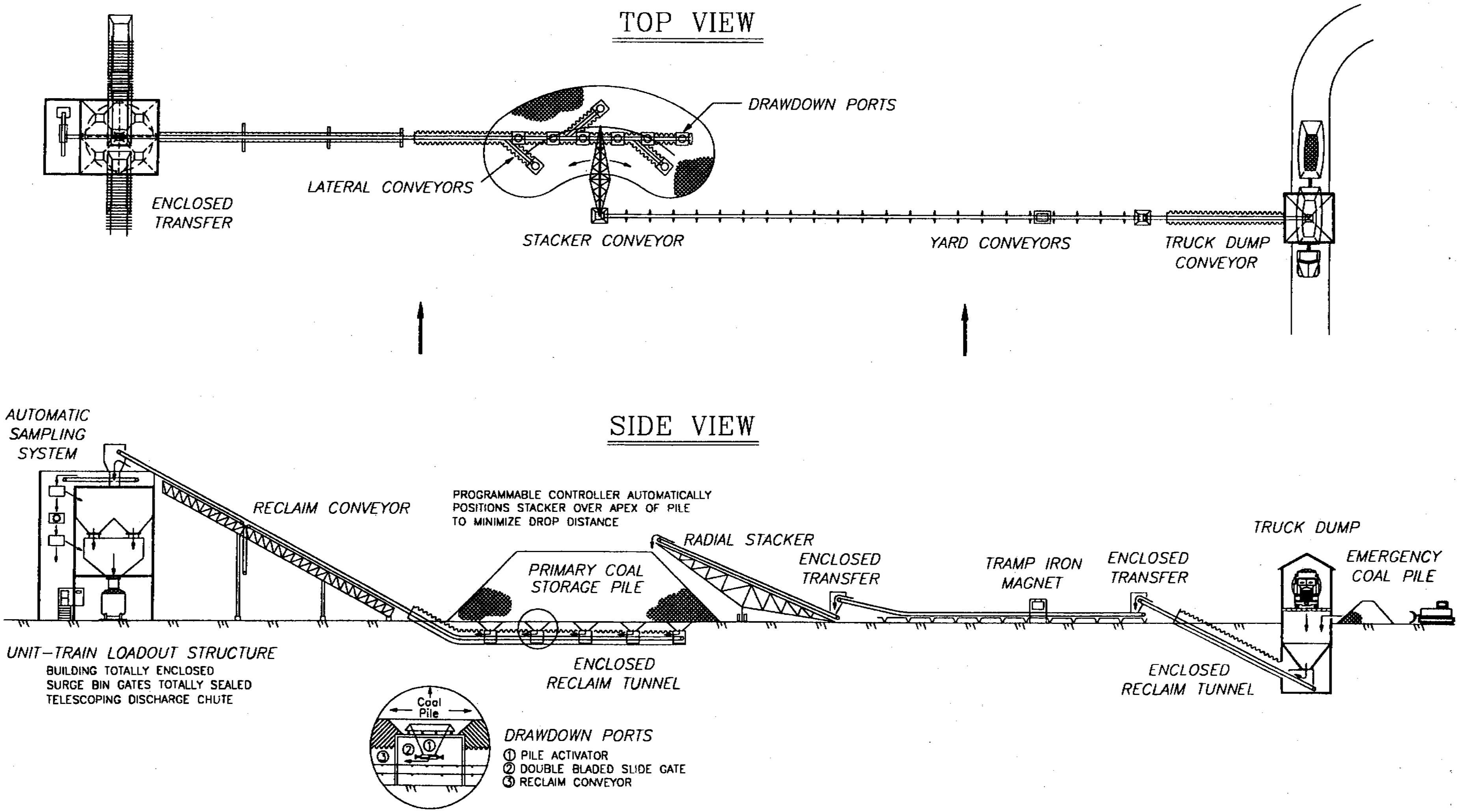
The loadout facility would be designed primarily to receive incoming coal from the proposed mine, transfer the coal to a temporary stockpile, and reclaim the coal for loading onto unit-trains. No coal processing or washing would be done, and no coal wastes or byproducts would be produced at the site. The facility would be capable of operating continuously, 24 hours per day, 365 days per year.

Haul trucks would deliver crushed coal to the unloading station (the truck dump) at the loadout. Coal would be dumped into a 180-ton surge bin located below a drive-through enclosure. When the surge bin is unable to receive incoming coal due to scheduled maintenance downtime or emergency breakdowns, incoming trucks would use the temporary, emergency storage area located in the interior of the truck loop. A dozer or front-end loader would move this coal into the main 180-ton surge bin through a separate dozer-trap opening when surge bin operations resume.

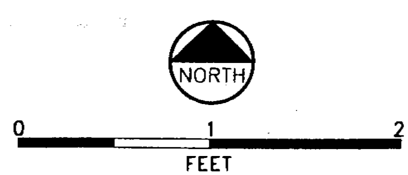
The coal would be transferred from the bin/storage area at the truck dump to the primary coal stockpile by a series of belt conveyors at rates of about 800 tons per hour (tph). The conveyor system would include a 170-foot reclaim conveyor, a 400-foot yard conveyor, and a 300-foot radial stacker conveyor (Figure A-10). The primary coal stockpile would have a crest length of 400 feet and a height of 80 feet when built to its fullest extent and would provide about 100,000 tons of storage capacity. A programmable controller would be used to automatically position the stacker conveyor over the apex of the stockpile as it is being built in order to minimize the drop distance of the coal. During the train-loading process, coal would be transferred from the primary coal stockpile to a 300-ton surge bin in the loadout structure by a 1,200-foot reclaim conveyor at rates of about 6,000 tph. An accessway/catwalk would be constructed adjacent to the conveyor to facilitate inspection and maintenance.

The unit-train loadout structure would be an enclosed building about 30 feet long, 30 feet wide, and 95 feet high. It would contain two large coal bins, a three-stage automated ASTM sampling system, an operator's control room, and all necessary hydraulic power components, motor control centers, starters, electrical switch gear, and computer equipment. During the train-loading process, the surge bin would release coal onto a 120-ton weigh bin designed to hold a load of coal for a single railcar. The contents of the weigh bin would be electronically weighed prior to being loaded onto the advancing railcar. As each railcar approaches the loading position, the coal in the weigh bin would be discharged through a telescoping loading chute positioned over the railcar. Coal would be trim-loaded into the railcar as the car moves below the weigh bin chute. The entire batching/weighing process would be computer controlled and would take place during the few seconds that elapse between the end of the previously loaded car and the front of the next empty car to be loaded. Weights recorded for each car would be accurate to within 0.1 percent of the actual weight and would be certified by the Weights and Measure Division of the Utah Department of Agriculture.

To contain dust, all conveyors would be covered, and each transfer of coal from one conveyor to another would occur within enclosed chutework at transfer structures. The radial stacker feeding the primary coal stockpile would be designed to automatically position over the apex of the pile to reduce the drop distance and minimize particulate emissions. The transfer structure between the reclaim and yard conveyor would include a self-cleaning iron magnet and a metal detector to remove any tramp metal prior to the coal reaching downstream equipment. A water-spray system would be installed on the reclaim conveyor to reduce dust in the coal before it reaches the train loadout structure. Coal transfer within the unit-train loadout facility would be completely enclosed. The telescoping chute would minimize particulate emissions when the crushed coal is being loaded into waiting train cars. Work areas within the operation yard would be treated with chemical dust suppressants (e.g., magnesium chloride) to minimize dust in those areas.



NOTE: THIS DRAWING IS A CONCEPTUAL REPRESENTATION AND IS NOT TO SCALE.



WARM SPRINGS PROJECT

FIGURE A-10
PROPOSED IRON SPRINGS
UNIT-TRAIN LOADOUT
COAL HANDLING FLOW DIAGRAM

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Unit-trains would consist of 85 to 100 or more railcars that would be loaded in motion (at about 0.5 mph) at rates of about 6,000 tph. The loadout capacity at the facility would allow one 100-car unit-train to be loaded in less than 2 hours. With an average capacity of 10,000 tons of coal per train (100 tons per car), production of about 2.5 to 3.0 million tons would require 250 to 300 unit-trains to be loaded each year (one train every 1 to 2 days).

A.2.6 Moapa Unit-Train Loadout

A.2.6.1 Introduction

To deliver coal produced at the proposed mine, Anadalex would construct a unit-train loadout adjacent to the Union Pacific main line, about 1.5 miles south of the Nevada Power Company's Reid Gardner coal-fired powerplant and about 3 miles southwest of Moapa, Nevada (Chapter 1, Figure 1-4). Overton Power District (Overton) would provide electric power to the proposed loadout through the construction of a 2.7-mile 69-kV power transmission line to the facility. Moapa Valley Telephone Company, Inc. (Moapa Valley), would provide telephone service to the proposed loadout through the installation of a 1.3-mile buried cable. Union Pacific and Andalex would provide rail access to the proposed loadout through the construction of a 2.6-mile siding and rail loop adjacent to the facility. (Specific details on the existing Reid Gardner Powerplant, the existing Overton power system, the existing Moapa Valley telephone system, and the existing Union Pacific rail system are included in Appendix B.)

The proposed Moapa unit-train loadout and its associated powerline, telephone line, and rail siding would involve 638 acres of private and Federal land (Table A-2). Construction activities would disturb about 198 of these acres, about 6 acres of which have previously been disturbed. About 100,000 tons of crushed coal could be stored in the primary stockpile at the loadout at any one time, but additional emergency storage could also be accommodated. About 2.5 to 3.0 million tons of coal would be transferred through this facility each year throughout the life of the proposed mine. Coal would be hauled by truck about 228 miles over county, State, and Federal roadways from the proposed mine to this loadout (Section A.2.7.6, Truck Haul).

Loadout activities could eventually employ 20 full-time workers throughout the life of the proposed mine, including equipment operators, mechanics, electricians, and supervisory personnel (Chapter 1, Table 1-3). Throughout the life of the proposed loadout, the operation and maintenance of the power transmission line and the rail siding would be the responsibility of employees from Overton and Union Pacific, respectively. In addition, about 57 workers would be employed to complete facility construction activities over an 18-month period.

A.2.6.2 Loadout Facilities

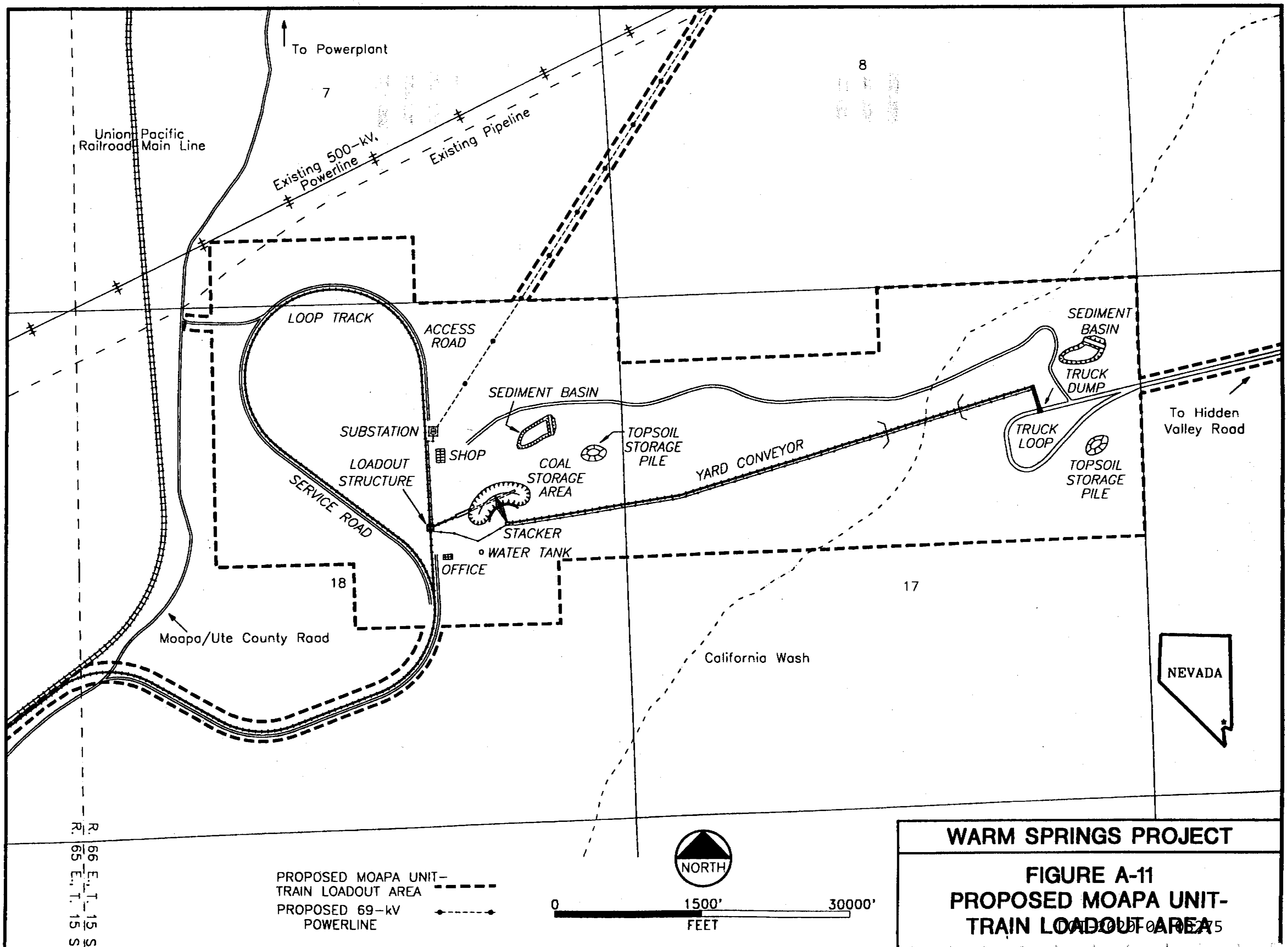
The unit-train loadout facilities proposed at Iron Springs and at Moapa would be similar in concept and design. Both would use nearly identical components, such as the office and shop buildings, fuel and lube oil storage system, sediment control structures, water supply system, wastewater system, electrical distribution system, and internal communication system. Unless noted otherwise, structures, facilities, and processes proposed at Moapa would be the same as those described for Iron Springs (Section A.2.5.2, Loadout Facilities).

Unlike the Iron Springs loadout, where most of the components of the facility would be tightly grouped within a relatively small area, the Moapa unit-train loadout facility would be constructed in a more linear arrangement stretching about 3 miles from Interstate-15 on the east to the Union Pacific main line tracks on the west (Figure A-11). Also, the loadout site would consist of two generally distinct working areas separated by California Wash. The truck-unloading facilities would be constructed on the east side of California Wash, and the coal stockpiling, train loading, and other support facilities would be constructed on the west side. A service road and an elevated overland conveyor, powerline, and telephone cable would cross California Wash and connect the facilities. The primary loadout right-of-way, including the railroad loop track and the access roads, would involve 618 acres of private and Federal land, of which about 189 acres would be disturbed by construction activities. About 4 of theses acres have been previously disturbed by railroad and gravel-borrow activities.

Power would be provided by a new 2.7-mile, 69-kV power transmission line from Overton's existing 69-kV power transmission line in the NW¼ of section 4 (T. 15 S., R. 66 E.), southeast of Moapa. A set of high-voltage disconnects would tap the existing line to provide 69-kV power to an electrical substation that would be constructed near the coal storage area. The proposed 7,400-foot right-of-way would parallel Los Angeles Department of Water and Power's (LADWP) existing 500-kV power transmission line and Kern River Gas Transmission Company's (Kern River) existing 36-inch-diameter gas pipeline for about 1.6 miles, then continue southeastward for about 1.1 miles to the loadout substation. Construction equipment would access the right-of-way from either side of the Muddy River and would not directly cross the channel. The powerline right-of-way would involve 23 acres of private and Federal land. About 7 acres would be disturbed by powerline construction activities, of which about 2 acres have been previously disturbed by LADWP, Kern River, and the Hidden Valley Dairy. (Specific details of the existing LADWP power system, the existing Kern River pipeline system, and the Hidden Valley Dairy are included in Appendix B.) In addition to other power facilities within the loadout, a single-pole, overhead transmission line would parallel the yard conveyor to provide power to the east-side truck dump facilities.

Telephone communication would be provided from Moapa Valley's new Overton to Las Vegas fiber-optic communication line running along Interstate-15. About 6,800 feet of buried telephone cable would originate at a telephone switching pedestal in the SW¼SW¼ of section 10 (T. 15 S., R. 66 E.), near the Hidden Valley interchange. It would run west along the Hidden Valley Road and then southwest along the main loadout access road to the east-side truck unloading facility. Telephone service would be available at the truck unloading facility where it would connect to the private loadout communication system. The telephone right-of-way would involve 4 acres of Federal land. About 2 acres would be disturbed by cable installation activities; less than 1 acre has been previously disturbed.

Two or more sediment ponds, totaling about 4 surface acres, would be located throughout the loadout facility. The primary sediment pond, covering about 2 surface acres, would be located north of the primary coal stockpile to collect runoff and sediment from the coal storage area. One or more secondary ponds



WARM SPRINGS PROJECT

FIGURE A-11
PROPOSED MOAPA UNIT-TRAIN LOADOUT AREA

would be located north of the truck unloading station to collect runoff from the truck loop area. Topsoil stockpiles would be located away from operation areas near the sediment ponds.

A dedicated, 2.6-mile loop track would be constructed by Andalex off the Union Pacific main line tracks to provide rail access to the west side of the loadout. This loop track would allow up to 120-car unit trains to be loaded at the site before reentering the main line tracks. It would utilize an electrical power switch at the turnout controlled by the Union Pacific central dispatching office. About 34 acres of private and Federal lands would be disturbed by railroad construction activities; about 1 acre has been previously disturbed by Union Pacific along its mainline.

Haul trucks and other traffic would access the east-side truck unloading facility from Interstate-15 along the existing Hidden Valley Road, about 500 feet northwest of the Hidden Valley exit (Section A.2.7.6, Truck Haul). The trucks would reach the unloading station within the proposed loadout on a new, 6,000-foot, dedicated access road. The road would have a 28-foot-wide, paved, all-weather surface with two 12-foot-wide running lanes, 2-foot-wide shoulders, and center/shoulder striping for traffic control and safety. Worker and service vehicles would access the west-side coal storage and train-loading facilities on a new, 3,300-foot-long dedicated access road constructed from the Moapa/Ute County Road that passes the Reid Gardner Powerplant and parallels the Union Pacific main line. A service road, about 4,500 feet long, would be constructed to connect the east-side truck unloading facilities with the west-side coal storage and train-loading facilities. From the truck dump area, this road would descend along a dugway into and across California Wash, then follow a minor drainage feature toward the coal storage/train-loading area. Both the west-side access road and the connecting service road would be 28 feet wide with a graveled surface and 2-foot-wide shoulders. These roads, as well as the parking areas for the office and shop buildings, would be treated with a chemical stabilizer (such as magnesium chloride) for dust control. Culverts and a bladed, dry-weather crossing of California Wash would be installed along the east-west service road. Culverts and triangular trenches or special fencing would be installed along both the east-side and west-side access roads to minimize traffic dangers to the desert tortoise (Section A.3.5.3.2, Desert Tortoise Habitat).

One maintenance road, about 8,400 feet long, would be constructed adjacent to the loop track. Another maintenance road, about 4,200 feet long, would be constructed in two segments, one on each side of California Wash, immediately adjacent to the main yard conveyor to provide access for construction and maintenance. These roads would be 20 feet wide, including borrow ditches, and would be revegetated following construction. Culverts would be installed to allow limited use, but no gravel or other surface material would be applied.

A.2.6.3 Coal Handling Facilities and Operations

The coal handling and unit-train loading facilities proposed at Iron Springs and at Moapa would be very similar in concept, design, and size. They would both use nearly identical components, such as the truck unloading station, conveyor transfers, radial stacker, coal storage pile, reclaim system, dust-control system, and unit-train loadout structure. Unless noted otherwise, structures, facilities, and processes proposed at Moapa would be the same as those described for Iron Springs (Section A.2.5.3, Coal Handling Facilities and Operations).

Haul trucks would deliver crushed coal to the unloading station (the truck dump) at the east-side facility area of the loadout. Coal would be dumped into a surge bin or at a temporary storage area and transferred to the primary coal stockpile in the west-side facility area by a series of belt conveyors. The conveyor system would include a 170-foot reclaim conveyor, two yard conveyors (a total of 5,100 feet) supported by a series of elevated truss structures to cross California Wash, and a 300-foot radial stacker conveyor (Figure A-12). Weights recorded for each railcar would be accurate to within 0.1 percent of the actual weight and would be certified by the Weights and Measure Division of the Nevada Department of Agriculture.

A.2.7 Truck Maintenance Facility and Truck Haul

A.2.7.1 Introduction

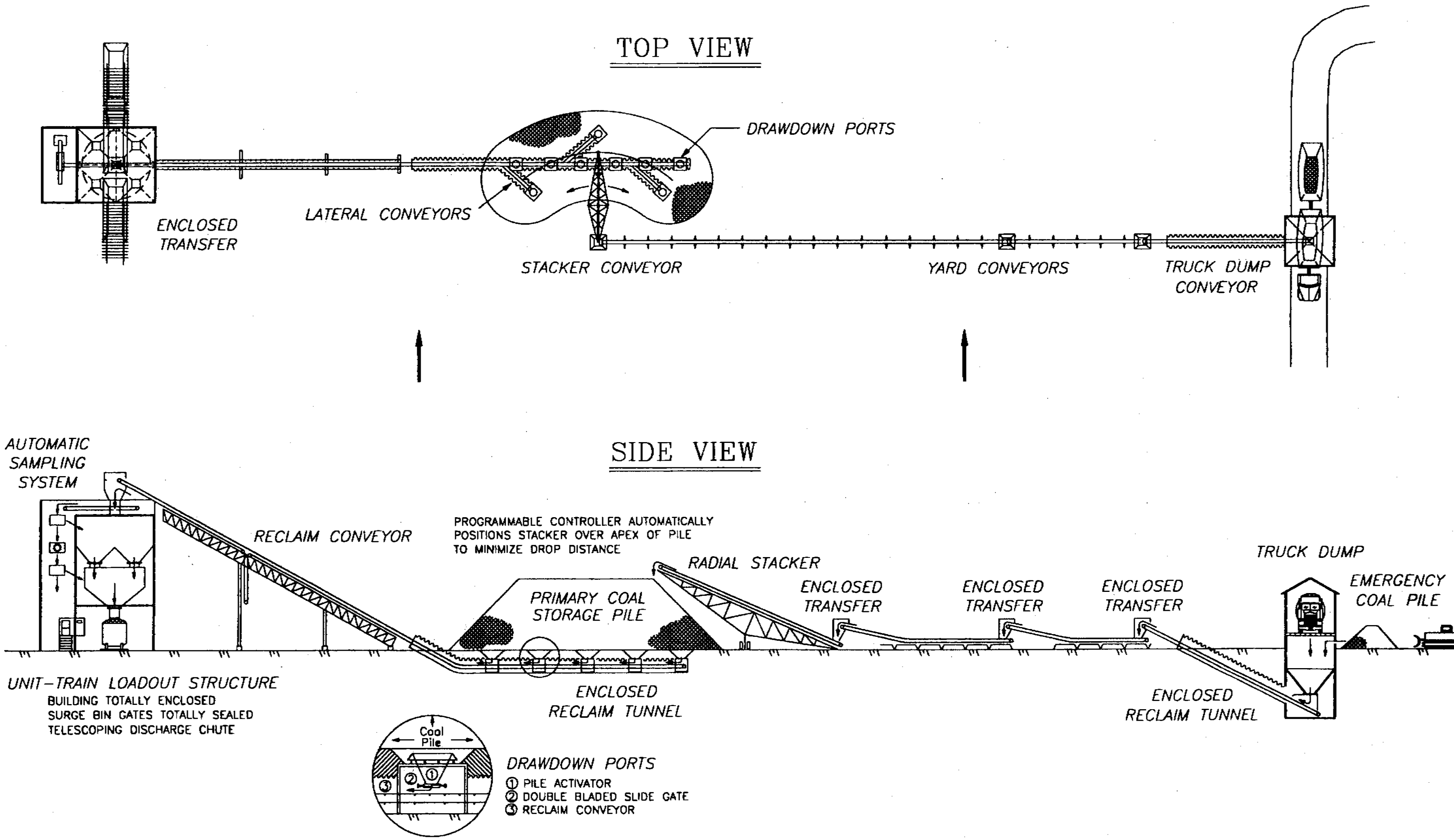
A private bulk-carrier transport company would deliver coal produced at the proposed mine to the Iron Springs and Moapa unit-train loadouts. The trucking operation would be based out of a maintenance and office facility located along the haul route in Fredonia, Arizona (Chapter 1, Figure 1-5), or in Hurricane, Utah (Chapter 1, Figure 1-6). The maintenance facility would be constructed, owned, and operated by the contract carrier.

The maintenance and office facility for the trucking contractor would involve 20 acres of private land (Table A-2). It would be located adjacent to the PetroSource Asphalt Refinery 1.8 miles north of Fredonia, Arizona (Appendix B), or in an industrial area about 4 miles west of Hurricane, Utah. Construction activities would disturb the entire 20 acres. The location and size of this truck maintenance facility is hypothetical for the purpose of this analysis; the actual location and design would be selected by the specific contractor chosen to provide the truck haul and maintenance service. The facility, wherever it is ultimately located, would provide maintenance and office space to support up to 90 trucks on a round-the-clock basis, eventually hauling about 2.5 to 3.0 million tons of crushed coal to the Iron Springs (Cedar City) and Moapa unit-train loadouts each year.

Truck maintenance and coal hauling operations could eventually employ 260 full-time workers throughout the life of the proposed mine, including drivers, mechanics, clerical staff, and supervisors (Chapter 1, Table 1-3). About five workers would be employed to complete facility construction activities over a 12-month period.

A.2.7.2 Truck Maintenance Facility

The truck maintenance facility would include a multibay, drive-through shop and maintenance building that could accommodate up to six tractor-trailer units simultaneously, administrative offices, an equipment and truck washing/cleaning station, a parts warehouse, a fueling station, and employee and truck parking (Figure A-13). The building, about 60 feet wide, 100 feet long, and 30 feet high, would be constructed in the central part of the site, using prefabricated metal with steel siding and concrete flooring. The repair bays would be equipped with overhead cranes, sized to allow maintenance and overhaul of the mobile equipment used in the trucking operation. All buildings, storage tanks, and other structures would be painted a neutral, gray or tan color to blend with the surrounding environment. All facility lighting would be shielded and



NOTE: THIS DRAWING IS A CONCEPTUAL REPRESENTATION AND IS NOT TO SCALE.

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FIGURE A-12
PROPOSED MOAPA UNIT-TRAIN LOADOUT COAL HANDLING FLOW DIAGRAM

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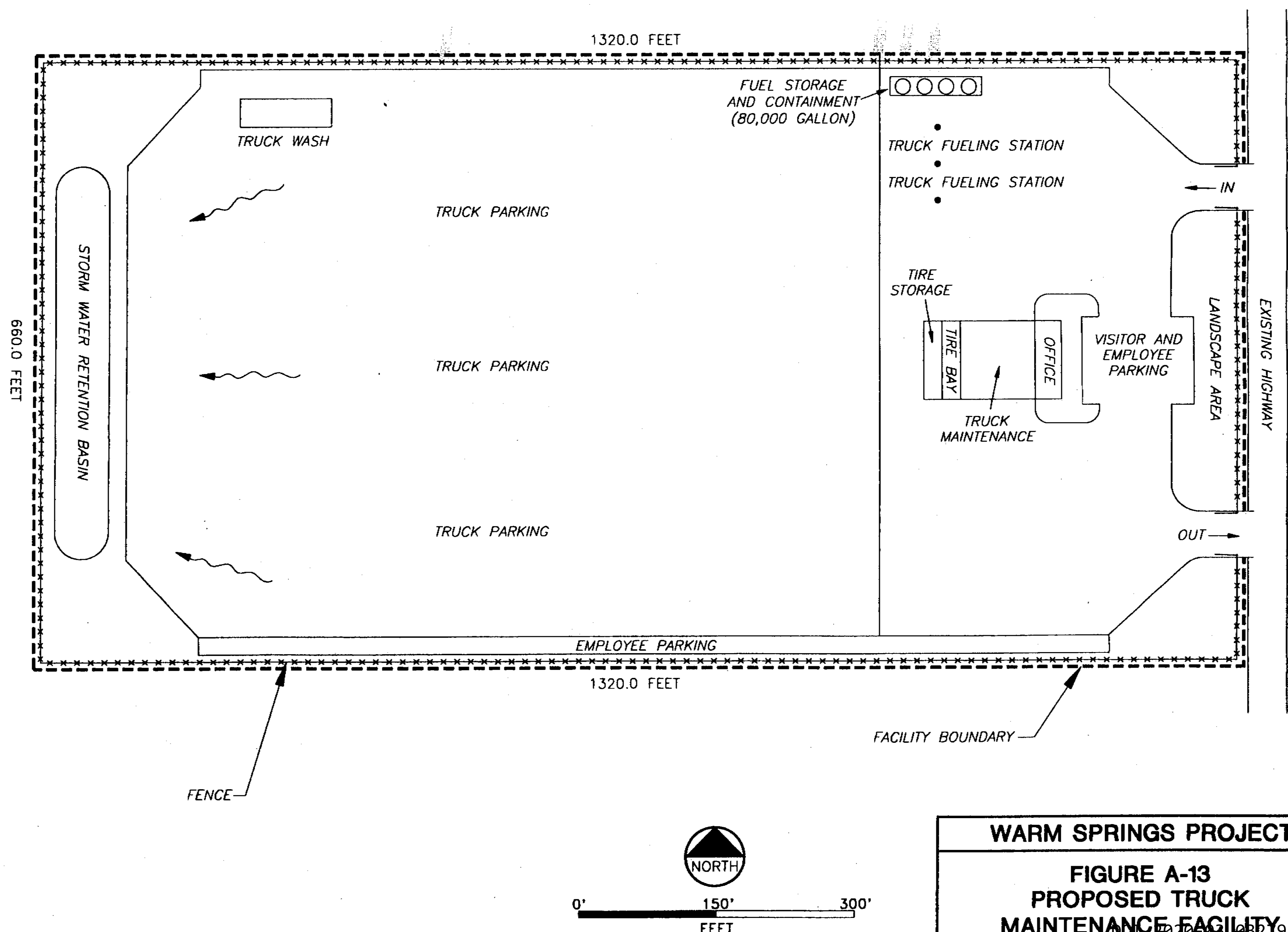

WARM SPRINGS PROJECT

FIGURE A-13
PROPOSED TRUCK MAINTENANCE FACILITY

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directed downward to minimize the potential for night glow. The maintenance yard, about 660 feet wide and 1,320 feet long, would be enclosed by an 8-foot-high chainlink fence to restrict unauthorized access. Drivers would begin and end their runs from this location, so that all equipment would be serviced and inspected in preparation for the next run.

Pressurized water would be available throughout the facility for fire prevention. Wastewater from showers and toilets would be treated and disposed of onsite in a septic tank/drain-field system adjacent to the office building. Truck washing liquids (biodegradable soap and water) would be impounded onsite in a separate collection facility. Excess sewage solids would be periodically removed to an approved offsite disposal facility.

The fuel and lube oil storage system would be located in an unfenced area near the shop/warehouse building. Grease and oil would be stored in sealed containers on an impervious surface covered by a steel awning. Diesel fuel and unleaded gasoline would be stored separately in four to six aboveground, locked, 20,000-gallon steel tanks. Each fuel or lube oil storage area would be installed within a bermed containment structure capable of adequately holding the entire volume of the largest tank. The grease/oil storage area would be fire-resistant and covered to provide protection from the elements.

Solid waste (garbage, construction, and other debris) would be temporarily stored in specially designed containers (dumpsters) conveniently located near the shop/warehouse building. The waste would be periodically disposed of at a licensed commercial solid-waste disposal facility. Waste paper, glass, wood, metal, and other such materials determined to be nonhazardous would be recycled as much as possible. Waste grease, lubricants, paints, and flammable liquids would be stored in steel containers near the shop/warehouse for periodic disposal at a licensed and bonded liquid-waste disposal facility. Materials determined to be hazardous, or those with specific handling requirements, would be disposed of according to appropriate State and Federal regulations.

Access roads and parking areas within the maintenance facility would be graveled and chemically stabilized to control dust. Gravel would be obtained from commercial sources in the immediate area. Ditches and culverts would be installed where necessary to provide adequate drainage control for a 10-year, 6-hour precipitation event.

Topsoil, when available, would be salvaged and respread around the completed facility. Temporary straw bale or filter fabric dikes would be used for sediment control during construction. The entire disturbed area not necessary for truck maintenance operations would be scarified and reseeded (Section A.3.4, Reclamation Activities).

A.2.7.3 Fredonia Facility

The hypothetical Fredonia truck maintenance facility would be located in the NW¼NE¼ of section 8 (T. 41 N., R. 2 W.), about 1.8 miles north of the Fredonia business district, near the PetroSource Asphalt Plant. The site would be within the city limits of Fredonia on privately owned land adjacent to U.S. Hwy. 89A. Access would be from a driveway off U.S. Hwy. 89A. Utilities, such as electrical power, water, and telephone service, are available adjacent to the site. The site has open zoning (unzoned). (Specific details of the PetroSource Asphalt Plant near Fredonia are included in Appendix B.)

A.2.7.4 Hurricane Facility

The hypothetical Hurricane truck maintenance facility would be located in an industrial area in the SW¼NW¼ of section 31 (T. 41 S., R. 13 W.), about 4 miles west of the Hurricane business district. The site would be on privately owned land near Utah Route 9 within the city limits of Hurricane. Access would be from a driveway off Road 3900-West, just north of Utah Route 9. Utilities, such as electrical power, water, and telephone service, are available adjacent to the site. The site has open zoning (unzoned). (Specific details of the industrial area near Hurricane are included in Appendix B.)

A.2.7.5 Haul Trucks

Coal would be transported from the mine to the Iron Springs and Moapa unit-train loadouts by standard double-trailer haul trucks, owned and operated by the independent trucking contractor. The tractor/trailer units would use either 10 or 11 axles, have a gross vehicle weight of either 123,500 or 129,000 pounds, have an overall length of 92 feet, and would haul about 44 to 46 tons of coal (Figure A-14). The trailers would be lightweight aluminum with bottom-discharge capabilities. The entire fleet of as many as 90 trucks would be legally licensed and permitted for operation on all county, State, and Federal highways along the haul routes, conforming to all State and Federal requirements governing gross vehicle weight, overall length, axle loading, and tire width/pavement loading. All tractor/trailer combinations would conform to the Federal Formula-B bridge laws, which govern axle loading, grouping, and spacing on all federally funded highways. The tractor/trailer combination would have a turning radius of 40 to 45 feet, allowing it to operate in normal traffic.

All trucks would use tarps, mechanical closures, or other effective means to minimize coal dust emissions. All truck axles (steering, driver, and trailer) would be equipped with self-adjusting pneumatic brakes. In addition, the trucks would be equipped with compression (Jake) brakes to increase their safety on hills, but they would not be used in communities with local noise ordinances.

Trucks would undergo safety and maintenance inspections at the central shop facilities prior to every shift. Safety inspection and maintenance facilities would also be provided at the mine and loadouts to allow drivers to perform any additional servicing on the trucks during periods of loading and unloading. Drivers would be instructed to pull off the highway and wait for assistance from specially equipped service trucks dispatched from the central shop if safety or mechanical problems develop enroute. All trucks would be equipped with radios to maintain communication with the central shop. Trucks would be cycled out of the active fleet for preventive maintenance and overhaul on a regular basis.

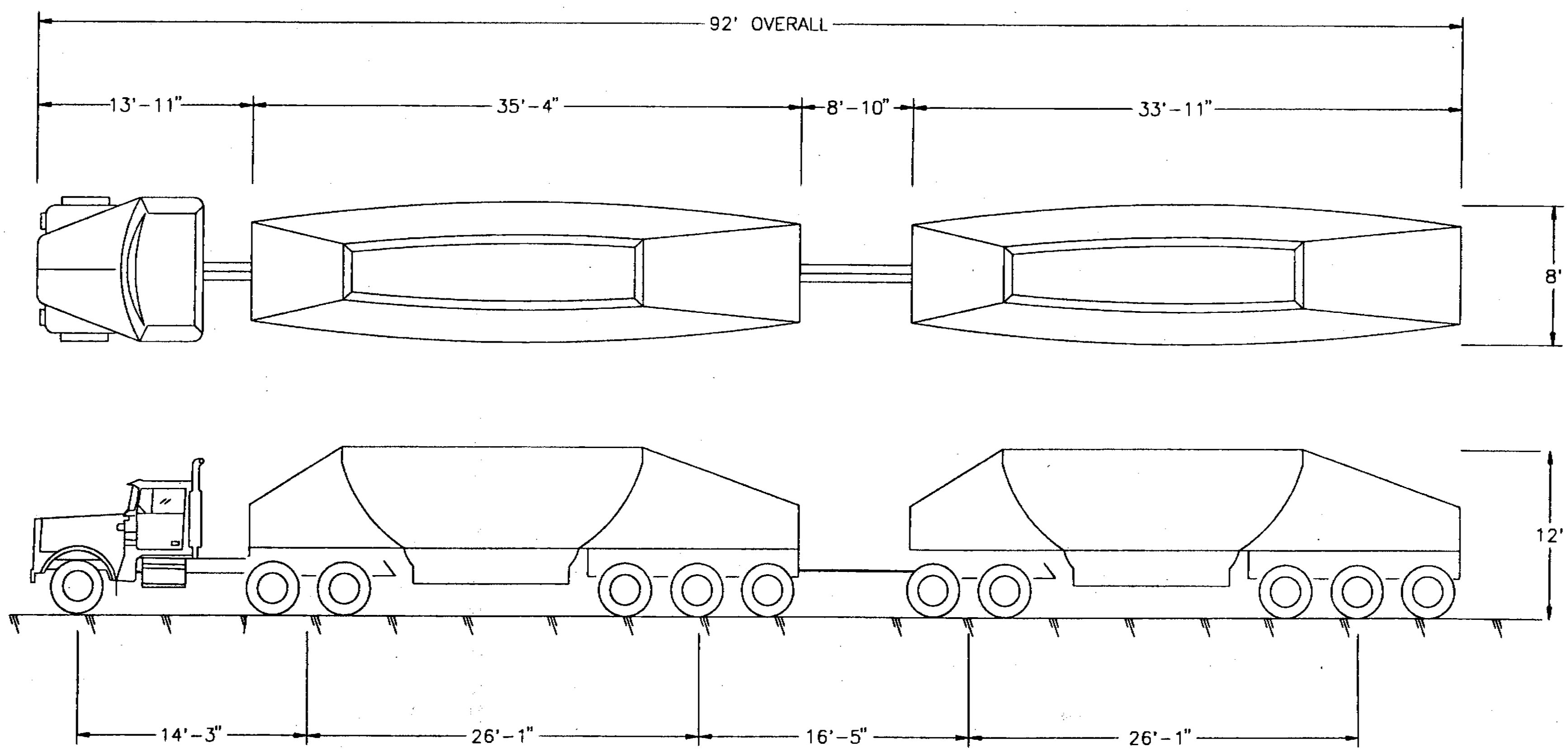

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FIGURE A-14
TYPICAL COAL
HAUL TRUCK

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A.2.7.6 Truck Haul

Coal loading and hauling operations could occur 24 hours per day, 365 days per year. With an average capacity of about 44 to 46 tons of coal per truck, production of about 2.5 to 3.0 million tons would require between 54,000 and 65,000 loads to be trucked to the Iron Springs and Moapa unit-train loadouts each year. This would require between 150 and 175 loads per day, with loaded haul trucks being dispatched from the Smoky Hollow Mine at about 8- to 10-minute intervals. Each driver would make one round-trip in a 10-hour shift, allowing each truck to make at least two round-trips per day.

Trucks would be loaded at the proposed mine by means of an automated batch-weigh loading system (Section A.2.1.2.2, Coal Handling Facilities). Each load would be preweighed, using a State-certified weighing system accurate to within 0.1 percent. Load documentation (weigh tickets) would be generated for each truckload and could be presented at State highway checking stations along the route.

The 382-mile round-trip (191 miles direct) along designated truck routes from the proposed mine to the Iron Springs unit-train loadout (Chapter 1, Figure 1-1) is expected to take 8.5 to 9 hours to complete. Loaded trucks would use the Warm Creek/Benchtop Road to travel from the surface facilities complex at the Smoky Hollow Mine to Big Water (about 21 miles). From Big Water, trucks would travel west on U.S. Hwy. 89 to Kanab, Utah (about 56 miles). They would turn south at the traffic light on 100-East in Kanab and follow U.S. Hwy. 89A to Fredonia, Arizona (about 7 miles). Trucks would travel west from Fredonia on Arizona Route 389 to Colorado City, Arizona/Hildale, Utah (about 32 miles), and on Utah Route 59 to Hurricane, Utah (about 23 miles). After stopping in Hurricane at the bottom of Hurricane Hill, the trucks would turn north on Main Street for one block. They would turn east at the traffic light on State Street and follow Utah Route 9/17 through La Verkin and Toquerville to Interstate-15 at Anderson Junction (about 9 miles). The trucks would travel north on Interstate-15 to Cedar City, Utah, leaving the freeway at exit 59 in Cedar City (about 32 miles). They would travel west from Cedar City on Utah Route 56 (about 4 miles) and the Iron Springs Road (about 7 miles) to Iron Springs and the turnoff to the loadout site, off the Vermillion Mine Road.

The 456-mile round-trip (228 miles direct) along designated truck routes from the proposed mine to the Moapa unit-train loadout (Chapter 1, Figure 1-2) is expected to take 9.5 to 10 hours to complete. Loaded trucks going to Moapa would follow the same route from the Smoky Hollow Mine to Hurricane, Utah, as that used by trucks going to Iron Springs. In Hurricane, the trucks would turn west at the traffic light on State Street and follow Utah Route 9 to Interstate-15 at Harrisburg Junction (about 9 miles). They would travel on Interstate-15 south through St. George, Utah, and Mesquite, Nevada, leaving the freeway at the Hidden Valley Road exit just south of Moapa, Nevada (about 79 miles). They would travel west on the Hidden Valley Road about 500 feet before turning onto the main access road to the loadout site and reaching the east-side truck unloading facilities (about 1 mile).

All haul truck drivers would be responsible for obeying the posted speed limits during the round-trip truck haul. Trucks would be confined to the public highway system along the primary haul route. Drivers would not be authorized to stop along the route or to travel on city streets or other alternate routes, except in emergencies. On average, trucks would be dispatched from the Smoky Hollow Mine about every 8 to 10 minutes continuously throughout the day, at six to eight truckloads per hour, in order to keep the density on the highways as low as possible. Trucks should be spaced an average of 7 to 10 miles apart along the haul route. When traffic or weather conditions alter this spacing, trucks would use radio contact to maintain a minimum 1-mile spacing to allow safe passing and minimize congestion. Haul drivers would be instructed to not travel in convoys or groups.

A.3 RECLAMATION PLAN

A.3.1 Introduction

Plans for the construction of the various project facilities, for the underground mining of coal, and for reclamation of the associated surface disturbances are interdependent to ensure that reclamation for each of the elements of the proposed Project would be performed at the earliest possible time. Reclamation activities fall into one of two categories: interim and permanent (final). Interim activities are those intended to stabilize an area during its use in the mining or mining-related activity, whereas final activities are those intended to return the area to its long-term condition before releasing it from operator responsibility (i.e., before releasing any applicable performance bonds).

Interim reclamation activities, generally associated with longer lived elements of the proposed Project or parts of a particular element that would not be actively used, would occur primarily during the first 2 to 3 years of the Project (Chapter 1, Table 1-2). These activities would begin immediately after the construction and development of each particular facility had been completed. This would include those areas around buildings and equipment that would not be needed for the operation of the facility. Interim reclamation would continue to occur on a smaller scale throughout the remainder of the Project as other components of the operation were initiated.

Final reclamation activities could occur any time during the 53- to 54-year life of the Project, beginning immediately after the service life for a particular Project element has ended. In the case of temporary disturbance activities around permanent facilities or where the life of the activity would be limited, final reclamation would occur soon after construction activities were completed. This would include cut-and-fill slopes associated with the Warm Creek/Benchtop Road, powerline structure workpads, exploratory drilling sites, some access roads, buried pipelines and cables that would eventually be abandoned in place, and those temporary staging areas associated with the various construction activities.

Final reclamation of all remaining mining-related disturbances (i.e., the surface facilities complex, the topsoil borrow area, and the Iron Springs and Moapa unit-train loadouts) would not begin until the end of underground mining activities in year 41 or 42 of the Project. Final reclamation of some permanent facilities (such as the UP&L 34.5-kV power distribution line near Iron Springs, and the truck maintenance facility) may not take place in the foreseeable future. Depending on how the owner of each particular facility chooses to utilize it beyond the end of this Project, the disturbed area may or may not be reclaimed in year 41 or 42 when other final reclamation activities would take place. In the case of the Warm Creek/Benchtop Road, Kane County intends for the planned improvements to become permanent features of its public road system.

Final reclamation activities would generally proceed as follows:

Year 0 - End of the useful service life for a particular Project element, or a part thereof;
Year 1+ - Backfilling, regrading, topsoil replacement, recontouring, drainage control, and reseeding; and,
Year 11+ - Vegetation sampling for final reclamation bond and liability release, when/where appropriate.

Final reclamation operations would generally occur in two phases. During the first phase, mining-related structures would be dismantled and removed. The majority of reclamation operations, including backfilling and grading, topsoiling, and reseeding, would follow. However, sediment control structures would be retained to control surface runoff in each area during the initial period of vegetation establishment. During the second phase, after vegetation becomes established, the sediment control structures would be removed and the remaining disturbance areas would be reclaimed. Alternate sediment controls would be utilized to treat drainage in the stage 2 reclamation area. The final reclamation bond and liability for each particular site would be released by the appropriate regulatory authority when reclamation had been deemed successful: a minimum of 10 years after the last seeding in those areas formally permitted by Utah DOGM.

A.3.2 Postmining Character of Project Elements

A.3.2.1 Postmining Land Use

Reclamation efforts would be designed to return most postmining surface acreages to their premining (historic) use. Primary historic land uses in and around the Smoky Hollow life-of-mine area, including the area of the proposed 138-kV power distribution line and the proposed Mustard Point communication site, have been cattle grazing and wildlife habitat. Parts of these areas have historically been used by Kane County and by BLM for public access roads. Premining (historic) uses of the areas proposed for the Iron Springs and Moapa unit-train loadouts have also been cattle grazing and wildlife habitat. In addition, the area in and around the Iron Springs unit-train loadout has been extensively used for iron mining and exploration, gravel extraction, trash disposal, train loading, and other industrial activities. The area in and around the Moapa unit-train loadout has been used for off-road vehicle recreation, power generation (the Reid Gardner Powerplant), trash and hazardous material disposal, and public facility corridors (interstate highways, high-voltage powerlines, a gas pipeline, and a railroad). There are no improved rangelands, croplands, or pasturelands within these proposed disturbance areas, and none is proposed as a postmining land use.

Historic uses of the land adjacent to the existing Warm Creek Road have been cattle grazing, wildlife habitat, and limited-access recreation. The road has been used for vehicular access to the western part of the NRA and to provide a transportation link to various mining and ranching operations to the north and east, as well as to Garfield County and the town of Escalante. Areas in and around the proposed Benchtop Road have been used for cattle grazing and year-round wildlife habitat. Areas in and around the proposed Fredonia and Hurricane truck maintenance facility sites have been used for industrial and commercial purposes, cattle grazing, and limited wildlife habitat. Reclamation efforts in and around all the Project elements, because of their essentially permanent nature, would be limited to interim activities. Use would continue according to the long-term plans of the owner of that facility after proposed mining-related operations have been completed. Reclamation activities would, however, be designed to accommodate the historic use for the area as much as possible.

Some historic uses of the land (e.g., ranching, recreation) would be eliminated in a few parts of the Project area during the entire 54-year period of facility construction, active mining and mining-related operations, reclamation, and bond release (Chapter 1, Table 1-2). This would occur within the surface facilities complex, at the Iron Springs and Moapa unit-train loadouts, and in other small support areas used for microwave communication and hydrologic monitoring. Those historic uses that occur along the various powerline, telephone communication, and temporary access rights-of-way associated with the proposed Project would only be temporarily disrupted during actual construction and reclamation activities. Historic uses adjacent to these areas and within the remainder of the Smoky Hollow life-of-mine area would continue uninterrupted. Revegetated areas judged by the appropriate regulatory authority to be capable of withstanding grazing pressures would again be incorporated into ranching activities at that time.

A.3.2.2 Postmining Topography

Reclamation activities associated with the Project would be designed to approximate the original predisturbance contours of the area and blend with the adjacent undisturbed topography as much as possible. All drainage channels and floodplains would be reestablished with sufficient capacity to carry flow from a 100-year, 6-hour precipitation event. Premining elevations for selected parts of the various Project elements are shown in Table A-4.

Postmining topography in the surface facilities complex and at the proposed topsoil borrow area would be expected to approximate existing elevations and contours. Elevations in the area of the inactive Missing Canyon Coal Mine would be recontoured to approximate the original, undisturbed topography as much as possible. Elevations in the coal removal and buffer areas of the life-of-mine area would essentially remain unchanged, although local surface changes from mining-related subsidence are expected in the coal removal area. (A discussion concerning the mechanisms of subsidence is included in Appendix C.) Postmining contours in those areas where limited surface disturbance is proposed (e.g., for access roads, exploration drillholes, hydrologic monitoring) would approximate original contours at or near original elevations.

Premining topography along the Warm Creek/Benchtop Road, along the UP&L 34.5-kV power distribution line near Iron Springs, and in the area of the truck maintenance facility would be changed permanently. These facilities would remain in place after the end of the proposed Project for continued public/private use, depending on how the owner of that facility chooses to utilize it beyond the end of the Project.

Table A-4 — Premining Elevations of the Proposed Warm Springs Project

[Values represent feet above mean sea level]

Facility	Elevation
SMOKY HOLLOW MINE	
Ship Mountain Point (highest point)	6,510
Smoky Mountain	5,543
Topsoil borrow area	5,510
Missing Canyon Mine (inactive)	4,720
Smoky Hollow Creek (lowest point)	4,480
138-KV POWER TRANSMISSION LINE	
Garkane substation (Arizona)	4,260
Big Water cutoff (from Sigurd line)	4,300
Nipple Bench (highest point)	5,220
Jacobs Draw (lowest point)	4,170
MICROWAVE COMMUNICATION SYSTEM	
Big Water terminal area	4,110
Mustard Point repeater station area	5,350
Spring Point reflector station area	5,270
SMOKY MOUNTAIN ROAD SYSTEM	
Wahweap Creek (Warm Creek Road)	3,890
Wahweap Creek (Benchtop Road)	3,924
Crosby Canyon (Warm Creek Road)	3,940
Tibbet Bench (Benchtop Road)	5,000
Smoky Hollow confluence (Warm Creek/Benchtop Road)	4,260
IRON SPRINGS (CEDAR CITY) UNIT-TRAIN LOADOUT	
Loadout facility area (highest point)	5,460
Railroad siding (lowest point)	5,385
MOAPA UNIT-TRAIN LOADOUT	
East-side facility area (highest point)	1,706
California Wash (lowest point)	1,608
West-side facility area (highest point)	1,740
Powerline substation area	1,657
TRUCK MAINTENANCE FACILITY	
Fredonia facility area	4,730
Hurricane facility area	2,960

A.3.3 Construction Activities

A.3.3.1 Introduction

Development of the various support facilities and other mining-related construction associated with each of the Project elements would generally involve new surface disturbance. In each case, disturbance and eventual construction activity would follow a standard sequence of events: survey and staking, clearing and grubbing, topsoil salvage and storage, grading, and excavation. Where applicable, foundations, buildings, and equipment would be installed. Construction/development work should primarily take place during daylight hours, but some work could require round-the-clock activity, depending on the type of operation involved, equipment needs, time of year, weather, schedules, or other factors.

A.3.3.2 Clearing and Grubbing

Before starting topsoil salvage in newly disturbed areas throughout the proposed Project area, surfaces would be cleared and very large shrubs, trees, and boulders that would interfere with topsoil stripping would be removed to an approved disposal area.

A.3.3.3 Topsoil Salvage Operations

Suitable topsoil and subsoil materials, if present, would be removed from all disturbance areas associated with the proposed Project and stockpiled for use during final reclamation. Prior to actual topsoil removal operations, proper salvaging depth would be identified and staked under the supervision of a qualified person.

Soil material salvaged at the surface facilities complex, up to 65,000 cubic yards, would be stored in a single stockpile north of the mine yard (Section A.2.1.2.3, Ancillary Facilities). Soil material salvaged from the Iron Springs (Cedar City) unit-train loadout and the Moapa unit-train loadout would be stored at designated locations. These stockpiles would remain in place for the 42- to 43-year life of the support facilities. Topsoil storage piles would be seeded to reduce erosion. Berms/ditches would be placed around the base of the stockpiles to contain sediment during runoff.

Soil material salvaged from the Warm Creek/Benchtop Road, the truck maintenance facility, and the various temporary disturbance areas, including the powerpole locations, microwave communication facilities, hydrologic monitoring sites, and access roads, would be temporarily stored in small stockpiles and/or windrows located close to the site from which it was removed.

A.3.4 Reclamation Activities

A.3.4.1 Introduction

As with construction activities, reclamation of the various support facilities and other mining-related surface disturbance associated with each of the Project elements would follow a standard sequence of events: demolition and salvage, backfilling and grading, topsoil replacement, and revegetation.

A.3.4.2 Facility Demolition and Salvage

Mining-related structures throughout the Project area would be dismantled, and materials with any use or scrap value would be salvaged and removed from the site. This includes the rails, ties, and ballast associated with the rail spur at the unit-train loadouts and the poles and wire associated with the various powerlines. Foundations, slabs, and machinery mounts of concrete and asphalt would be fractured, either by mechanical means (for slab thicknesses of less than 12 inches) or by use of explosives. About 740 cubic yards of waste concrete and asphalt within the surface facilities complex would be buried at least 4 feet deep in the backfill, along the base of the portal highwall. Waste concrete, asphalt, and excess coal fines from other Project areas would be removed to an approved offsite disposal facility. Road surface materials associated with the gravel roads within the surface facilities complex and other Project areas would be buried in the backfill of the reclaimed disturbance area.

All exploration holes, wells, and other exposed underground openings would be permanently sealed or plugged when no longer needed for mining-related operations. Any mine entry that becomes temporarily inactive but could have a future useful life would be protected by barricades or other covering devices, fenced to restrict unauthorized access, and posted with signs to identify the hazard. Mine portals would be sealed with a concrete-block wall and 50 feet of nonflammable earthen backfill material. If necessary, the concrete-block wall would be designed and installed to function as a hydraulic seal. Additional backfill material would be used outside the portals to reestablish approximate original contour along the base of the highwall.

Materials used in the construction of the Warm Creek/Benchtop Road, the UP&L 34.5-kV power distribution line near Iron Springs, and the truck maintenance facility would not be salvaged. These facilities would remain in place after the end of the proposed Project for continued public/private use.

A.3.4.3 Backfilling and Grading

All disturbed areas associated with the proposed Project would be backfilled and graded as soon as they were determined to be unnecessary for mining-related activities. During active mining operations, backfilling and grading would occur only in those disturbed areas unnecessary for future operations and in temporary-use areas, including subsidence fracture areas and access roads. After the end of mining-related operations, backfilling and grading would occur on any disturbed areas not already included in the reclamation program.

Access roads and rail loops would be regraded by pushing the fill portion of each area into the cut portion. Steep slopes would be reduced by backfill operations to create slopes similar to surrounding topography. Contours would be established so that maximum outslopes would not exceed 2 horizontal feet to each 1 vertical foot (2:1), although flatter slopes would be created wherever possible. The highwall part of the surface facilities complex would be eliminated after the portals had been sealed and plugged. The majority of the surface facilities pad would be graded into the cut area against the highwall, with noncombustible fill materials placed over the sealed portals. Backfilled material would be compacted during regrading operations by using reclamation equipment.

The grading program would be designed to create an undulating surface similar to the approximate original contour. The ground would be ripped to a depth of 18 inches before redistributing the backfill material. Then, dozers and scrapers would be used to backfill and rough-grade each area to about 1 foot below the postmining contour. Ripping would be performed on the contour, where possible, using dozer-mounted rippers. In disturbed areas within the Smoky Hollow life-of-mine area, the top 4 feet of overburden/backfilled material would be composed of material suitable for revegetation. Borrow and regrading activities in the topsoil borrow area would ensure that a minimum of 18 inches of topsoil material remained in place for revegetation of that area (Section A.2.1.3.2, Topsoil Borrow Area).

The main and secondary culverts beneath the mine yard would be salvaged and the channels restored to design configurations similar to other channels in the area. Regraded channels would be capable of safely handling runoff from a 100-year, 6-hour precipitation event.

Drainage ditches or other alternate sediment control measures, such as straw bales and silt fences, would be established near the base of reclaimed slopes within the life-of-mine area to convey runoff from the reclaimed area to the sediment pond while vegetation became established. No permanent sedimentation impoundment would remain after reclamation operations unless the Utah Division of Wildlife Resources (DWR) receives approval from the Utah Division of Water Rights (Utah DNR), Utah DOGM, and BLM to maintain the impoundment for wildlife purposes beyond that period. When no longer needed, the sediment pond would be backfilled and graded, in accordance with the reclamation plans for the site. Alternate sediment control measures would also be used after the sediment pond is removed to treat drainage during the period of vegetation establishment in these areas.

A.3.4.4 Backfilling (Special Handling)

If material is encountered during mining-related operations within the life-of-mine area that is not suitable for reclamation, it would be selectively handled. This material would be placed in the backfill at the base of the highwall, below the vegetation rooting zone, above the groundwater potentiometric surface, and outside the area of drainage channels or their floodplains. Unsuitable mine development waste (e.g., rock, material from the mine refuse storage area) would also be placed in the backfill at the base of the highwall. After compacting, all specially handled material would be covered by a minimum 4-foot layer of nontoxic, noncombustible material.

To be sure no unsuitable material was overlooked, regraded backfill in the highwall area would be sampled at a density of 1 hole per 100 feet on a square grid basis. Should any sampled materials prove unsuitable for revegetation, additional sampling would locate the exact area of unsuitable material. These areas would be eliminated by deep ripping and blending, adding amendments, or removing the unsuitable material and replacing it.

A.3.4.5 Topsoil Replacement

During final reclamation, backfilled material would be ripped prior to redistribution of the topsoil material. Backfill in the surface facilities complex would be ripped to a minimum depth of 18 inches, whereas backfill at other Project areas, including the Iron Springs and Moapa unit-train loadouts, would be ripped to a minimum depth of 12 inches.

Stockpiled topsoil would be spread uniformly across all regraded areas to establish a suitable seedbed for revegetation activities. Within the surface facilities complex, topsoil would be spread to a minimum depth of 12 inches. If needed, additional material would be obtained from the topsoil borrow area (Section A.2.1.3.2, Topsoil Borrow Area).

In those areas receiving immediate reclamation (interim and final), available topsoil that had been salvaged from the disturbed area would be respread over graded, ripped slopes immediately following construction activities. These areas include the Iron Springs and Moapa rail spurs, the Warm Creek/Benchtop Road, the Garkane 138-kV power transmission line, and other similar areas.

Topsoil would be replaced using scrapers or dozers, then graded with rubber-tire graders to final contours required to establish the postmining topography. To prepare an adequate seedbed, the soil would be tilled after final grading.

A.3.4.6 Revegetation Operations

All lands disturbed by Project-related activities that are not proposed for permanent facilities would be revegetated. No revegetation activities are proposed for the active travel surface of the Warm Creek/Benchtop Road or in the area of the truck maintenance facility, as these facilities would remain in place after the end of the Project. Final revegetation would be consistent with the long-term plans of the owner of that facility.

Eight seed mixtures are proposed for use in revegetation activities throughout the proposed Project area. They were developed to be compatible with the native vegetation in surrounding areas, to provide nutritious forage for livestock and wildlife, and to minimize surface soil erosion. (Scientific names for all the proposed revegetation species are listed in Table A-5.)

- Seed mixture No. 1, the interim revegetation mixture, is made up of rapid-establishment, drought-tolerant grasses, forbs, and shrubs. It would be used as a temporary cover for stabilization purposes within the surface facilities complex (e.g., around facilities, on the sediment pond, on topsoil

Table A-5 — Revegetation Species for the Proposed Warm Springs Project

Grasses	
Alkali sacaton	*Sporobolus airoides*
Annual rye	*Lolium perenne*
Blue grama	*Bouteloua gracilis*
Crested wheatgrass (Hycrest, Ephraim)	*Agropyron cristatum*
Galleta	*Hilaria jamesii*
Indian ricegrass	*Elymus hispidus*
Intermediate wheatgrass	*Stipa hymenoides*
Mesa dropseed	*Sporobolus flexuosus*
Needle-and-thread grass	*Stipa comata*
Sand dropseed	*Sporobolus cryptandrus*
Sideoats grama	*Bouteloua curtipendula*
Forbs	
Alfalfa	*Medicago sativa*
Common sunflower	*Helianthus annuus*
Desert plaintain	*Plantago insularis*
Desert princesplume	*Stanleya pinnata*
Eastwood camissonia	*Camissonia eastwoodiae*
Forage kochia	*Kochia prostrata*
Goldenhead	*Acamptopappus sphaerocephalus*
Gooseberry-leaf globemallow	*Sphaeralcea grossulariifolia*
Lewis flax	*Linum lewisii*
Narrow-leaf cattail	*Typha angustifolia*
Nelson globemallow	*Sphaeralcea parvifolia*
Palmer cleomella	*Cleomella palmeriana*
Palmer penstemon	*Penstemon palmeri*
Phacelia	*Phacelia pulchella*
Scarlet globemallow	*Sphaeralcea coccinea*
Yellow sego lilly	*Calochortus aureus*
Yellow sweetclover	*Melilotus officinalis*

Table A-5 — Revegetation Species for the Proposed Warm Springs Project (Continued)

Shrubs	
Big sagebrush (Wyoming)	*Artemisia tridentata wyomingensis*
Bigelov sagebrush	*Artemisia bigelovii*
Bitterbrush	*Purshia tridentata*
Blackbrush	*Coleogyne ramosissima*
Bottlebrush	*Eriogonum inflatum*
Broom snakeweed	*Gutierrezia sarothrae*
Bud sage	*Artemisia spinescens*
Cliffrose	*Purshia mexicana*
Creosotebush	*Larrea tridentata*
Four-wing saltbush	*Atriplex canescens*
Green ephedra (Mormon tea)	*Ephedra viridis*
Joint-fir ephedra	*Ephedra nevadensis*
Low rabbitbrush	*Chrysothamnus viscidiflorus*
Mat saltbush	*Atriplex corrugata*
Old-man sagebrush	*Artemisia filifolia*
Rubber rabbitbrush	*Chrysothamnus nauseosus*
Seep willow	*Baccharis glutinosa*
Shadscale	*Atriplex confertifolia*
Spiney hopsage	*Grayia spinosa*
Squawbush	*Rhus trilobata*
Torrey seepweed	*Suaeda torreyana*
White bursage	*Ambrosia dumosa*
Winterfat	*Ceratoides lanata*
Grass-like	
Baltic rush	*Juncus balticus*

stockpiles with a life of more than 6 months, and where vegetation is needed to provide a temporary, effective cover). It would consist of crested wheatgrass (Hycrest), intermediate wheatgrass, and Indian ricegrass; alfalfa and yellow sweetclover; and four-wing saltbush, rubber rabbitbrush, and low rabbitbrush.

- Seed mixture No. 2, the minesite revegetation mixture, would be used to restore the shadscale-galleta community in and around the surface facilities complex. It would consist of blue grama, galleta, Indian ricegrass, sand dropseed, and needle-and-thread grass; Palmer penstemon and Nelson globemallow (or gooseberry-leaf globemallow); and bud sage (transplants only), four-wing saltbush, shadscale, winterfat, rubber rabbitbrush, low rabbitbrush, green ephedra (Mormon tea), cliffrose, and squawbush.

- Seed mixture No. 3, the upper-elevation benchlands revegetation mixture, would be used to restore the pinyon-juniper and warm desert shrub communities on the flat, upper-elevation benchlands of the Smoky Hollow life-of-mine area, including the topsoil borrow area. It would consist of sideoats grama, blue grama, galleta, Indian ricegrass, and needle-and-thread grass; Palmer penstemon, scarlet globemallow, and Nelson globemallow (or gooseberry-leaf globemallow); and four-wing saltbush, shadscale, winterfat, rubber rabbitbrush, green ephedra (Mormon tea), spiney hopsage, and cliffrose.

- Seed mixture No. 4, the Smoky Mountain Road revegetation mixture, would be used to restore the spiny hopsage-Indian ricegrass community along the Benchtop and Warm Creek access roads, the Mustard Point repeater station, and the 138-kV power tranmission line right-of-way. It would consist of galleta, Indian ricegrass, sand dropseed, and needle-and-thread grass; Nelson globemallow (or gooseberry-leaf globemallow), desert princesplume, alfalfa, and yellow sweetclover; and four-wing saltbush, shadscale, winterfat, spiney hopsage, and cliffrose. Several additional species could be included in this mixture, as necessary. They would include alkali sacaton and Mesa dropseed; goldenhead, Lewis flax, and phacelia; and Bigelov sagebrush, old-man sagebrush, blackbrush, bottlebrush, and bitterbrush.

- Seed mixture No. 5, the Tropic Shale mixture, would be used for the restoration of the salt desert shrub communities along the Warm Creek Road. It would consist of galleta, Indian ricegrass, and alkali sacaton; Palmer cleomella, common sunflower, Nelson globemallow (or gooseberry-leaf globemallow), and desert princesplume; and shadscale, mat saltbush, and Torrey seepweed. Several additional species could be included in this mixture, as necessary. They would include Mesa dropseed; yellow sego lily, Eastwood camissonia, and phacelia; and winterfat and bottlebrush.

- Seed mixture No. 6, the riparian revegetation mixture, would be used for the restoration of the riparian communities within the life-of-mine area and along the Warm Creek/Benchtop Road. It would consist of narrow-leaf cattail; seep willow, rubber rabbitbrush, and broom snakeweed; and Baltic rush.

- Seed mixture No. 7, the Iron Springs revegetation mixture, would be used to restore the desert shrub community at the Iron Springs unit-train loadout site. This seed mix would also be used to revegetate temporary disturbances and construction-related disturbance within the loadout site. It would consist of crested wheatgrass (Hycrest and Ephraim), galleta, Indian ricegrass, and sand dropseed; forage kochia, yellow sweetclover, and scarlet globemallow; and big sagebrush (Wyoming) and four-wing saltbush.

- Seed mixture No. 8, the Moapa revegetation mixture, would be used to restore the white bursage-creosote community at the Moapa unit-train loadout site. This seed mix would also be used to revegetate temporary disturbances and construction-related disturbance within the loadout site. It would consist of galleta and Indian ricegrass; desert plantain; and white bursage, joint-fir ephedra, and creosotebush.

Whenever possible, seeds of native species would be collected and/or purchased in the local area to promote genetic uniformity and increase revegetation success.

All reseeding would take place within 90 days of soil replacement, if possible. Otherwise, it would occur immediately prior to, or during, the most favorable periods for plant growth. To take advantage of late summer and fall moisture, seedings would take place from July 15 to November 15 in the Smoky Mountain and Fredonia areas, from September 1 to November 1 in the Iron Springs area, and from November 1 to December 1 in the Moapa and Hurricane areas. Spring seedings could begin after spring thaw and continue until early May in all areas. Drill seeding, hydroseeding, or broadcast seeding would be used, depending upon time of year, soil texture, vegetation species, and slope. Rates for drill seeding would generally range from 15 to 34 pounds of pure live seed per acre, depending on the specific needs of the surface management agency. Five pounds of pure live seed would be drill-seeded on each acre of the Iron Springs and Moapa unit-train loadout sites. Where broadcast seeding is used, seeding rates would double the rates used for drilling.

If an area was not ready for revegetation during the spring or fall reseeding periods, or seed could not be applied for more than 90 days, that area would be rough-tilled and mulched. Cover crops of winter barley or other annual grains may be planted at rates of 10 to 15 pounds per acre in conjunction with seedings of perennials. Forage kochia may be broadcast-seeded at a rate of 2 pounds per acre over snow cover in winter or early spring at the Iron Springs unit-train loadout.

Disturbed areas would be fertilized during seeding operations, depending on the specific needs of the surface management agency. Before reseeding, routine representative soil samples would be taken to determine fertilization rates. Fertilizer would be applied by broadcast methods. Owing to potential conflicts with the desert tortoise, no fertilizer would be applied at the Moapa unit-train loadout site.

Where possible, broadcast-seeded/fertilized areas would be disked, chained, or harrowed to cover the seed and multipacked or dozer-tracked to firm the seedbed.

Mulch would be used at all reclaimed sites, as needed. Straw mulch would be used at a rate of 1 to 2 tons of clean straw or hay (certified weed-free) per acre and anchored by crimping or netting. Artificial mulches, such as hydromulch, rock riprap, jute netting, excelsior, and paper-net mulch, would be used where straw mulch was not sufficient, depending on the specific needs of the surface management agency.

A.3.5 Enhancement Activities

A.3.5.1 Vegetation Enhancement

Existing survey data on the Smoky Mountain evening primrose and the Higgins biscuitroot would be updated with intensive field inventories in and around those areas proposed for Project-related construction and/or subsidence activities. The inventories would be conducted for the presence of these species by an agency-approved biologist using approved survey protocol. A report of findings would be prepared and submitted to appropriate State and Federal agencies no more than 2 years prior to disturbance. Additional inventory, evaluation, and mitigation measures, if necessary, would be coordinated with the agencies involved. Specifically, that part of John Henry Canyon (i.e., north-facing slopes) that could be affected by the construction of the proposed Benchtop Road would be inventoried for the presence or absence of the Smoky Mountain evening primrose, and those Tropic Shale areas that could be affected by the reconstruction of the proposed Warm Creek Road would be inventoried for the presence or absence of the Higgins biscuitroot.

Weeds and pests would be controlled whenever they became a problem. Herbicides could be used, but weeds preferably would be mowed before reaching seed maturity. Herbicides would be applied according to the recommendations of the manufacturer.

Final grading plans would include small depressions, local topographic undulations, and contour furrows to minimize erosion, trap sediment, conserve moisture, and promote vegetation. These features would be field-located during reclamation operations and should not restrict normal access through the reclaimed areas or constitute a hazard.

To the extent possible, soil materials would not be handled during unduly moist or wet conditions in order to avoid compaction. Similarly, soil handling would be avoided during extremely windy conditions to reduce the potential for excessive wind erosion. If material from the topsoil borrow area is needed, it would be hauled directly from the borrow area to the final revegetation site.

Alternative erosion-control techniques would include the use of diversions, check dams, ditches, erosion stops, matting, and roughened surfaces. These treatments could be implemented in conjunction with various kinds of straw bales, netting, and matting to effectively reduce overland flow, where necessary. Should gullies with excessive, active downcutting form, they would be blocked with one of the above-mentioned treatments and given the opportunity to stabilize naturally by vegetation growth.

Riprap or other suitable channel linings would be utilized to minimize the potential for erosion during runoff events.

For all revegetation areas larger than 1 acre, temporary fences would be built to ensure protection from trampling and grazing by cattle until the plant communities were mature enough to withstand grazing pressure. Permanent fencing and cattle guards would be replaced in those locations in the proposed Project area where determined necessary for grazing management needs.

A.3.5.2 Hydrologic Enhancement

Water resources (potential) at 17 seeps/springs in and around the Smoky Hollow life-of-mine area would be monitored for mining-related effects (Sections A.2.1.3.5, Water Monitoring Facilities, and A.3.5.6.5, Hydrologic Monitoring). If routine monitoring indicated that any of those seeps were impacted by mining-related activities, these resources would be replaced at or near their original location through the use of interim water supplies, repair of shallow surface fractures, horizontal drains, or guzzlers.

A.3.5.3 Wildlife Enhancement

A.3.5.3.1 Wildlife Habitat

Reclamation activities throughout the proposed Project area would restore existing wildlife habitats by creating similar habitats in form and function. Vegetation species in proposed revegetation seed mixtures include 23 native shrub species selected for their palatability, nutrition, and cover values for locally identified wildlife species (Section A.3.4.6, Revegetation Operation).

Undulations and small hills would be designed into the regraded final topography to enhance habitat diversity. Rockpiles and boulders would be placed throughout the reclaimed surface facilities complex, Iron Springs unit-train loadout, and Moapa unit-train loadout in a random fashion to provide visual cover during wildlife movement. They would be placed at a density of about 10 to 15 rockpiles per 640-acre section, depending on the availability of material.

If necessary, scattered, riparian habitat and associated water resources disturbed by mining activities or disrupted during road construction would be replaced in the immediate vicinity of the original community (Section A.3.5.2, Hyrdrologic Enhancement). Vegetation species in the proposed riparian revegetation seed mixture (mixture No. 6) include species selected for their riparian values (Section A.3.4.6, Revegetation Operations).

Permanent sedimentation impoundments could remain after reclamation operations at the end-of-mine life if Utah DWR receives approval from Utah DNR, Utah DOGM, and BLM to maintain the impoundments for wildlife purposes beyond that period.

A.3.5.3.2 Desert Tortoise Habitat

Appropriate Federal and State wildlife agencies would be immediately contacted if any desert tortoises or eggs were to be observed in or near proposed Project locations in the Moapa or Hurricane areas.

Existing survey data on the desert tortoise would be updated with intensive field inventories in and around areas proposed for Project-related construction activities that lie within identified desert tortoise habitat (e.g., the Moapa unit-train loadout and the Hurricane truck maintenance facility). The inventories would be conducted for the presence of desert tortoises or eggs by an agency-approved biologist using approved survey protocol. A report of findings would be prepared and submitted to appropriate Federal and State agencies no more than 1 year prior to disturbance. Additional inventory, evaluation, and mitigation measures, if necessary, would be coordinated with the agencies involved. In addition to general inventory updates, a thorough tortoise survey would be conducted in and around all proposed construction areas by a qualified tortoise biologist to locate any tortoises or eggs that could be present prior to beginning construction activities. Owing to the uncertain and hypothetical nature of the Hurricane truck maintenance facility, tortoise surveys would be delayed until after a decision was made to place the facility in the Hurricane area, a definite location for that facility was selected, and desert tortoise habitat was determined to be present.

Prior to construction, tortoise-proof fencing would be installed around the perimeter of the west-side train loading facility and east-side truck unloading facility at the Moapa unit-train loadout, and, if necessary, around the perimeter of the Hurricane truck maintenance facility. The fencing would be reduced to the limits of actual use in those areas after construction activities have been completed but would be maintained for the life of the Project. The fence would consist of 1-inch mesh, 36-inch-wide hardware cloth (i.e., steel-mesh fencing) of which 12 inches would be buried and 24 inches would extend aboveground. In areas where surface materials preclude burying, the fence would be constructed to maintain zero clearance between the ground and the bottom edge of the hardware cloth. Tortoise-proof guards or gates would be installed at entrances to the work areas. At the Moapa unit-train loadout, the main access road being used by haul trucks would be open at the turnoff from the Hidden Valley Road.

Triangular trenches would be installed along both shoulders of the main access road to the east-side truck unloading facility at the Moapa unit-train loadout to limit tortoise access to the roadway. Trenches, with a 3-foot vertical wall on the road side and outslopes of 3 horizontal feet to each 1 vertical foot (3:1), would be located at the perimeter of each shoulder. Should trenches prove to be inadequate to prevent tortoise access to the roadway, a tortoise-proof fence would be constructed.

Tortoise-proof fences would be monitored, particularly following any rainfall events, and regularly maintained monthly. Trash and sediment would be removed, and the integrity of the buried/zero clearance aspects of the fence would be maintained.

Corrugated-metal culverts, at least 24 inches in diameter, would be installed at regular intervals under both the main access road to the east-side truck unloading facility and the loop railroad track bed in the west-side train-loading facility at the Moapa unit-train loadout to allow desert tortoises to move from one side of the road/railroad to the other.

An active litter control program, including the use of covered, raven-proof trash containers, would be implemented at each construction site and maintained throughout the life of the Project. All trash would be removed from the site to a designated solid-waste facility on a regular basis. In addition, all powerpole structures in tortoise habitat would be designed to deter raven nesting and perching.

Qualified tortoise biologists would be onsite during all phases of facility construction, including fence installation, to ensure that desert tortoises or their eggs would not be inadvertently harmed. Construction areas outside the fenced exclosure areas (including access and service roads, powerlines and maintenance roads, yard-conveyor areas, and loop railroad tracks and maintenance roads) would be searched no more than 24 hours prior to initiation of construction activities. Searches would use techniques designed to provide 100 percent coverage. Any desert tortoise burrows or any other species' burrows that may be used by desert tortoises would be marked and then examined for occupancy, using fiber-optic scopes, if necessary. A minimum of two searches would be conducted.

Any desert tortoises or eggs found within the construction areas would be removed by qualified tortoise biologists using Agency-approved protocol. Burrows would be excavated by hand, using hand tools, to ensure the animals' safe removal. Tortoises would be released in undisturbed habitat in the vicinity of the collection site. They would be placed in the shade of a shrub, a natural unoccupied burrow, or an artificial burrow. Tortoises would be released on private lands only with the written permission of the landowner. If a suitable location could not be found in the immediate area or if eggs or dead, sick, or injured individuals are involved, the tortoises or eggs would be removed to an approved transfer or conservation facility. Deliveries would occur in clearly marked cardboard boxes after a 10-day notice had been given to the transfer/conservation facility.

All construction areas outside the fenced exclosure areas, including equipment storage areas, would be clearly marked or flagged at their outer limits prior to beginning any surface-disturbing activity. All personnel would be informed that their activities must be confined within the marked or flagged areas throughout the life of the Project. Heavy equipment operators working outside a fenced area would be accompanied by a tortoise biologist.

All permanent and temporary workers, including supervisory and maintenance personnel, would be informed about the desert tortoise, including its life history, its protected status, an explanation of "taking," penalties for taking a threatened species, protocols for dealing with tortoises if they were to be encountered, and specific terms and conditions of permits related to the desert tortoise. Employees would be required to sign an acknowledgement form at the completion of training.

A company representative would be designated to coordinate with BLM and to oversee compliance with all desert tortoise protective measures.

Before moving vehicles outside the fenced exclosure area, employees would be required to inspect the area for desert tortoises around and beneath their vehicles or equipment.

All construction and operations traffic would be limited to 25 mph within the loadout/maintenance facility area. Traffic would be restricted to construction, access, and service roads within the loadout/maintenance facility area. No cross-country travel would be permitted.

The Desert Tortoise Habitat Conservation Fund No. 730-9999 (administered by the Clark County Department of Administrative Services) would be supported through the payment of a standard fee of $324 per acre of tortoise habitat disturbance at the Moapa unit-train loadout. Fees would be used by the county for the purpose of securing tortoise management areas, habitat enhancement, and tortoise research.

A.3.5.3.3 Hydrologic Structures

Water delivery systems, consisting of either freeze-proof piping and watering troughs or some other appropriate mechanism, would be installed at any horizontal drain or guzzler development that may be required to supply the drinking water needs of wildlife and livestock. Any horizontal drain or guzzler that is developed would be fenced to prevent habitat degradation by livestock. Design overflow areas would be maintained inside the exclosure fence to preserve their availability for small game.

The slopes associated with construction or repair of sediment ponds would be designed to provide easy access for wildlife and revegetated to ensure adequate wildlife cover and forage.

A.3.5.3.4 Other Enhancements

Appropriate Federal and State wildlife agencies would be immediately contacted if any federally or State-listed endangered or threatened species (plant or animal) were to be observed in or near the various Project areas.

Existing survey data on raptors and other small nongame species (reptiles, amphibians, bats, etc.) would be updated with intensive field inventories in and around those areas proposed for Project-related construction and/or subsidence activities. The inventories would be conducted for the presence of breeding birds or animals by an agency-approved biologist using approved survey protocol. A report of findings would be prepared and submitted to appropriate Federal and State agencies no more than 1 year prior to disturbance. Additional inventory, evaluation, and mitigation measures, if necessary, would be coordinated with the agencies involved. In addition to general inventory updates, inventories would be made for the presence or absence of:

- The Mexican spotted owl in that part of Wesses Canyon that could experience the surface effects of proposed underground mining (subsidence) at the Smoky Hollow Mine and that part of John Henry Canyon that could be affected by the construction of the proposed Benchtop Road.

- The peregrine falcon in those areas in and around the Smoky Mountain area that could be affected by proposed Project activities.

- The ferruginous hawk in those areas in and around Iron Springs that could be affected by activities associated with the proposed Iron Springs unit-train loadout.

All powerlines constructed for mining-related operations would be designed to minimize electrocutions of raptors, waterfowl, and other wildlife species (Ollendorf et al. 1981). The conductors on 69-kV and larger power transmission lines are, by design, spaced far enough apart to preclude raptor electrocution. Smaller powerlines would be constructed in accordance with Rural Electric Association standards and other suggested practices for raptor protection on powerlines designed to reduce risk of electrocution to raptors. In addition, raptor-perch platforms would be installed on 138-kV power transmission line structures at various remote locations along the route from south of Big Water to the mine, in consultation with Utah DWR.

Fences throughout the Project area would be constructed to BLM design standards. Wire would be spaced to ensure that fences would not restrict wildlife movements and migration. In secure, hazardous, or critical areas, an 8-foot-high woven-wire or chainlink fence would be used to keep out wildlife and unauthorized personnel. Tortoise-proof fencing would also be installed around facility areas at the Moapa unit-train loadout, and, if necessary, at the Hurricane truck maintenance facility (Section A.3.5.3.2, Desert Tortoise Habitat). When topography and materials allow, rockpiles, brush, and other natural barrier materials would be used to supplement fencing and to create small mammal habitat and cover but still block livestock access around horizontal drains or guzzler development areas.

Speed limits for Project personnel on all unpaved access roads throughout the Project area would be restricted to 25 mph to reduce wildlife/vehicle collisions.

Andalex would provide assistance to Utah DWR for the evaluation of existing deer populations, including participation in a radio-collaring program. If studies indicate the need, Andalex would also participate in the construction of several proposed water impoundment structures north of U.S. Hwy. 89 in Kitchen Corral Wash, Fin Little Canyon, Telegraph Wash, and Seaman Wash. In conjunction with BLM, Utah DWR may propose to reduce the extent of the Paunsaugunt Mule Deer Herd migration across U.S. Hwy. 89 in the vicinity of milepost 41 to 51 by providing additional water resources on the north side of the highway. In order to dilute the density of haul trucks on this stretch of highway at any one time, a continuous (24-hour) haulage schedule would be used whenever the mine operates at full production.

All employees, including those involved in temporary construction activities, would be informed about appropriate Utah, Arizona, and/or Nevada game laws and cautioned not to harass or poach game and nongame animals. In addition, they would be instructed to report highway mortality of wildlife, particularly deer. These employees would also receive annual training from qualified individuals to develop awareness of and sensitivity to wildlife issues and concerns specific to the proposed Project area.

A.3.5.4 Air Quality Enhancement

Air quality impacts from fugitive dust and particulates would be controlled through a variety of measures, according to the terms of the permits issued by the responsible air quality regulatory agencies (Appendix D). These measures would ensure that visible emissions (the opacity of the air) at certain emission points throughout the Project area did not exceed specific limits, ranging between 10 and 20 percent.

All coal storage piles at the surface facilities complex and the Iron Springs and Moapa unit-train loadouts would be watered, as conditions warrant, to minimize the generation of fugitive dusts and to maintain an average moisture content of 6.5 percent in the pile and throughout all transfer points within each facility. In addition, the crusher, the truck loadout structure, and all conveyor-to-conveyor transfer points would be enclosed. All aboveground conveyors would be covered, and all reclaim points would be located below the stockpile(s). Water sprays would be installed ahead of the crusher.

Coal production at the mine would be limited to a maximum 3.0 million tons per 12-month period; the truck haul would be limited to a maximum 175 haul trucks loaded per 24-hour period; and the diesel generator would be limited to a maximum 12 hours of operation per 24-hour period and to 2,400 hours of operation per 12-month period.

During the 40 years of full coal production, haul trucks traveling between the mine and the unit-train loadouts would travel only on paved roads (chip-and-seal or asphalt). Paved roads within the truck loop(s) at the mine and loadouts would be water-flushed and/or broom-swept as necessary to control fugitive dust. Haul trucks would not exceed 10 mph on the truck loop road(s).

All fuel-oil-powered (diesel-powered) equipment used at the mine or the unit-train loadouts would use low-sulfur fuel oil (less than 0.50 percent sulfur, by weight) to control emissions of sulfur dioxide (SO_2).

All unpaved roads used by mining-related equipment would be chemically treated with magnesium chloride ($MgCl_2$) or its equivalent to control fugitive dust. Areas disturbed during construction of the various facilities that would not be subject to repeated disturbance would be revegetated. Repeatedly disturbed areas would also be chemically treated with $MgCl_2$.

Daily records of production/operation would be kept for all periods when the coal processing and handling facilities at the mine and unit-train loadouts were operating.

A.3.5.5 Archaeological and Paleontological Conservation

Appropriate Federal and State agencies would be immediately contacted if any archaeological, cultural, or paleontological resources were to be found in or near the various Project areas.

Existing survey data on archaeological, cultural, or paleontological resources would be updated with intensive field inventories in and around all areas proposed for Project-related construction activities. In addition, those areas within the Smoky Hollow life-of-mine area that have a high probability both for archaeological, cultural, or paleontological resources and for future surface disturbances due to mining-related subsidence would be identified. A report of findings would be prepared and submitted to appropriate Federal and State agencies no more than 2 years prior to disturbance. Additional inventory, evaluation, and mitigation measures, if necessary, would be coordinated with the agencies involved.

Archaeological and/or paleontological sites that could not be avoided would be tested for eligibility in the National Register of Historic Places. Data recovery programs would be completed prior to actual disturbance. In areas of high resource potential, a qualified archaeologist/paleontologist would monitor all construction activities, and development zones would be flagged to limit construction traffic and personnel movement.

Intensive on-the-ground (field) surveys have already been conducted to identify existing archaeological, cultural, and paleontological resources in those proposed Project areas where mining-related surface disturbance has been proposed. Specifically, qualified archaeologists and paleontologists surveyed the entire area in and around the proposed microwave communication sites, the proposed Moapa unit-train loadout, and the proposed Iron Springs unit-train loadout, and those areas involved with the proposed 138-kV power transmission line, the proposed Warm Creek Road, and the proposed Benchtop Road. Selected areas associated with the proposed Smoky Hollow Mine (the surface facilities complex, the existing exploration boreholes, and the topsoil borrow area) were surveyed as well. In all cases, the surveys covered the actual area of the proposed mining-related disturbance and a reasonable buffer zone around those areas.

Field survey results were used during the design and engineering of the routes for the 138-kV power transmission line, the Warm Creek Road, and the Benchtop Road. The alignment of the 138-kV power transmission line was altered to avoid two specific archaeological sites, and the pole site locations and spacing were adjusted to avoid several others. Five segments of the Warm Creek Road alignment were relocated within the Warm Creek drainage, and four segments of the Benchtop Road alignment were relocated in Nipple Creek Canyon and on Nipple and Tibbet Benches.

All employees,including those involved in temporary construction activities, would be informed about appropriate Federal and State cultural and historic laws and cautioned not to disturb any sites they might uncover. These employees would receive annual training from qualified individuals to develop an awareness of and sensitivity to cultural/historic issues and concerns specific to the proposed Project area.

A.3.5.6 Environmental Monitoring

A.3.5.6.1 Introduction

Environmental monitoring would be conducted regularly at all proposed Project locations to further define predisturbance baseline environmental conditions and to detect mining operation-related changes. Operational and postmining data would be compared with predisturbance data during the life of the proposed Project to design corrective measures, as needed. All monitoring would be conducted by agency-approved personnel using approved monitoring protocol.

In addition to vegetation, wildlife, subsidence, and hydrologic data collection, monitoring would be conducted for undetected cultural or paleontological resources, topsoil stability and suitability, and meteorological data.

A.3.5.6.2 Vegetation

Monitoring would be conducted to assess the success of revegetation efforts in all disturbed areas throughout the Project area. Revegetated areas would be evaluated for cover and density during the first two seasons following seeding or planting to determine initial revegetation success. All revegetated areas within the life-of-mine area would be evaluated for cover, frequency, density, and productivity in years 2 through 5 and in years 8 through 10 following seeding or planting. If vegetation monitoring showed that corrective action were to be needed, reclamation techniques and seed mixes would be revised to address the specific revegetation concerns.

In addition, revegetation test plots would be initiated to investigate the success or failure of various revegetation procedures, including type of mulches, type of water-harvesting mechanism, optimal season for seeding, and the effect of microclimates. Following seeding and raking, 10 or more plots would be established on parts of the topsoil pile located at north end of the surface facilities complex. Plots would be treated with three different mulch techniques (hydromulch, straw mulch held down by either netting or excelsior-type matting, and a polyacrylamide soil stabilizer); two different water-harvesting techniques (contour furrowing and land imprinting); two different planting season scenarios (late July and late October); and two different microclimate scenarios (with and without large boulders).

A.3.5.6.3 Wildlife

Monitoring would be conducted to detect changes in wildlife concentrations at all Project locations in the Smoky Mountain area (including the Warm Creek/Benchtop Road, the surface facilities complex, and those areas of potential subsidence) and the unit-train loadout sites during the life of the Project. This would include variations in species distribution or relative abundance and degradation of habitats for indigenous species, such as snakes, lizards, bats, tortoise, deer, and raptors. Monitoring activities would include field surveys, data compilation, impact assessment, and report preparation, when necessary.

The presence and distribution of breeding raptors throughout the Project area would be monitored on a regular basis. Observations of species or their sign would be recorded. Previously recorded nests would be examined for occupancy during any scheduled aerial survey. In addition, each nest would be checked from the ground. When appropriate, active nests would be monitored throughout the breeding season to determine success and production. Opportunistic observations made during aerial and ground surveys would be used to identify pairs of raptors not affiliated with a known nest in the area. New nests would be monitored along with all other recorded nests.

Extensive monitoring of desert tortoise populations would occur during planning and construction of the Moapa unit-train loadout, and, if necessary, at the Hurricane truck maintenance facility (Section A.3.5.3.2, Desert Tortoise Habitat). Limited monitoring would continue throughout the remainder of the service life of the facility.

A.3.5.6.4 Subsidence

Photogrammetric monitoring would be conducted throughout the life-of-mine area to detect movements in the land surface from mining-related subsidence. Monument grids would be placed over the mining panels, extending over the solid coal block, and surveyed to detect ground movements. The subsidence monitoring grid would include monuments located outside the mining area to serve as constant reference points for photogrammetric measurement of the area above the longwall panels. All monuments would be constructed to ensure that they would not be affected by movements unrelated to subsidence, such as soil heave due to freezing. Site-specific angle of draw, subsidence factor, tensile strain, and extent of subsidence would be calculated. The photogrammetric subsidence readings (baseline elevations minus the new elevations), mapped to depict the net change in elevation in the area, would be submitted to Utah DOGM annually.

Visual monitoring would be conducted along all public/county roads located above the potential subsidence areas for surficial cracks resulting from mining-related subsidence. Potential subsidence areas would be posted to inform the traveling public of possible subsidence damage. Damaged areas of the roadway would be blocked until the damage could be repaired. Temporary alternate routes would be designated. Andalex has committed to assisting Kane County in the posting, monitoring, and rapid repair of mining-related damage to the public roadways in the Smoky Mountain area.

A.3.5.6.5 Hydrologic Monitoring

Monitoring would be conducted in and adjacent to the Smoky Hollow Mine to detect changes in a variety of the surface and underground wells, and in 1 sediment pond, 17 seeps/springs, and 14 drainage bottom sites in the Warm Creek drainage system (Wesses, John Henry, Smoky Hollow, and Warm Creek Canyons). All the wells, 10 of the seeps/springs, 9 of the drainage bottom sites, and the sediment pond are located within the life-of-mine area (Section A.2.1.3.5, Water Monitoring Facilities and Table A-3). Seven of the seeps/springs and five of the drainage bottom sites are located outside the life-of-mine area. Monitoring would include both quantity and quality information recorded on a quarterly basis and/or after major precipitation events. Within the life-of-mine area, monitoring frequency would increase as mining approached, then passed below, the location of a particular feature. When more frequent monitoring indicated that the effects of subsidence had stabilized, the original, less frequent monitoring schedule for that feature would resume. Particular data to be collected would depend somewhat on the type of hydrologic feature being monitored. Wells would be monitored for water elevation and quality. Seeps and ephemeral drainages would be monitored for flow rate and quality.

SUMMARY DESCRIPTION OF CUMULATIVE DEVELOPMENT

APPENDIX B

B.1 INTRODUCTION

Several past, present, and reasonably foreseeable future projects have been identified in the southern Utah, northern Arizona, southeastern Nevada area that could contribute cumulative effects to the environment in combination with development of the proposed Project. The following discussions provide descriptions of each project considered in this EIS, including its location, the nature of the business, its size, and who operates or manages it. The actual effects of these projects, evaluated in association with the proposed Project, are discussed throughout Chapter 4, where appropriate.

B.2 PROJECT DESCRIPTIONS

B.2.1 Cedar City Industrial Park

The Cedar City Industrial Park is located on 140 acres near the Cedar City, Utah, municipal airport at Kitty Hawk Street and Airport Road, 2.5 miles west of Cedar City, Utah.

The Industrial Park, which is operated and managed by the City of Cedar City, Utah, currently has three companies in operation at its facilities: Anderson-Hickey, a manufacturer of steel office furniture; DCI, Inc., a fabricator of steel tanks for food and water; and Fabral, a manufacturer of steel and aluminum roofing and siding. Additional operation facilities are under construction.

Anderson-Hickey recently began operations with 50 workers. The company plans to increase the workforce to 250 in 1995 or 1996. The plant is 87,000 square feet in size. Seventy operations workers will be employed once the project is fully operational. Only two or three managerial workers will be in-migrants and the rest have been and will be local hires. Because of the local hires, the company has no plans to alleviate housing problems for workers. The project is expected to have a life of many years (Burchfield 1993).

DCI, Inc., began fabrication operations in 1994 in a 41,000-square-foot plant built at a cost of $3 million. Thirty-four employees currently work at the facility, and up to 85 are expected to be employed in 1995. Supplies are delivered by common carrier, totaling two or three round-trips a day, mostly coming south to Cedar City on Interstate-15. Two to three times a week, over-dimension trucks leave the plant on the interstate, mostly going to markets on the West Coast. Long-range plans include possible doubling of the workforce in the next 5 to 10 years (Howard 1993; Conant 1994).

Fabral has been in operation since late June 1994 and occupies a 20,000-square-foot facility. The company currently has 7 full-time employees, with 14 full-time employees expected when peak operation is reached by 1996. One truck per day carrying finished product leaves the facility; 20 trucks per day are expected to leave the facility during peak operation (Hill 1994). About 10 trucks per week will be arriving at the facility to deliver raw materials. Fabral was previously owned by Alcan Aluminum in Cleveland, Ohio; it currently is in the process of being purchased by Genstar Capital Corporation.

Cedar City Industrial Park is expanding its boundaries to accommodate current and future tenants. A 100,000-square-foot facility for Gen-Pak, a manufacturer of polystyrene containers, is under construction. Gen-Pak is expected to hire 100 employees as soon as operations begin.

A 500,000-square-foot facility for O-Sullivan, a furniture manufacturer, is also under construction. Approximately 100 employees will be hired initially by O-Sullivan, with an anticipated future workforce of 450 employees after several years.

Construction of a 12,000-square-foot facility for Al-Co Precision Covers, a mountain-bike parts manufacturer, has been completed and the company is moving into the building. Al-Co will hire 25 employees.

A packaging company, which could potentially hire 50 employees, is negotiating with Cedar City for a 50,000-square-foot space in the industrial park (Drew 1994).

B.2.2 CMS Generating Company Tires-to-Energy Project

The CMS Generating Company Tires-to-Energy Project, which will be managed by CMS Generating Company of California, a unit of CMS Energy Corporation of Dearborn, Michigan, would be located near Moapa, Nevada, about 2 miles northeast of the Reid Gardner Powerplant.

CMS is proposing to build a 53-megawatt, tires-to-energy cogeneration plant that is expected to operate for 30 years on 100 acres of land that it owns. Power from the facility would be sold to utilities.

Construction will take about 24 months and would employ 37 workers at full operation. An additional 50 to 60 employees would collect tires for use as fuel. These numbers do not include personnel involved in sorting or transporting the tires to the generation plant.

A large percentage of the tires would be shipped to the plant by rail. Approximately 5 to 10 trucks per day would also deliver tires to the facilities. A year's supply of tires would be stockpiled prior to initiating power production (Roberts 1994).

CMS has contracted with a Nevada contractor to build the plant. As many as 75 percent of the construction workers will be persons not now living in the area. A higher percentage of the permanent employees is anticipated to be local hires. The company will not assist in acquiring housing for either permanent or temporary workers (Shelton 1993).

As of September 1994, the Public Service Commission had not given final approval on the project due to disputes related to cost/benefit issues. The case is being appealed by CMS in District Court in Las Vegas, Nevada. A final decision on the project is not expected until 1996 (Roberts, J. 1994).

B.2.3 Deadman Canyon Mine Complex (Apex, Aberdeen, and Pinnacle Coal Mines)

The Apex, Aberdeen, and Pinnacle Coal Mines are 11 miles northeast of Price, Utah, and are operated and managed by the Tower Division of Andalex Resources, Inc., a privately owned company with corporate headquarters in Kentucky. The company also operates the Wildcat coal loadout facility, about 5 miles west of Price.

The three mines use three separate portals, or entrances, and follow three separate coal seams but share surface facilities. The mines lease 5,014 acres of Federal land and maintain a combined production rate from all three mines of about 1.5 million tons of coal per year, using both room-and-pillar/continuous mining and longwall mining methods of coal extraction.

The coal is hauled the 40-mile round-trip from the mines to the Wildcat loadout on standard double-trailer trucks. The mine operates 250 days per year, 5 days a week for 16 hours per day, at about 9 truck round-trips per hour for a total of about 136 to 144 truck trips per day. The mines employ 103 people: 25 salaried employees and 78 hourly employees (Andalex Resources, Inc. 1992 1994b).

B.2.4 Garkane Power Association Transmission Facilities

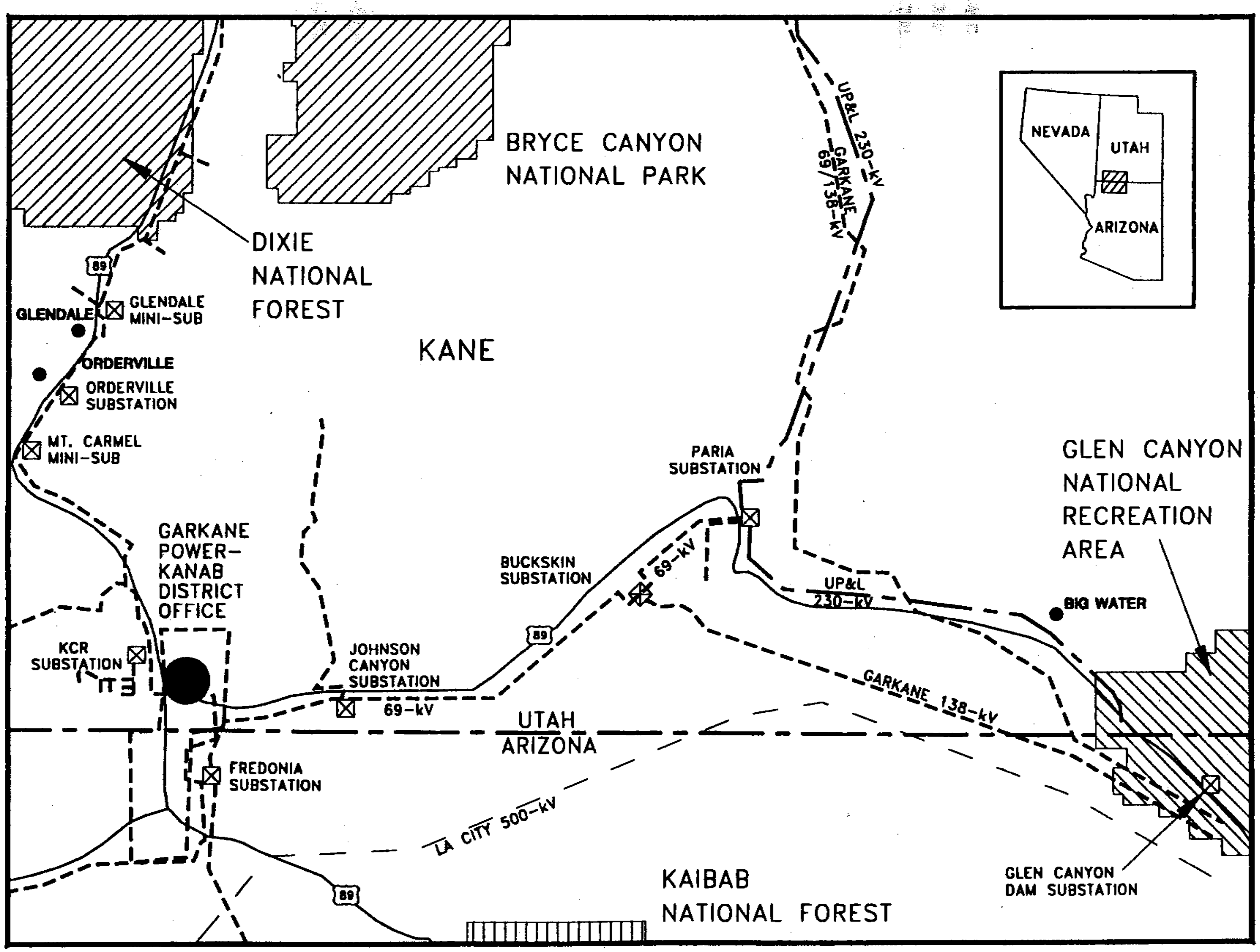
Garkane Power Association, a consumer-owned energy cooperative, has district offices in Loa, Hatch, and Kanab, Utah; its main office is in Richfield, Utah. It has a hydroelectric plant in Boulder, Utah, and is a part-owner in a coal-fired plant in the northeastern part of Utah. Garkane Power has a customer base of 7,000, and its service area includes six counties in Utah and two counties in northern Arizona (Figure B-1). It currently employs 40 people. Garkane Power has 1,685 miles of transmission and distribution lines with 30 substations. About 95 percent of the power supplied by Garkane Power is hydroelectric-generated, and 5 percent is coal-fired electric power. It receives its hydroelectric power from the Boulder, Utah, hydroelectric plant and from Glen Canyon Dam. The company currently sells 30 megawatts of total load, and its combined facilities have a net worth of $32 million.

B.2.5 Gateway Center Planned Unit Development

The Gateway Center Planned Unit Development (PUD), which will be operated by Sant Pacific Group of St. George, Utah, is planned for construction on U.S. Hwy. 91, near the Wal-Mart facility located at 148 North U.S. Hwy. 91. The site lies near Interstate 15 and Utah Route 9, 8 miles west of downtown Hurricane, Utah.

Within a larger PUD, 570 acres have been set aside for an industrial park at this location. The Wal-Mart facility was built within the industrial park; however, about 340 more acres are available for development.

Pace-American Trailer, which occupies 10 acres in the Center, has been in operation at the site since early 1994. The company employs 40 to 60 people and is currently in full operation. Three additional companies are currently negotiating for space in the Center (Cox 1994).



GARKANE POWER FACILITIES - - - - -
UTAH POWER & LIGHT FACILITIES —— - ——
LA CITY — — — —

NORTH

0 5 10
MILES

SOURCE: GARKANE POWER

WARM SPRINGS PROJECT

FIGURE B-1
GARKANE POWER AND UTAH POWER AND LIGHT TRANSMISSION FACILITIES

The total PUD is on 2,700 acres, two-thirds of which is Utah TLA lands to be leased, and one-third of which is fee land to be sold by the owner, Winding River Trust (Cox 1993 1994; Cardon 1993).

B.2.6 Gravel Operations

Several gravel operations are located along the Wahweap Terrace near Wahweap Creek, north of Big Water, Utah. They are as follows:

- Green Pit. Nielson, Inc., leases the Green Pit from Arthur Green, who leases it from Utah TLA. The 10-acre pit lies north and west of Big Water. The company is in the process of constructing an asphalt batch plant at the site. About 10 people work at the pit. Nielson's main office is in Cortez, Colorado. Until its closure, about 20 trucks per day entered and left the site; gravel was transported 25 miles to a road site in Arizona. Nielson's closed its gravel operation and began reclamation in October 1994 (Nofsinger 1994).

- Kocjan Pit. The Kocjan Company has completed removal of 75,000 cubic yards of gravel from land it leased in competitive bid on BLM land; work stopped in 1993. Haulage was to Page, Arizona. Some gravel remains in the area; BLM may have another competitive bid to allow removal of this reserve. The Kocjan area lies southeast of the Green Pit.

- Kaneco Pit. Cloyd Chamberlain has obtained a lease from BLM to mine 50,000 cubic yards of gravel west of and immediately adjacent to the Green Pit. Mining has not started; however, the operation has 5 years to begin work.

B.2.7 Hidden Valley Ranch

The Hidden Valley Ranch, about 800 acres, is located near Moapa, Nevada, north-northeast of the Reid Gardner Powerplant. The ranch, which is privately owned, operates with two full-time employees. The ranch currently leases 200 acres of pasture and dairy to the Moapa Valley Dairy and plans to lease the remaining 600 acres to a local Moapa, Nevada, farmer who plans to raise corn, barley, alfalfa, and winter wheat on the land.

About 1,000 pheasants are released each year on the ranch for private invitational hunting, which takes place from November through April (Davis 1994).

B.2.8 Intermountain Refining Company Facility

The Intermountain Refining Company's facility sits on 20 acres at 1346 North U.S. Hwy. 89A in Fredonia, Arizona, and is operated and managed by Unico of Farmington, New Mexico.

The facility has the capability to refine crude oil and generate power. At present, no refining is being done at the site. The company currently has no plans to expand; any expansion would depend upon crude oil availability and feed stock supply.

The company is currently generating power for Garkane Power using #2 diesel. The diesel is brought in by truck with one truck arriving every 2 to 3 days. When the refining process is operating, four to six trucks enter and leave the facility per day. The company currently employs seven people (Weaver 1994; Chatterly 1994).

B.2.9 Kern River Gas Transmission Pipeline

The Kern River Gas Transmission's pipeline delivers natural gas from Wyoming to California and is owned by Williams Company of Tulsa, Oklahoma, and Tenneco of Houston, Texas. The Kern River Gas Transmission Company manages the pipeline; its main offices are in Salt Lake City, Utah.

The Kern River gas pipeline extends from near Opal, Wyoming, south-southwest across Utah and Nevada and west across the Mojave Desert to San Bernardino and Kern Counties in California. It delivers natural gas to various local distribution companies in southern California from Utah, Wyoming, and western Canadian gas fields.

The pipeline is 837 miles long and carries 700 million cubic feet per day at a pressure of 1,200 pounds per square inch. The line passes directly south and east of the Reid Gardner Powerplant near Moapa, Nevada (Figure 1-4; Rhoads 1994).

B.2.10 Lasco Bathware Facility

Lasco Bathware is located at the intersection of Nevada Hwy. 168 with the railroad tracks, west of Moapa, Nevada.

The bathware factory, which will manufacture fiberglass bathtubs, should be in full operation by 1995 to 1996. The company expects to hire 60 employees initially, with at least 200 people employed at the factory when it is fully operational. The facility will occupy about 150,000 square feet; it is owned and operated by Tomkins Company of Dayton, Ohio.

About 20 trucks per day will deliver materials and load goods when the factory is fully operational. Initially 5 to 10 trucks per day will enter and leave the facility. The trucks will be using Nevada Hwy. 168 to access Interstate-15 (Braman 1994).

B.2.11 Los Angeles Department of Water and Power Transit System

The Los Angeles Department of Water and Power (LADWP) Transit System supplies and regulates water and power to the city of Los Angeles, California. The headquarters of the Power Operations and Maintenance Division of LADWP is located in Los Angeles, California. LADWP has two high-power transmission lines that run south and east of the Reid Gardner Powerplant near Moapa, Nevada: the Intermountain Line and the Navajo-McCullough Line (Figure 1-4).

The Intermountain Line is a plus or minus 500 kV-DC transmission line. It originates in Delta, Utah, and traverses 488 miles to its terminus in Adelanto, California, where the power is converted to usable forms. The Intermountain Line has a maximum load capacity of 1,920 megawatts, enough power to supply 1.9 million homes. The line is owned by the Intermountain Power Agency (IPA), a political subdivision of the State of Utah, which provides power to the California communities of Anaheim, Riverside, Pasadena, Burbank, Glendale, and Los Angeles. No municipalities are tapped into the Intermountain Line throughout its length, and LADWP does not foresee allowing any to do so in the future.

The Navajo-McCullough Line, a 500 kV-AC line, lies west of and adjacent to the Intermountain Line in the Moapa area. It originates in Page, Arizona, and traverses 274 miles to its terminus southeast of Las Vegas, Nevada, at the McCullough switching station. The Navajo-McCullough Line has a maximum load capacity of 1,200 megawatts, with the load determined by demand and time of year, and provides enough power to supply 1.2 million homes. Nevada Power Company, the U.S. Bureau of Reclamation, and LADWP own the Navajo-McCullough Line (Swyter 1994; Burt 1994).

B.2.12 Missing Canyon Coal Mine

The Missing Canyon Coal Mine, now inactive, is located in Smoky Hollow Canyon in the area of the proposed Warm Springs Project surface facilities complex (Figure A-2). Previous mining and exploration activities took place in the minesite area from 1964 to 1978 as part of the Kaiparowits Power Project. This activity included large-scale outcrop excavations, horizontal auger drilling, and development of an underground exploratory mine. The Missing Canyon Coal Mine was developed in Smoky Hollow in April 1971. This underground mine was a drift mine, developed using a continuous miner, shuttle cars, and roof bolter. Mining was conducted to obtain bulk samples for coal quality information and to develop knowledge of the mining conditions in the area.

About 12,000 tons of coal were mined from the underground workings. The mine was active during the spring of 1971; both portals were closed in 1973, and the mine became inactive. About 15 acres on the surface were disturbed as a result of coal mining and exploration activities. The original operators of the Missing Canyon Coal Mine were the Resources Company, a subsidiary of Arizona Public Service Company, San Diego Gas and Electric Company, and Southern California Edison Company (Andalex Resources, Inc. 1994a, c).

B.2.13 Moapa Valley Dairy

The Moapa Valley Dairy is located on the Hidden Valley Road near Moapa, Nevada, north of the Reid Gardner Powerplant and the proposed Moapa unit-train loadout facility site. The dairy produces 15,000 to 20,000 gallons of milk per day; its main customer is Anderson Dairies in Las Vegas, Nevada. The dairy currently employs 25 to 30 people. Rockview Farms of Downey, California, the current owner of the cows and equipment used at the dairy, leases the dairy and the 200 operating acres from private individuals. The dairy also leases a rail siding from Union Pacific, where it receives half of its feed by railcar (three to four railcars per month), while the other half of the feed is trucked in (five to nine trucks per week). The dairy has been operating for 75 years (Madewell 1994; Edwards 1994).

B.2.14 Moapa Valley Telephone Communications System

The Moapa Valley Telephone Company, whose headquarters are in Overton, Nevada, has a service area that includes three different counties in Nevada, and Echo Bay on Lake Mead in the south to Warm Springs, Nevada, which lies off of U.S. Hwy. 6 in the north (Figure B-2). Moapa Valley Telephone is operated under a cooperative structure, has 7 employees, and carries 2,700 access lines with a customer base of 2,500. It has been experiencing an annual growth rate of approximately 6 percent. Its main industrial customers include Nevada Power and JR Simplots Silica Sand Mine (Lyon 1994).

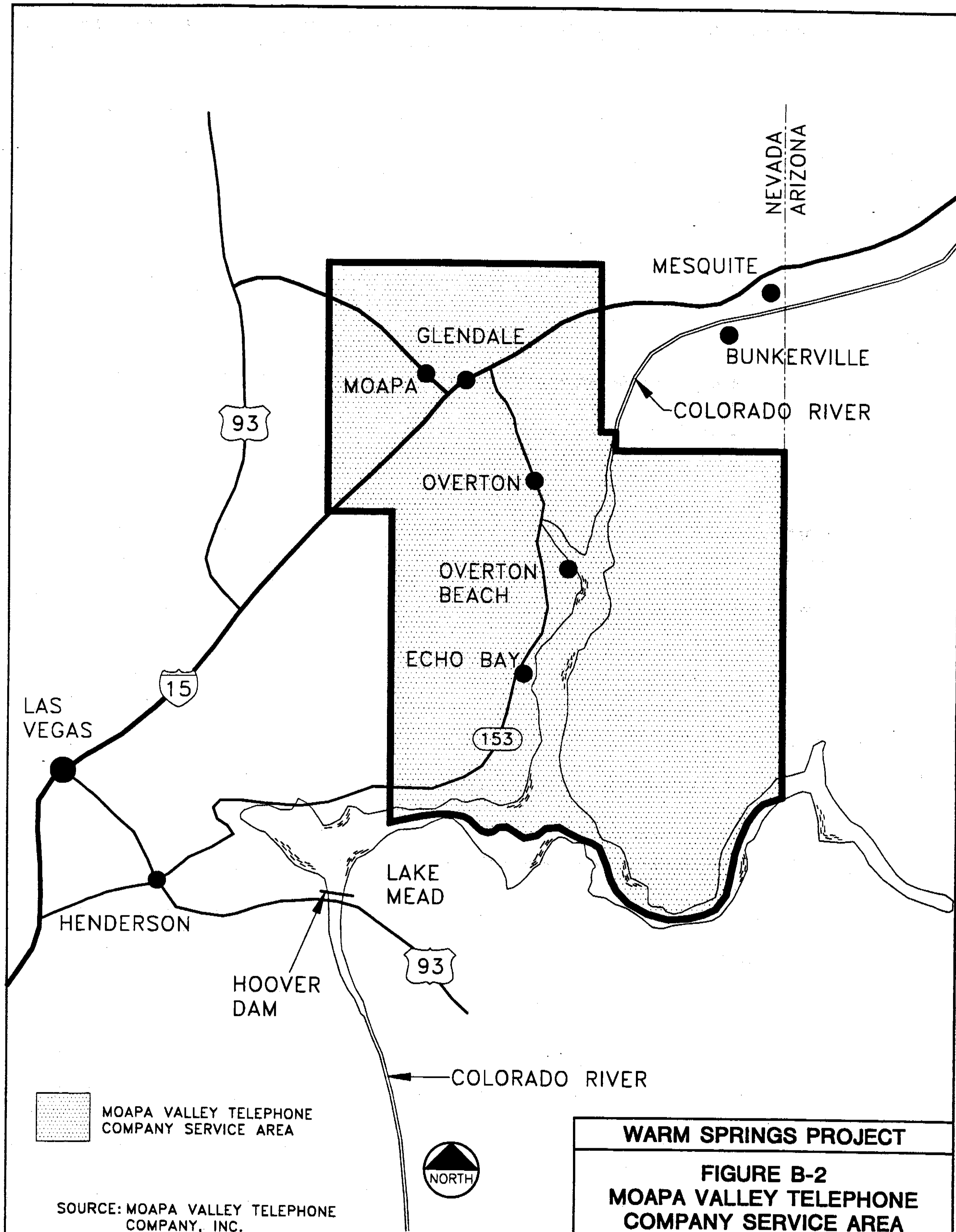
The Moapa Valley Telephone Company is proposing to lay additional cable as part of its Overton to Las Vegas fiber optic communication line upgrade, which will run along Interstate 15.

B.2.15 Navajo Generating Station Scrubber Project

The Navajo Generating Station Scrubber Project, which is managed and operated by the Salt River Project of Phoenix, Arizona, is 10 miles southeast of Page, Arizona, at the Navajo Generating Station. Salt River Project, the third largest public power utility in the United States, is the manager of the generating station (Salt River Project 1994).

Three new scrubbers (pollution control devices which will be installed in the stacks to remove sulfur dioxide from the gases emitted from the generating station's three stacks) must be commercially operable at the generating station by August 1999 to meet Federal EPA mandates. The project schedule includes several phases. Construction on the scrubbers began in January 1995, with the first unit startup scheduled for May 1 1997.

The first unit is scheduled to be fully in service by November 1997, with the second unit startup initiated by May 1 1998. The second unit is expected to be fully operational by November 1998, with initiation of the third unit startup by February 1 1999. The third unit is expected to be fully operational by mid-August 1999 (Rojas 1994; Salt River Project 1994). The employment schedule is expected to be as follows (in numbers of workers): first quarter 1995, 150; fourth quarter 1995, 350; first quarter 1996, 450; third quarter 1996, 500; third quarter 1998, 150; first quarter 1999, 100; first quarter 2000, 0 (Jentzsch 1993).



WARM SPRINGS PROJECT

FIGURE B-2
MOAPA VALLEY TELEPHONE COMPANY SERVICE AREA

DATE: MARCH 1995 ACAD FILE: MV-TELE.DWG

Total escalated cost of the project would be about $530 million. No estimate of the number of in-migrant workers is available at present. The company is committed to training and hiring and is encouraging contractors to train and hire as many employees as possible who are members of the Navajo Nation. The company funded a housing study, but has no plans to assist in meeting demand for housing (Rojas 1993). Twenty to 30 trucks per day would make deliveries to the project 5 days a week.

In association with the scrubber project, Salt River Project is working on an interagency agreement with the Arizona Department of Transportation (DOT) for construction of a proposed State Route 89 to 98 Intertie.

Salt River Project would provide upfront funding to accelerate the construction schedule; Arizona DOT will reimburse the Salt River Project when Arizona DOT funds become available. It is anticipated that an agreement will be reached by the end of 1994 (Salt River Project 1994).

B.2.16 Overton Power Transmission System

The Overton Power Transmission System District No. 5's transmission system has a service area that includes Echo Bay, Nevada, on Lake Mead in the south to the Lincoln County line on the north, and from the Utah and Arizona State lines on the east to about 70 miles west at the Valley of Fire exit on Interstate-15 (Figure B-3). It has a main office in Overton, Nevada, and a branch office in Mesquite, Nevada, and is privately-owned and operated.

Overton currently has 30 employees, with a customer base of about 4,300 customers, 720 miles of transmission and distribution lines, and 9 substations. Its power comes from four sources: the Hoover Dam hydroelectric plant, the Parker-Davis Project, the Colorado River Storage Project, and Nevada Power. About 60 percent of Overton's power is hydroelectric and 40 percent is coal-fired (Leatham 1994a, b).

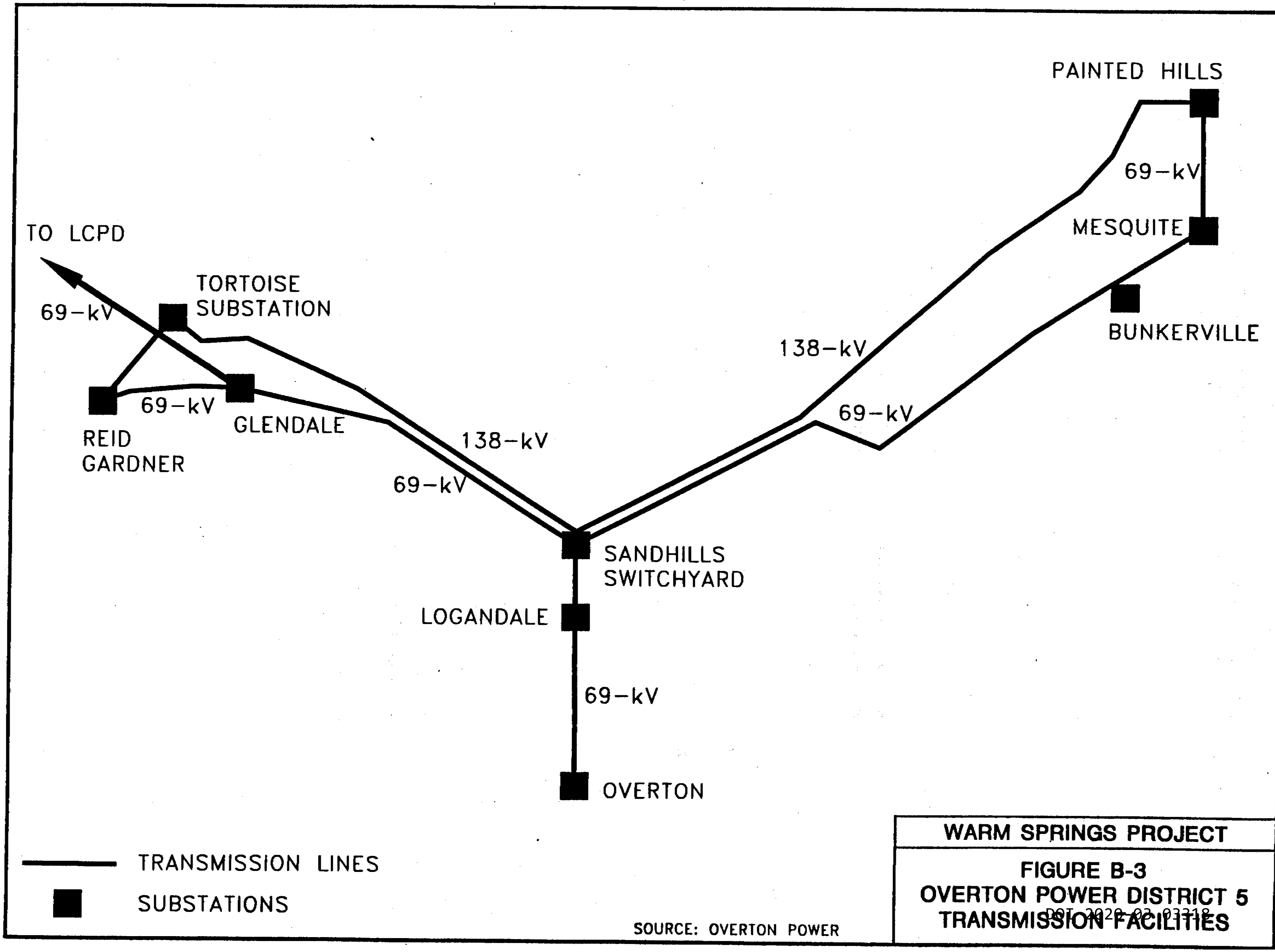
B.2.17 Petro Source Refining Partners Facility

The Petro Source Refining Partners facility sits on 11 acres at 1420 North U.S. Hwy. 89A in Fredonia, Arizona, and is operated and managed by Petro Source Corporation of Salt Lake City, Utah.

The company is an asphalt marketer and sells various asphalt products. Petro Source currently employs 15 people and operates a fleet of 7 trucks. Most company trucks use U.S. Hwy. 89. Petro Source has no immediate plans to expand its operation (Ipson 1994; Mackelprang 1994).

B.2.18 Pipe Springs and Kanab Area Casinos

The Kaibab Paiute Indian Tribe has opened one casino near Pipe Springs National Monument, outside Fredonia, Arizona, and is intending to open and operate a second casino on the Arizona-Utah border near Kanab, Utah. The Pipe Springs casino opened in June 1994. The 2,300-square-foot facility has 112 slot and electronic Keno machines. The second casino will be substantially larger and will also offer Blackjack in



WARM SPRINGS PROJECT

FIGURE B-3
OVERTON POWER DISTRICT 5
TRANSMISSION FACILITIES

addition to slots and Keno. Traffic near the border casino is expected to be heavier than at the Pipe Springs site. About 200 people will be employed at the two sites, with a high percentage of employees belonging to the Kaibab Paiute Tribe (there are only 275 members of the tribe, so employment of non-Native Americans is also anticipated) (Big Water Times 1994).

B.2.19 Reid Gardner Powerplant

The Reid Gardner Powerplant lies west of Moapa, Nevada, about 1 mile north of the proposed Moapa unit-train loadout facility (Figure 1-4). The corporate offices of Nevada Power Company, which owns and operates the plant, are in Las Vegas, Nevada (Hughes 1994).

The Reid Gardner Powerplant produces more than 600 megawatts of power, which it supplies to Overton Power, and to customers in Las Vegas and in the southern tip of Nevada. The plant employs about 200 people and serves about 1 million customers. Coal used to power the facility arrives by both truck and rail from Utah.

B.2.20 Union Pacific Rail System

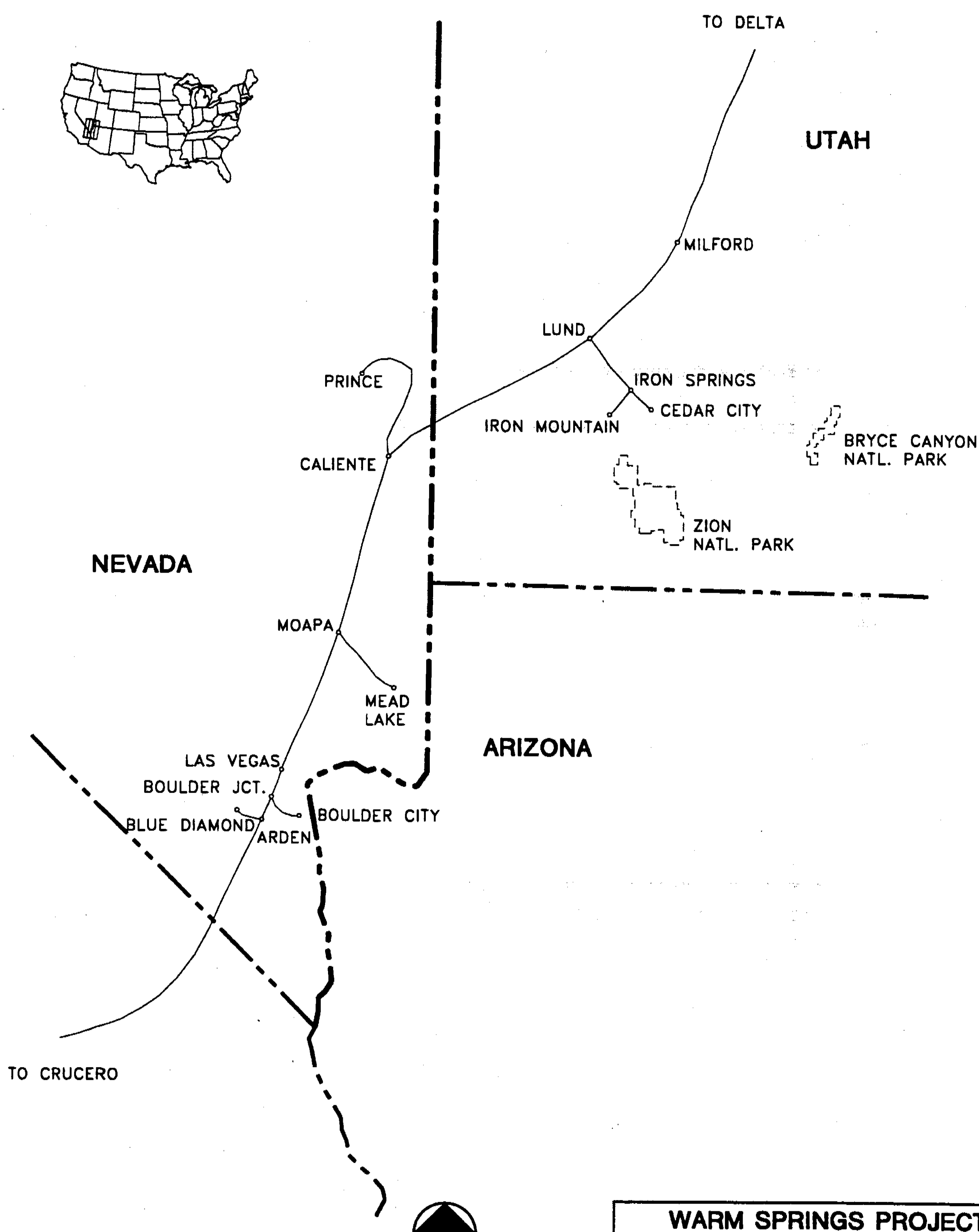
Union Pacific Railroad Company, whose headquarters are in Omaha, Nebraska, ships various types of commodities, including coal, throughout the United States. Union Pacific runs about two hundred 84- to 110-car coal trains per year on the mainline tracks to the Reid Gardner Powerplant near Moapa, Nevada, and the proposed Moapa unit-train loadout site (Figure B-4). These mainline tracks also go through Lund, Utah, where the Cedar City branch would connect the proposed Iron Springs unit-train loadout facility to the mainline. At this juncture, an additional 450 coal trains per year use the tracks, along with trains carrying various other commodities, for a total of 650 coal trains per year (Knock 1994).

B.2.21 U.S. West Communications Facilities

U.S. West provides telephone communication service to southern Utah and parts of northern Arizona. The company has 2,600 customers in Hurricane, Utah; 2,300 customers in Kanab, Utah; Fredonia, Arizona; Big Water, Utah; and Pipe Springs, Utah, combined; and a small number of customers in the area northwest of Cedar City, Utah, near Iron Springs. U.S. West employs 1.5 people in Hurricane and 1 person each in the Kanab, Fredonia, Big Water, and Pipe Springs areas. Its regional office is in St. George, Utah (Chapman 1994).

B.2.22 Utah Power and Light Transmission Facilities

Utah Power and Light (UP&L) is a division of Pacificorp, based out of Portland, Oregon. Pacificorp is a diversified electric company serving 1.3 million customers in 7 States. It is the third largest electric utility company west of the Rockies, based upon energy sales.



SOURCE: RAND McNALLY RAILROAD ATLAS OF THE U.S. 1980

WARM SPRINGS PROJECT

FIGURE B-4
UNION PACIFIC RAILROAD CO. RAIL SYSTEM IN SOUTHERN NEVADA AND SOUTHWESTERN UTAH

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UP&L serves 14,000 customers in southern Utah and has about 14,000 miles of transmission and distribution line in what is designated as the "scenic Southwest" area (Figure B-1). Between 45 to 50 substations are also located in the Southwest area. UP&Ls 132 employees in the area occupy 13 offices. Forty employees work out of the main office in Cedar City, Utah. The power supplied to the area is 90 percent coal-fired power and 10 percent hydroelectric power. The power supply is generated by a combination of 34 minor and 20 major hydroelectric powerplants, as well as 15 major coal-fired powerplants and 1 geothermal powerplant (Rasmussen 1994).

UP&L's primary line in the Big Water area is the 150-mile long, 230-kV transfer Sigurd transmission line (the Sigurd Line), which runs from Glen Canyon Dam to Sigurd, Utah (Bytheway 1994).

B.2.23 Wahweap Warm Water Hatchery

Wahweap Warm Water Hatchery is located about 1 mile north of Big Water, Utah (T. 43 S., R. 2 E., sec. 3), in Kane County. The hatchery was constructed in 1972 and is the only warm water fisheries rearing unit in Utah. The facility is a year-round unit for the federally endangered razorback sucker. The hatchery also rears game fish species from April through July. Game species include smallmouth bass, hybrid striped bass, tiger musky, grass carp, and black crappie.

The entire facility covers about 40 acres, with 8 acres of open ponds, and is operated and managed by the Utah Division of Wildlife Resources (Gustaveson 1993; Berg 1994).

B.2.24 Wal-Mart Western Regional Distribution Center for Soft Goods

The Wal-Mart Western Regional Distribution Center for soft goods is located near Hurricane, Utah, at 148 North U.S. Hwy. 93, near Interstate-15 and Utah Route 9, 8 miles west of downtown Hurricane.

The Western Regional Distribution Center, which is owned and operated by Wal-Mart Stores, Inc., of Bentonville, Arkansas, consists of a 1.2-million-square-foot warehouse and 15,600-square-foot truck maintenance facility. The center distributes basic and seasonal clothing, shoes, and other soft goods to retail stores located, for now, in California and Colorado. The truck maintenance facility is equipped to service up to 150 tractors and 900 trailers used to transport goods. The facilities sit on a 217-acre parcel (Brummett 1993).

Cost to construct the distribution center was about $30 million, with construction completed in 1994. Construction employment was 300 to 500 workers (Brummett 1993). In 1995, operational employment at the center may be increased to 500 workers. The facility can be expanded to employ 600 to 700 workers and may do so at an undetermined time in the future. Transportation activity began in November 1993, with a schedule of 180 round-trips per day (Cox 1993).

Wal-Mart planned to hire all workers locally with the exception of one or two managers who in-migrated to Hurricane. The company did not assist construction workers and has not assisted operations workers in obtaining housing. The company has made an $8,000 grant to the local school district (Cox 1993).

B.2.25 Western Electrochemical Company Facility

The Western Electrochemical Company (WECCO), a manufacturer of specialty chemicals, is located off the Iron County Road, 5 to 7 miles west of Cedar City, Utah. WECCO is a subsidiary of American Pacific Company (AMPAC), whose headquarters are in Las Vegas, Nevada.

About 80 percent of WECCO's operations are devoted to the production of ammonium perchlorate, a solid rocket fuel. The company also produces sodium azide, a chemical used in automobile airbags. WECCO's primary customer is the Department of Defense/NASA. WECCO currently has 165 employees and is operating at 70 percent of full production. It receives two to three truck shipments per day; it ships out about one truckload of product per day. About two railcars of shipments per week arrive at the plant; three railcars per week of product are shipped out. WECCO has been in operation for about 5.5 years.

The WECCO facility occupies about 200 acres of land. The facility is in the southeast corner of a 5,000-acre parcel owned by AMPAC. An additional 500 acres are used to cultivate hay, and the remaining 4,300 acres are leased for grazing (Thayer 1994).

UNDERGROUND MINING OF COAL

APPENDIX C

C.1 INTRODUCTION

Coal mining involves the extraction of coal deposits. Although the thickness of a coalbed may vary, minable deposits generally are continuous over large areas. When the deposit is close to the ground surface (less than 200 feet deep), it is generally mined by using open-pit, surface methods. Deeper deposits are generally mined by underground methods.

Rocks above and below the coal deposit are known as overburden and underburden, respectively. The overburden and underburden rocks that are actually in contact with coal in an underground mine are called the "roof" and "floor," respectively. Blocks of coal left in place to help support the roof of the underground mine are called "pillars."

Removal of coal by underground methods creates a void in the rock column. As a block of coal is extracted, natural forces act on the stability of the overburden and cause the column to subside. Even in the strongest rock formations, large, artificial underground openings will eventually be filled by the collapse and compaction of overburden and pillars. Underground mining methods are generally classified or distinguished from each other by the type of support used to prevent the roof from collapsing prematurely on workers and equipment.

C.2 ROOM-AND-PILLAR MINING OPERATIONS

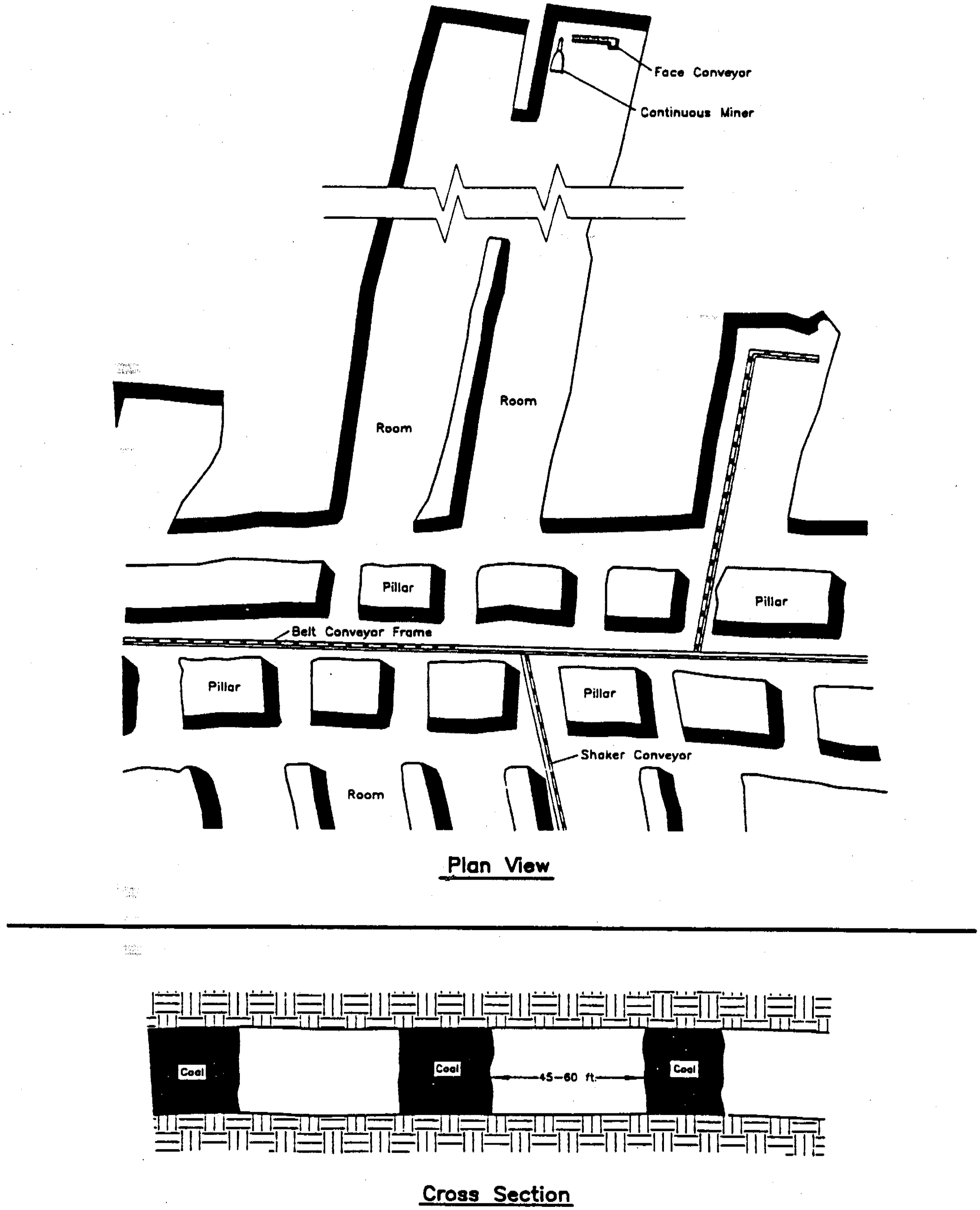
Room-and-pillar mining is generally defined as "a system of mining in which part of the coal is mined out and the rest is left in place as pillars for support" (Stout 1980). It involves the partial removal of coal from a series of small areas, or "rooms," that are large enough to make coal removal economical, yet small enough to leave remaining walls and pillars of adequate size to support the roof and ensure the safety of both workers and their mining equipment (Figure C-1).

Room-and-pillar operations are generally conducted with a continuous-miner system, which includes:

- A coal extraction machine (continuous miner).
- A coal haulage system (shuttle cars and conveyor belts).
- A roof support system (roof bolts and pillars).

The continuous miner is electrohydraulically powered and track-propelled. Major components of this machine include a rotating-cutting drum, a gathering head beneath the cutting drum, and an internal conveyor. The machine operator drives the rotating-cutting drum at the front (head) of the machine into the coalbed and cuts coal from the coal face. The gathering head shifts the cut coal to the conveyor for transfer to the rear (tail) of the machine. A rear, articulating conveyor then transfers the coal to shuttle cars.

Shuttle cars are used to transport mined coal (10 to 15 tons per car) from the continuous miner to a conveyor belt transfer point within the mine. The cars are either electric- or diesel-powered, 2- or



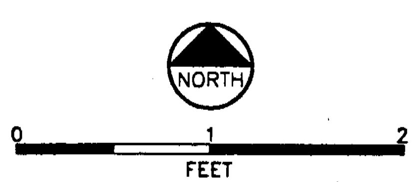


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FIGURE C-1
CONCEPTUAL ROOM-AND-PILLAR MINING

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4-wheel-drive, and have either a conveyor or push-ram system to discharge the coal. Additional stationary conveyor belts transport coal outside the mine portal, usually to a run-of-mine (ROM) coal stockpile.

Pillars and roof bolts are used to support the roof. Solid pillars of coal are left in place during the initial (advance) mining stage to provide basic roof support within each block of mined-out coal and along the main access corridors (entries) of the mine. Additional roof support is provided by the use of roof bolts. Roof bolts are long steel rods, drilled into place and then anchored to the roof rock by either a resin glue or a mechanical compression device. They create a supporting "beam" of rock by bonding or "bolting" several layers of rock strata together. The general mining/production sequence allows for the continuous miner to advance about 20 feet before the roof of the mined area is secured with roof bolts. Several continuous-miner sections (entries) are developed concurrently to allow for uninterrupted mining activity (i.e., while roof bolts are being installed in some entries, mining can continue in other entries), for safety, and for ventilation.

As a general rule, 30 to 60 percent of the coal remains in place in the form of pillars after the rooms are mined. To increase coal recovery, the roof can be temporarily reinforced with additional bolts so that those pillars not required for support of the main entries can be systematically removed. In this second stage of mining, pillars are removed (or "robbed") as the mining equipment "retreats" from each mined room. As pillar-robbing progresses, each mined-out block of rooms is allowed to cave in and the mined area is abandoned.

C.3 LONGWALL MINING OPERATIONS

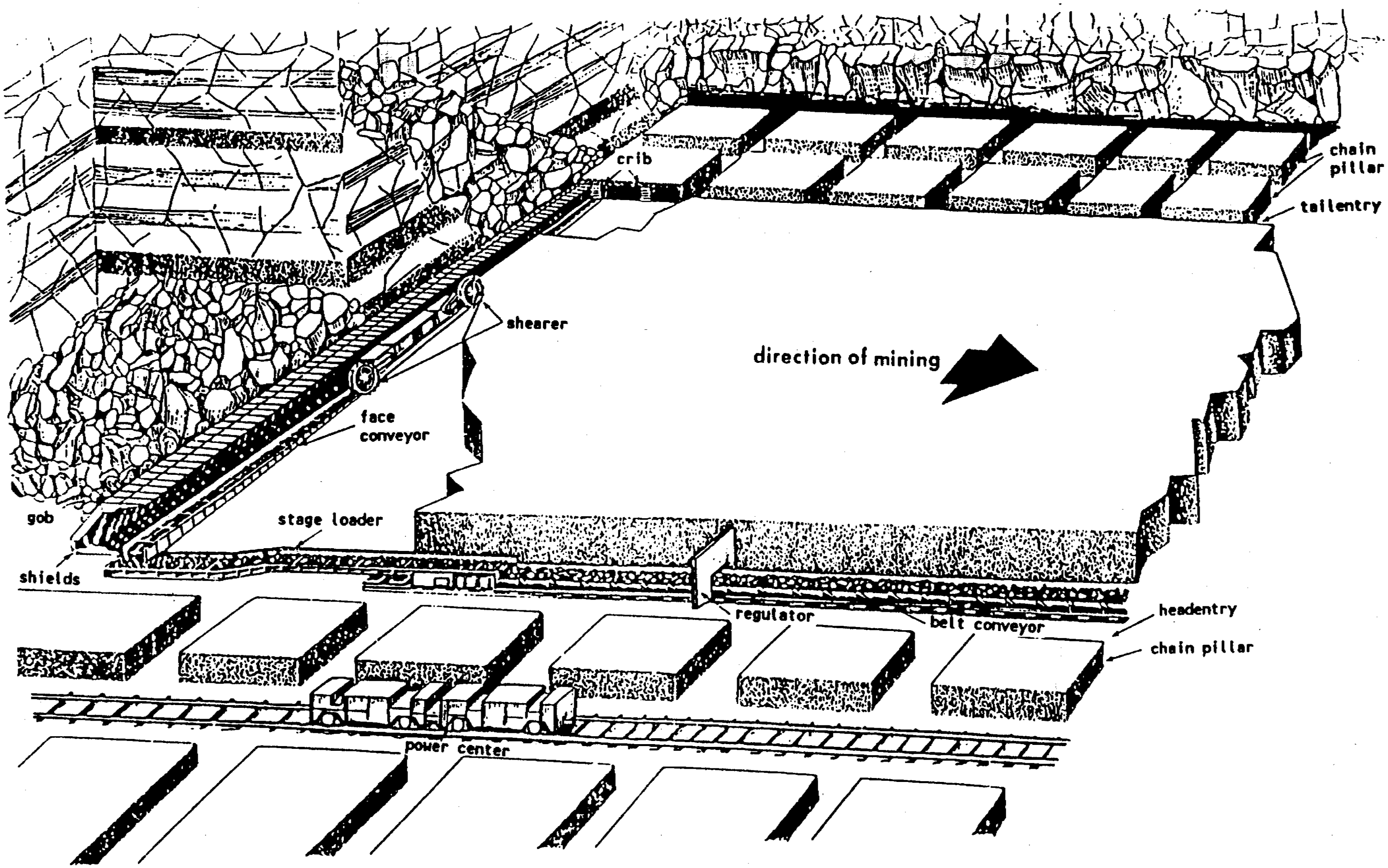
Longwall mining is generally defined as "a system of mining whereby most of the coal is mined and the roof over the worked-out area is allowed to cave" (Stout 1980). It involves a complete, single-stage extraction of coal that uses hydraulic equipment to temporarily support the roof during coal removal activities and ensure the safety of both workers and their mining equipment (Figure C-2).

Longwall operations begin with continuous-miner equipment and room-and-pillar techniques to create a set of parallel entries on either side of a large block (or "panel") of coal. These entries are connected at the far end of the panel, resulting in a long corridor, or "longwall." The distance between the entries is equal to the length of the longwall equipment that is used (ranging from 500 to 1,000 feet).

Longwall operations are generally conducted with a longwall mining system. As with the continuous miner, the longwall system would include:

- A coal extraction machine (shearer).
- A coal haulage system (face conveyor).
- A roof support system (shields).

Whereas the continuous-mining system involves several independently operated pieces of equipment to mine coal, the longwall mining system is totally integrated, with all of the necessary equipment interconnected.



WARM SPRINGS PROJECT

FIGURE C-2
CONCEPTUAL LONGWALL MINING

For example, in the longwall mining system, the shearer actually moves along the face conveyor and the shields are physically connected to it.

The shearer, like the continuous miner, is electrohydraulically powered. The major components of this machine are the rotating-cutting drums and the tram system. The drums, located at each side of the machine, are limited to an up-down movement. The machine operator drives the rotating-cutting drums into the coalbed as the machine trams laterally along the face conveyor, thereby cutting coal from the coal face. Cut coal falls to the floor-supported face conveyor for transport to the end of the longwall, or "headgate." There, the coal is transferred to another conveyor belt that transports the coal outside the mine portal. The end of the conveyor opposite the headgate is known as the "tailgate."

Longwall roof support is temporarily provided by the use of hydraulic roof supports (shields). Major components of the shields include canopy, hydraulic cylinder, hydraulic controls, and the base. The canopy is a thick, reinforced-steel plate that is pushed against the roof by hydraulic cylinders to support the weight of the overburden while coal removal operations continue below. Shields are generally 5 feet wide, vary from 5 to 15 feet high, and have a design-load capacity of 500 tons or more per shield. The base length of the shield is relatively short, allowing the face conveyer to sit on the floor in front of the base. Shields are designed to be large enough to safely cover the face conveyor, shearer, and workers. In the longwall system, individual shields are installed next to each other along the entire longwall face, from the face conveyor headgate to its tailgate.

The mining/production sequence involves cutting (shearing) a section of coal face, typically 30 to 42 inches deep, from the headgate to the tailgate, using hydraulic rams to move the face conveyor up against the face of the fresh-cut coal seam. Hydraulic rams attached to the face conveyor then move individual shields forward. The unsupported roof behind the shields is allowed to cave to the floor. As the block of coal is systematically removed, the mined area is gradually abandoned.

C.4 MECHANISMS OF SUBSIDENCE

Removal of coal deposits by underground mining methods creates voids that are filled when natural forces weaken the overburden and it collapses. The collapse of overburden into the void and the translation of this movement to the surface are known as subsidence. Subsidence-related deformation of rocks above underground mines can consist of fragmentation, fracturing, sagging, and bedding-plane separation. However, caving of the overburden into mined areas does not always translate into surface subsidence. The type of deformation that occurs, and whether the deformation reaches the surface, depends on a number of factors, including rock type, rock strength, mine layout, mine depth, and how far a particular horizon lies above the void in the mined area. The magnitude, extent, and duration of subsidence can be minimized by an efficient mine layout, proper barrier and pillar design, and a rapid and efficient mining system.

C.4.1 Subsidence-Related Deformation

In the overburden above mined areas, three zones of deformation tend to develop in response to subsidence (Figure C-3). In the fragmented zone, rocks of the immediate roof are expected to fragment, cave, and rotate. This zone can be as much as 10 times thicker than the void produced by mining (the mining height). Directly above, in the fractured zone, rocks are expected to fracture and deform, but they should maintain their continuity. Bedding-plane separations can occur. This zone can be as much as 50 times thicker than mining height. In the third zone, the deformation zone, rocks should sag downward without major fracturing, but bedding-plane separations can still occur. This zone can extend from the top of the fractured zone to the ground surface. After the deformation process, fractures that developed in softer sandstones and shales tend to close, while fractures that developed in more brittle rocks may remain open.

If deformation reaches the surface, subsidence will typically appear as basins or depressions, pits, and/or cracks. Subsidence basins can form above room-and-pillar mines where the pillars have been robbed or above longwall mines. These basins are typically elliptical or trough-shaped because the rooms or panels are large and rectangular, and coal seams often are nearly horizontal. Subsidence pits can form above room-and-pillar mines where the pillars have been retained because the overburden directly above the pillars continues to be supported, while the overburden above the mined area collapses into the mined-out rooms.

Horizontal strain, both tensile and compressive, results from lowering of the surface during subsidence. Tension that can cause cracks occurs as the surface begins to subside and stretch. Compression takes over and closes some of the tension cracks as the ground begins to settle. Corresponding changes in surface slope generally are temporary and commonly have a magnitude of less than 3 degrees. Tension cracks are more apparent than compression features because rocks are stronger in compression (Dunrud 1984). Tension cracks are more abundant in solid rock than they are in unconsolidated materials. At the surface, tension cracks can range from small (less than an inch), subtle features that are difficult to recognize to fractures that are several feet wide and several feet deep. Surface fractures may be temporary, with many closing during successive subsidence events, after natural deposition of sediment, or when frost heaving fills them. Tension cracks over the edges of the mined area (the mining boundaries) may remain open indefinitely. This is most evident in areas where brittle sandstones or other rocks crop out. The surface soil cover will have an influence on the cracking that is actually visible at the surface. Unconsolidated deposits of alluvium, colluvium, and soil tend to obscure surface cracks.

C.4.2 Factors Controlling Subsidence

Several factors control the area, amount, rate, and duration of subsidence. Mining factors include mine geometry, extraction ratio, mining method, height of the mine workings, and mining rate. Geologic factors include thickness of the coal deposit, and the thickness, lithology, strength, structure, and bulking factor of the overburden. The subsidence factor and the angle of draw are used to describe the maximum vertical displacement and the areal extent of subsidence, respectively.

The mine geometry (or mine design) determines the size and configuration of the rooms, pillars, and panels; the height of the openings and pillars; and the spatial relation to any abandoned mines that may be located

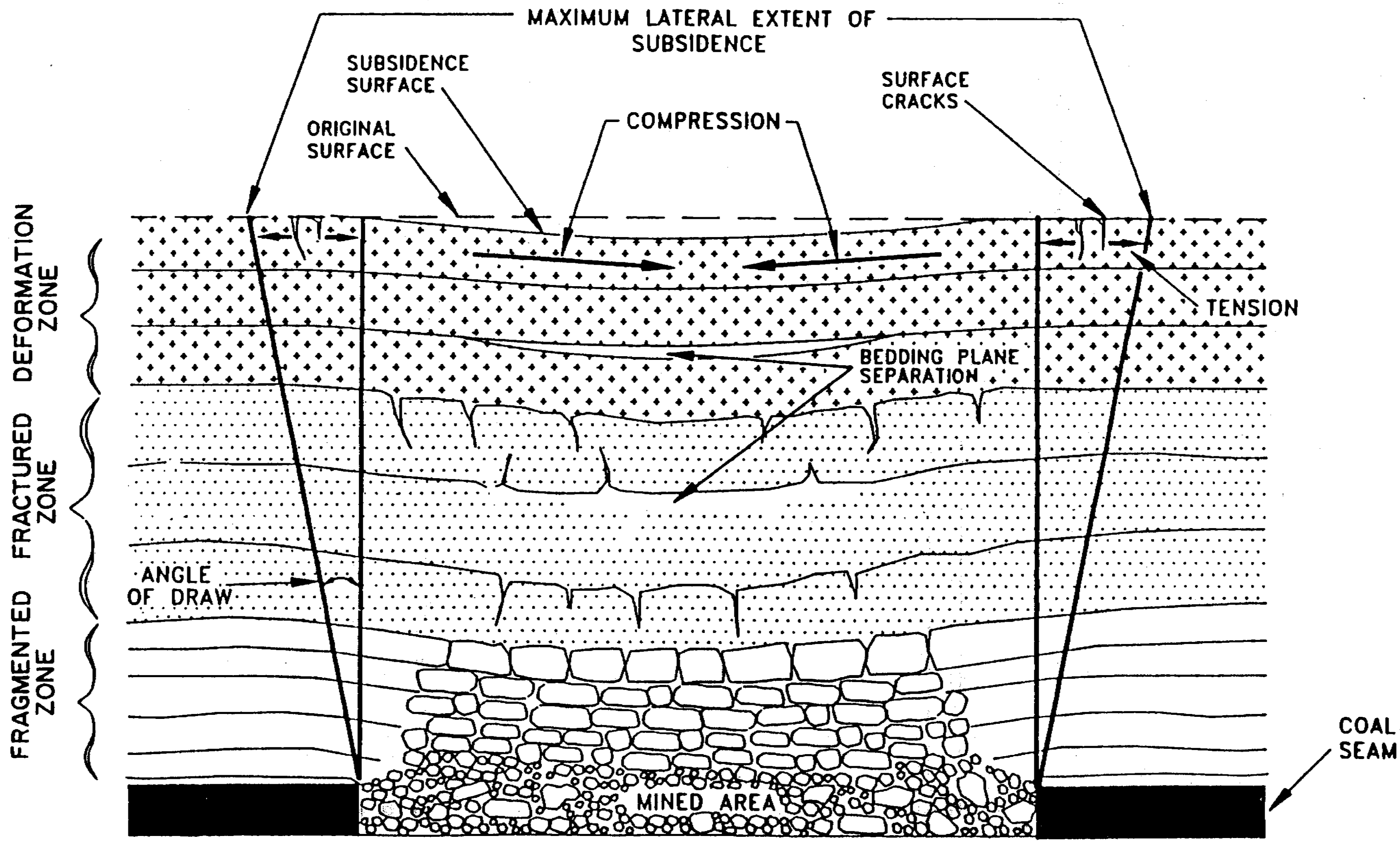


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FIGURE C-3
CONCEPTUAL REPRESENTATION OF SUBSIDENCE DEFORMATION ZONES

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above the active mine. Generally, mines are designed so that the subsidence process can take advantage of joints in the overburden. This can minimize sagging of the immediate roof and promote rapid roof collapse. Although subsidence can be reduced by leaving pillars for support, this procedure may only delay subsidence because pillars and roof rocks generally yield with time and weathering.

The extraction ratio is the ratio of the amount of coal extracted to the total amount of coal in the deposit (Dunrud 1984). Longwall mining, because it extracts nearly 100 percent of the coal within a longwall panel, generally achieves an overall extraction ratio in excess of 80 percent of the total coal deposit. Room-and-pillar mining rarely extracts more than 55 percent of the total resource, but pillar robbing upon retreat from a mine has the potential to extract nearly as much of the coal as does longwall mining.

The mining method also influences the amount of subsidence. Longwall mining results in more subsidence than room-and-pillar mining, principally because of its greater extraction of coal. Efficient robbing of pillars, however, can result in surface subsidence nearly equal in magnitude to that associated with longwall mining. Subsidence above room-and-pillar mining areas is also less predictable and more variable in surface expression than above longwall panels because the extraction ratios and heights of caving are more variable (Dunrud 1984).

The mining rate affects subsidence, too. When the mine face is extracted at an even and rapid rate, smoother subsidence profiles occur with less differential movement.

Thickness of the coal deposit, thickness of the overburden, and height of the mine workings control maximum subsidence. The subsidence factor is the ratio of maximum surface subsidence to the seam mining height and is often expressed as a percentage. For example, if 7 feet of subsidence occurred over a mine with a 10-foot mining height, then the subsidence factor would be 70 percent. In the Western United States, subsidence factors range from about 45 to 90 percent of the thickness of coal mined (Dunrud 1984). The angle of draw identifies the limits of subsidence beyond the boundaries of the mined area (the subsidence occurring at the ground surface will be larger than the underground void). It is expressed in degrees from vertical above the edge of the mined area. For example, if the angle of draw were 27 degrees and the overburden were 400 feet thick, then subsidence could occur as much as 200 feet beyond the edge of the mined area. In the Western United States, subsidence angles of draw range from about 5 to 30 degrees (Dunrud 1984).

Sagging, caving, and fragmentation are governed by the strength and structure of the overburden. The composition of the mineral grains and the cements that bind the grains together affect the strength of the rocks. Existing faults and fractures in the overburden offer good sliding surfaces that can influence the angle of draw. The strength and structure of the overburden rocks are considered when determining room, pillar, and panel orientation.

The bulking factor, or the volumetric increase of fragmented rocks relative to their undisturbed and in-place volume, is a major factor influencing subsidence. The bulking factor is determined by the size and shape of the broken rocks, the contact stresses among rock fragments within the fragmented zone, and the relative strengths of the affected rocks (Dunrud 1984). Bulking factors generally are lowest where the overburden is composed of soft claystones and thinly bedded shales, and greatest where hard, thickly bedded to massive sandstones and limestones predominate. If rock fragments randomly fall to the floor of the mined area, and if strong, massive rocks occur in the fractured and deformation zones, then the bulking factor is higher. Higher bulking factors in the overburden result in less vertical movement of the rocks and in reduced tension and compression at the surface.

C.4.3 Prediction of Subsidence

Subsidence associated with underground mining is anticipated, and its magnitude and extent can be predicted. Often, predictions of maximum surface subsidence and horizontal tensile and compressive strains are used to help assess the secondary impacts to other resources (both human and natural). Data collected during actual subsidence are used to verify premining predictions.

A method of calculation developed by the British National Coal Board (National Coal Board 1975) offers one of the most comprehensive, conservative, and accurate techniques for predicting subsidence and surface strains. Other researchers have modified it for the stronger strata of coal mines in the Western United States (Maleki 1987; Western Fuels Association, Inc. 1981). Inputs to the subsidence prediction model are depth, mining height (seam thickness), and room or panel geometry.

Subsidence profiles can be used to illustrate subsidence and strain predictions above a mined area. Diagrams A, B, and C of Figure C-4 show a cross-section of a longwall mine and the subsidence and strain profile that might be expected to develop over two mined-out longwall panels. In this example, the longwall panels are 800 feet wide, overburden is about 780 feet thick, mining height is 13.5 feet, the subsidence factor is 70 percent, and angle of draw is 22.5 degrees. Under these conditions, the maximum final surface subsidence would be 9.8 feet, which would occur over the middle of each panel. Final subsidence over the pillars between two panels, while not reaching the maximum, would still be about 5 feet. In diagram B, the dashed line indicates the limit of subsidence resulting from a single panel, and the upper solid line represents the extent of subsidence (about 2.5 feet) immediately after mining the adjacent panel. The lower solid line represents the maximum final subsidence over the pillars after they have collapsed under the weight of the overburden. Diagram C shows the compressional strain that occurs above the panels and the tensile strain that occurs at panel boundaries and over pillars as the rocks flex and stretch downward into the subsidence trough. In this example, the tensile strain exceeds the strain criterion recommended by Singh and Bhattacharya (1984) in areas above the panel boundaries and the pillars; surface cracking would be predicted in these areas, with larger maximum tensile strains possibly resulting in wider cracks. The exact location and actual width of open surface cracks is unpredictable.

A monitoring program is generally implemented at underground mines to collect subsidence data. These data are used to verify the accuracy of the predicted subsidence under actual ground conditions and to detect mining-induced impacts to surface resources, both predicted and unpredicted. In addition, site-specific angle of draw, subsidence factor, and tensile strains may be calculated. These results can be used to refine the predictive model, which then can be used to estimate the effects of mining in successive longwall panels during the remainder of the mine life.

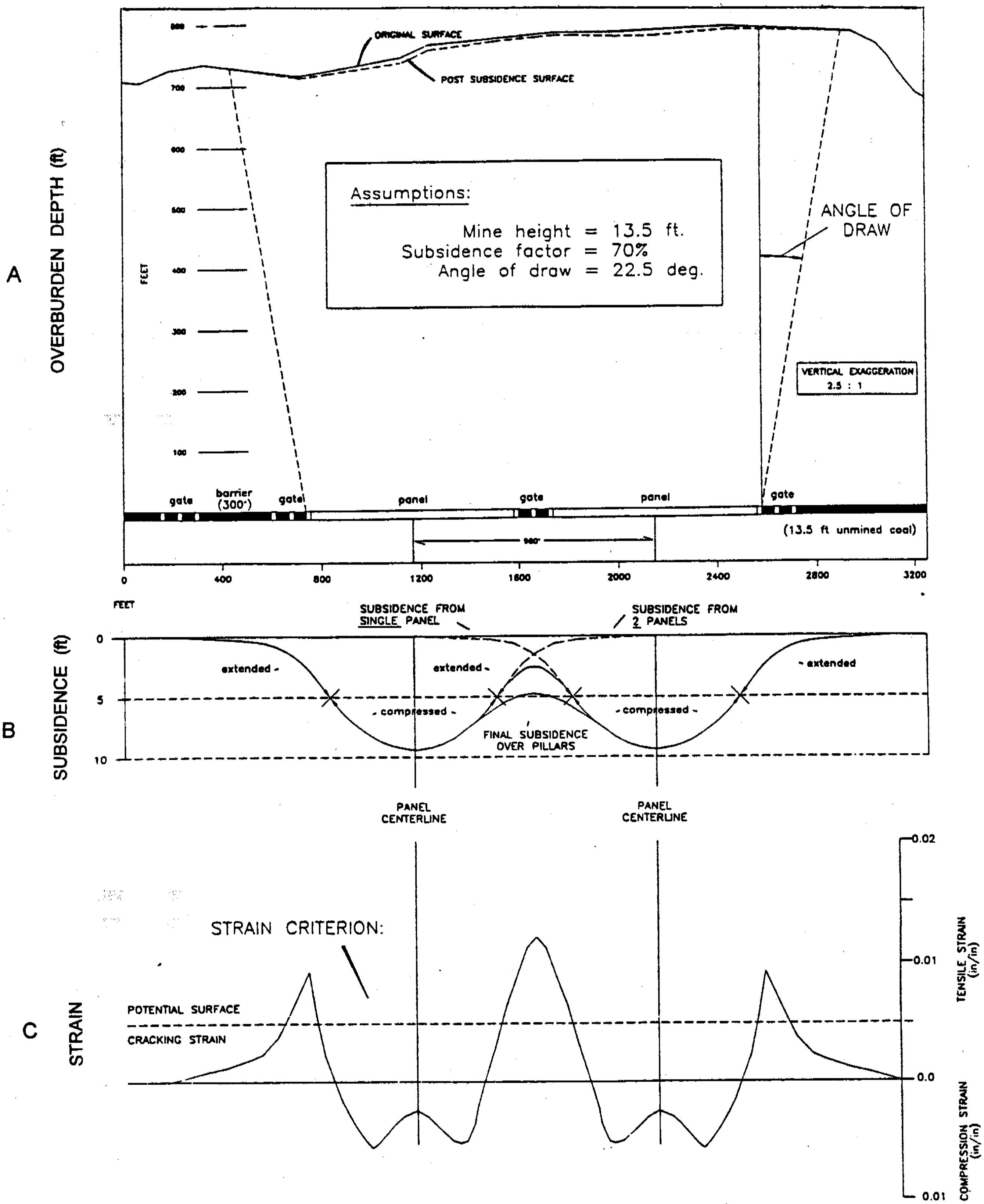

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FIGURE C-4
EXAMPLE OF SUBSIDENCE AND STRAIN PROFILES

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A number of techniques and types of equipment can be used in subsidence monitoring programs: conventional ground surveying of monuments located over panels and extending out over unmined areas; installation of extensometers to measure horizontal strain; aerial photographic surveying; analytical aerial triangulation; digital terrain modeling; surface observations; and well, surface water, and spring monitoring. To be effective, monuments must be constructed so they are unaffected by movements unrelated to subsidence, such as soil heave due to freezing.

C.4.4 The Subsidence Event

Subsidence, when load of the overburden is high compared with the rock strengths (that is, when the mined seam is fairly deep), may be summarized as follows:

- Sufficient coal is removed to open up the mine void, and the roof support system is withdrawn or advanced.

- The immediate roof is fragmented and "bulks" into the mined area, and a percentage of the mining height (i.e., the subsidence factor) subsides all the way to the surface. The surface sags downward behind the advancing front of the longwall mining activity or the retreat (when pillars are robbed) in room-and-pillar mining activity. The subsidence trough formed at the surface (controlled by the angle of draw) is wider than the mined area.

- The advance of the longwall mining activity or the retreat (when pillars are robbed) in room-and-pillar mining activity also extends the deformation in the overburden. As the overburden rocks bend into the subsidence trough, new ground is placed in tension and new fractures open up. As the mining face passes under and progresses away from a particular point, the area of tensile stress moves away as well. Settling, accompanied by compression, takes over behind the area of stress, and the tensional fractures tend to close. As successive areas are mined, this activity takes the form of a smooth subsidence wave. Pillars collapse under the overburden load when panels or rooms are mined on both sides of those pillars. This collapse can help smooth out surface irregularities and close some of the remaining surface cracks. Massive sandstones in the overburden can also assist in smoothing out irregularities when they act as "beams" and produce a more complete collapse of pillars.

- Subsidence movement over longwall mines and over room-and-pillar mines where pillars have been robbed tends to be relatively short-lived. Ninety to 95 percent of the subsidence is expected to occur once coal extraction in an area is complete (Dunrud, 1984). Residual subsidence should occur within 2 to 5 years after mining has ceased. Some delayed subsidence may occur over pillars that deteriorate slowly.

- Subsidence movement is much slower over room-and-pillar mines where pillars have been left behind, depending on the design and height of the pillars and how much overburden weight rests on each pillar. Eventually, even the strongest pillar will deteriorate and collapse.

Where a mined area is fairly shallow and massive sandstones in the roof provide some support to the overburden load, subsidence can occur abruptly with the entire load falling as a unit. Here, the surface expression may not be as smooth as that previously described, and larger cracks could result.

ROLES OF FEDERAL AND STATE AGENCIES IN PROJECT APPROVAL

APPENDIX D

D.1 Lead and Cooperating Agencies

D.1.1 State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining

The Utah Division of Oil, Gas, and Mining (Utah DOGM) is responsible for regulating coal mining operations within the State of Utah.

In January 1981, pursuant to Section 503 of the Surface Mining Control and Reclamation Act of 1977, as amended (SMCRA), the Secretary of the Interior approved Utah's permanent regulatory program on the basis of the Utah Coal Mining and Reclamation Act of 1977, as amended, and its implementing rules. The approval of the permanent program authorized Utah DOGM to regulate surface coal mining operations and the surface effects of underground coal mining on private and State lands within the State. In March 1987, pursuant to Section 523(c) of SMCRA, Utah DOGM entered into a cooperative agreement with the Secretary of the Interior authorizing Utah DOGM to regulate surface coal mining operations and the surface effects of underground coal mining on Federal lands within the State.

Prospective coal mine operators in Utah are required to submit detailed permit application packages (PAPs) to Utah DOGM for proposed mining and reclamation operations in the State. Utah DOGM reviews the PAP to ensure that it complies with the approved Utah State permanent program and other statutes. If it does comply, Utah DOGM issues the applicant a permit to conduct coal mining operations. Utah DOGM enforces the performance standards and permit requirements during the mine's operation and has primary authority in environmental emergencies.

D.1.2 U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement

The Office of Surface Mining Reclamation and Enforcement (OSM) has primary responsibility to administer programs that regulate surface coal mining operations and the surface effects of underground coal mining operations in the United States.

Pursuant to the Utah cooperative agreement with the Secretary of the Interior, Federal coal lease holders and prospective coal mine operators affecting Federal mineral estate in Utah must submit a PAP to OSM for proposed mining and reclamation operations. The PAP should contain detailed plans for mining coal (the mining plan). OSM and other Federal agencies review the PAP to ensure that it contains the necessary information for compliance with the coal lease, the Mineral Leasing Act of 1920, as amended (MLA), the National Environmental Policy Act of 1969, as amended (NEPA), and other applicable Federal laws and their attendant regulations.

For operations on leased Federal coal, OSM recommends to the Assistant Secretary of the Interior, Land and Minerals Management: (1) approval of the mining plan, (2) approval with conditions, or (3) disapproval.

Before making a recommendation on the mining plan, OSM obtains input from certain other Federal agencies, including the surface management agency.

Although Utah DOGM enforces the performance standards and permit requirements during the mine's operation and has primary authority in environmental emergencies, OSM retains oversight responsibility of this enforcement. OSM has authority in emergency situations in which Utah DOGM inspectors cannot act before significant environmental harm or damage occurs.

D.1.3 U.S. Department of the Interior, Bureau of Land Management

The Bureau of Land Management (BLM) administers the Federal lands under its jurisdiction to provide for the balanced management of the public lands and resources and their various values. Management is based upon the principles of multiple use and sustained yield; a combination of uses is considered, taking into account the long-term needs of future American 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.

Individuals or companies wishing to use BLM-administered lands for commercial purposes must submit an application to BLM that contains a detailed plan of development. BLM reviews the proposal for compliance with the pertinent Resource Management Plan (RMP); Title V, Section 501 of the Federal Land Policy and Management Act of 1976 (FLPMA); NEPA; and other applicable Federal laws and their attendant regulations. BLM establishes a fair market rental fee for the subject property and issues a Federal right-of-way if all compliance requirements are met.

Prospective coal lessees must submit an application to BLM to lease Federal coal estate in Utah. BLM reviews the application for compliance with the pertinent RMP, the MLA, and other Federal laws, including NEPA; determines the fair market value for the coal resource; and holds a competitive lease sale. If the sale is successful, BLM issues a Federal coal lease to the highest qualified bidder who meets or exceeds the fair market value. After lease issuance, BLM administers the terms of the lease and must approve any modifications to the lease as well as any formation of logical mining units (LMUs) that may be warranted. BLM inspectors conduct quarterly inspections of the mining operation to ensure diligent development, continued operation, and verification of tonnage mined for the accurate payment of Federal royalties.

Pursuant to the Utah cooperative agreement with the Secretary of the Interior, Federal coal leaseholders and prospective coal mine operators in Utah must submit a PAP containing a detailed resource recovery and protection plan to BLM for proposed coal removal operations on Federal lands in the State. BLM reviews the PAP to ensure that it contains the necessary information to determine maximum economic recovery of the Federal coal resource and compliance with the MLA. Before the mining plan can be approved by the Secretary of the Interior, BLM must provide OSM with its findings on maximum economic recovery and its recommendation on the resource recovery and protection plan.

Although Utah DOGM enforces the performance standards and permit requirements during the mine's operation and has primary authority in environmental emergencies, BLM has authority in emergency situations in which Utah DOGM or OSM inspectors cannot act before significant environmental harm or damage occurs.

D.1.4 U.S. Department of the Interior, National Park Service

The National Park Service (NPS) manages the Glen Canyon National Recreation Area (NRA), as a unit of the National Park System, to provide for public outdoor recreation use and enjoyment of Lake Powell and adjacent lands, and to preserve scenic, scientific, archaeological, and historic features contributing to public enjoyment of the area.

Individuals or companies wishing to use NPS-administered lands for commercial purposes must submit an application to NPS that contains a detailed plan of development. NPS reviews the plan to ensure that the proposed operations would not have adverse effects on the administration of the NRA or degrade park values or purposes. NPS also sees that the plan contains the necessary information for compliance with the act to establish the Glen Canyon NRA in the States of Arizona and Utah (the Glen Canyon NRA Act); the Glen Canyon NRA General Management Plan (GMP); NEPA; and other applicable Federal laws and their attendant regulations. Except in emergencies, Federal regulation only allows a right-of-way to be issued across NPS-administered lands if there is no practicable alternative to such use. If allowed, NPS establishes a fair market rental fee for the subject property and issues a Federal right-of-way.

Pursuant to the approved Utah State permanent regulatory program and the Utah cooperative agreement with the Secretary of the Interior, prospective coal mine operators in Utah must submit a PAP to NPS describing proposed mining and reclamation operations that may affect the NRA. NPS reviews the PAP to ensure that it contains the necessary information for compliance with the GMP. If OSM and Utah DOGM determine that the proposed operations have an adverse effect on the NRA, NPS and Utah DOGM must jointly approve the PAP before Utah DOGM may issue the permit to conduct coal mining operations.

D.2 Other Federal and State Agencies

The roles and responsibilities of other Federal and State agencies involved in various aspects of Project approval have been summarized in Table D-1.

Table D-1 — Other Permits, Approvals, and Reviews

Responsible Agency	Permit, Approval, or Review Name	Authorizing Legislation or Agency	Project Feature
FEDERAL AGENCIES			
Department of the Interior:			
U.S. Fish and Wildlife Service	Endangered species review; biological opinion concurrence. Section 7 consultation.	Endangered Species Act of 1973, as amended; Migratory Bird Treaty Act.	All facilities.
Mine Safety and Health Administration	Issues permits concerning operational safety; enforces safety regulations.	Mine Safety and Health Act of 1977; Title 30 CFR.	Smoky Hollow Mine, Iron Springs and Moapa unit-train loadouts.
Department of Defense:			
U.S. Army Corps of Engineers	Issues dredge and fill permit (Nationwide 404 Permit).	Clean Water Act, Section 404.	Warm Creek Road, Benchtop Road, Moapa unit-train loadout.
Department of the Treasury:			
Bureau of Alcohol, Tobacco, and Firearms	Issues permit to purchase, store, and use explosives.	Public Law 91-452 18 U.S.C., Ch. 40, as amended.	Smoky Hollow Mine.
Environmental Protection Agency	Reviews State PSD (air quality) permits.	Clean Air Act, as amended.	Smoky Hollow Mine, Iron Springs and Moapa unit-train loadouts.
	Issues Stormwater Discharge Permit (under National PDES).	Clean Water Act of 1977, as amended.	Fredonia truck maintenance facility.
	Reviews Spill Prevention Control and Counter Measures Plan.	Federal Water Pollution Control Act, as amended (Clean Water Act of 1977).	Surface facilities complex.
Advisory Council on Historic Preservation	Reviews compliance with National Historic Preservation Act.	National Historic Preservation Act, Executive Order 11593.	All facilities on Federal land.
Federal Communications Commission	Issues license to operate microwave radio facility.	Communications Act of 1934, as amended.	Microwave communication system.

Table D-1 — Other Permits, Approvals, and Reviews (Continued)

Responsible Agency	Permit, Approval, or Review Name	Authorizing Legislation or Agency	Project Feature
STATE AGENCIES			
Utah			
Utah School and Institutional Trust Lands Administration	Oversees mineral lease.	Utah Code Ann. 65-A.	Smoky Hollow Mine.
	Issues road and powerline ROW.	Utah Code Ann., 1953, 65-2-1 through 65-2-4.	Warm Creek Road, Benchtop Road, 138-kV power transmission line.
Utah Department of Natural Resources, Division of Water Rights	Issues permit to alter natural streams.	Utah Code Ann. 73-3-29.	Warm Creek Road, Benchtop Road.
	Issues certificate of appropriation of water.	Utah Code Ann. 1953, 73-3-1, 73-3-2, and 73-3-17.	Surface facilities complex.
Utah Department of Environmental Quality:			
Division of Air Quality	Approves PSD (air quality) order.	Clean Air Act; Utah Air Conservation Act; Utah Code Ann. 1953, as amended, 26-13.	Surface facilities complex, Iron Springs unit-train loadout.
Division of Water Quality	Issues Stormwater Discharge Permit (under Utah PDES).	Utah Code Ann. 73-14-5 and 73-14-10.	Surface facilities complex, Iron Springs unit-train loadout, Hurricane truck maintenance facility.
	Issues construction permits for wastewater treatment works and discharge of wastewater.	Utah Water Pollution Control Act, Title 26, Ch. II.; Utah Code Ann. 1953, as amended 1981.	Surface facilities complex, Iron Springs unit-train loadout.
	Approves drinking water system.	Utah Code Ann. 26-12-1.	Surface facilities complex, Iron Springs unit-train loadout.

Table D-1 — Other Permits, Approvals, and Reviews (Continued)

Responsible Agency	Permit, Approval, or Review Name	Authorizing Legislation or Agency	Project Feature
Utah Department of Transportation	Issues ROW Encroachment Permit.	Utah Code Ann. 27-12-7 and 27-12-133.	Surface facilities complex, Iron Springs unit-train loadout, Hurricane truck maintenance facility.
Utah Public Service Commission	Issues Certificate of Convenience and Necessity.	Utah Code Ann., 1953, 54-4-25, 54-6-5, and 54-7-6.	138-kV power transmission line.
Utah Office of Planning and Budget	Conducts RDCC Consultation and Review Process.	Resource Development Coordinating Committee, 63-28a-1 through 63-28a-7.	All facilities in Utah.
Utah Division of State History	Issues Permit to Conduct Archaeological Investigations and Data Recovery Programs (State Antiquities Act Permit).	Utah Code Ann. 63-11-2, as amended, 1977, 63-18-25.	All facilities in Utah.
	Reviews cultural resources clearance required by BLM and NHPA.	National Historic Preservation Act.	All Federal facilities in Utah.
	Issues Permit for Paleontological Investigations, Excavations, and/or Collection.	Utah State Antiquities Act of 1953, as amended, 1977, 63-18-25.	All facilities on Utah TLA lands.
Utah Industrial Commission	Enforces safety regulations.	Order No. 68373, issued by Industrial Commission of Utah.	Surface facilities complex, Iron Springs unit-train loadout, Hurricane truck maintenance facility.
Nevada			
Nevada Department of Conservation and Natural Resources:			
Division of Environmental Protection	Issues Stormwater Discharge Permit (under Nevada PDES).	Nevada Revised Statutes, 445.131 through 445.354.	Moapa unit-train loadout.
Division of Forestry	Issues Permit for Cactus/Yucca Transportation, Transplanting or Removal.	Nevada Cactus and Yucca Law.	Moapa unit-train loadout.
Division of Historic Preservation and Archaeology	Reviews cultural resources clearance required by BLM under NHPA.	National Historic Preservation Act.	Moapa unit-train loadout.

Table D-1 — Other Permits, Approvals, and Reviews (Continued)

Responsible Agency	Permit, Approval, or Review Name	Authorizing Legislation or Agency	Project Feature
Nevada Public Service Commission	Issues Permit to Construct Utility Facilities (transmission line).	Utility Environmental Protection Act of 1971.	Moapa unit-train loadout.
Arizona			
Arizona Department of Transportation	Issues ROW Encroachment Permit.	Arizona Revised Statues (28-108[19]).	Fredonia truck maintenance facility.
LOCAL AGENCIES			
Utah			
Kane County Planning Commission	Issues Conditional Use Permit.	Kane County Zoning Ordinances.	Surface facilities complex.
Kane County Building Department	Issues Building Permits.	Uniform Building Code 1991.	Surface facilities complex, microwave communication system.
Iron County Planning Commission	Issues Conditional Use Permit.	Iron County Zoning Ordinances.	Iron Springs unit-train loadout.
Iron County Building Department	Issues Building Permit.	Uniform Building Code 1991.	Iron Springs unit-train loadout.
Southwest District Health Department	Issues Septic System Permit.	Utah Administrative Rules (R-317-5).	Surface facilities complex, Iron Springs unit-train loadout.
City of Hurricane Planning Commission	Issues Conditional Use Permit/approves Site Development Plan.	Hurricane Zoning Ordinances.	Hurricane truck maintenance facility.
City of Hurricane Building Department	Issues Building Permit.	Uniform Building Code 1991.	Hurricane truck maintenance facility.
Nevada			
Clark County Building Department	Issues Grading Permit.	Clark County Development Code 28/29.	Moapa unit-train loadout.
	Issues Building Permit.	Uniform Building Code 1991.	Moapa unit-train loadout.
Clark County Health Department	Issues Septic System Permit.	Nevada Revised Statues Chapter 444.	Moapa unit-train loadout.

Table D-1 — Other Permits, Approvals, and Reviews (Continued)

Responsible Agency	Permit, Approval, or Review Name	Authorizing Legislation or Agency	Project Feature
Clark County Health Department	Issues Air Quality Permit to Construct; Permit to Operate.	Nevada Revised Statutes, 445.401 through 445.601.	Moapa unit-train loadout.
Clark County Department of Public Works	Issues ROW Encroachment Permit.	Clark County Development Code, Title 16.	Moapa unit-train loadout.
Clark County Department of Administrative Services.	Desert Tortoise Habitat Conservation Plan compliance approval.	Desert Tortoise Habitat Conservation Plan.	Moapa unit-train loadout.
Arizona			
City of Fredonia Building Department	Issues Building Permit.	Uniform Building Code, 1991.	Fredonia truck maintenance facility.
Cococino County Environmental Health Service	Issues Septic System Permit.	Arizona Revised Statutes 49-101.	Fredonia truck maintenance facility.

BLM = Bureau of Land Management.
NHPA = National Historic Preservation Act.
PDES = Pollution Discharge Elimination System.
PSD = Prevention of Significant Deterioration.
ROW = Right-of-way
RDCC = Resource Development Coordination Committee.

ANALYSIS SUPPORT DATA

APPENDIX E

E.1 INTRODUCTION

Appendix E contains technical and other support material that was used during development of the environmental analysis in Chapter 4.

To make this appendix easier to read, all tables have been placed at the end of the text.

E.2 HYDROLOGY DRAWDOWN CALCULATIONS

Water for the mine surface facilities complex and for the underground operation at the Smoky Hollow Mine would be obtained from one or more wells drilled to a depth of about 2,500 feet into the Navajo Sandstone Aquifer (Appendix A, Section A.2.1.2.3, Ancillary Facilities). The mining operation is expected to use as much as 550 acre-feet of water per year.

In order to determine the area that could be impacted by groundwater withdrawals from the Navajo Aquifer, several assumptions had to made. When a well is pumping from an aquifer, drawdown of the hydraulic head occurs at the well location. This drawdown area will expand as pumping continues. The lowering of the hydraulic head within the area of influence would induce vertical infiltration into the aquifer within the area of influence. Once the area of influence is large enough, infiltration equals the pumping rate, at which time the area of influence stops expanding horizontally, and steady state conditions are reached. The area of influence is calculated by using the formula:

$$A = Q/i,$$

where A is the area of influence (square feet),
Q is flow from the well (65,638 cubic feet per day, or 2.3958×10^7 cubic feet per year, or 550 acre-feet per year), and
i is the infiltration rate (feet per day).

The infiltration rate was assumed by using data obtained from Blanchard (1986). Infiltration is calculated by using the relationship

$$i = \text{Recharge/Area}.$$

The recharge to the Navajo Aquifer in the Kaiparowits area is estimated to be 8,300 to 16,900 acre-feet per year (Blanchard 1986). The area of the Kaiparowits Plateau is roughly 4,850 square miles (3.104×10^6 acres). Assuming the recharge is evenly distributed over the area, the infiltration rate (i) would range from:

$$8{,}300 \text{ acre-feet per year}/3.104 \times 10^6 \text{ acres to } 16{,}900 \text{ acre-feet per year}/3.104 \times 10^6 \text{ acres,}$$

or

$$0.0027 \text{ feet per year} < i < 0.00544 \text{ feet per year.}$$

Using an average value for i (0.00406 feet per year), the area of potential drawdown is estimated to be:

$$A = Q/i = 2.3958 \times 10^7 \text{ cubic feet per year} \div 0.00406 \text{ feet per year}$$

$$A = 5.901 \times 10^9 \text{ square feet.}$$

To convert the area of the drawdown into square miles:

$$A_1 = 5.901 \times 10^9 \text{ square feet} \div (5{,}280)^2,$$

where A_1 is the area of influence (square miles).

$$A_1 = 211.67 \text{ square miles.}$$

The area of influence is assumed to be circular. The area of a circle is equal to πr^2 with r as the radius of influence.

$$3.141 \times r^2 = 211.67 \text{ square miles,}$$

$$r^2 = 211.67 \div 3.141 = 67.389 \text{ miles, and}$$

$$r = \text{the square root of } 67.389 = 8.21 \text{ miles} = \text{the estimated radius of influence.}$$

E.3 SOILS INFORMATION

Suitable topsoil and subsoil materials, if present, would be removed from all disturbance areas associated with the proposed Project and stockpiled for use during final reclamation (Appendix A, Section A.3.3.3, Topsoil Salvage Operations). Soils units present in the proposed project area were identified by using existing soil survey reports and data collected by Andalex Resources, Inc. Soil summaries in Table E-1 include the average depth of the unit and the average depth of soil that is potentially available for salvage, based on texture and such limiting factors as erosion potential or the presence of caliche layers.

E.4 VEGETATION AND WILDLIFE SURVEY INFORMATION

Existing survey data on Federal candidate plant species and on raptors and other small nongame species would be updated with intensive field inventories in and around those areas proposed for Project-related construction and/or subsidence activities (Appendix A, Sections A.3.5.1, Vegetation Enhancement, and A.3.5.3.4, Other Enhancements). Previous raptor surveys include:

- An aerial survey was conducted in the life-of-mine area and along segments of the proposed Warm Creek and Benchtop Roads on June 14, 1989, to document raptor nesting. Four stick nests were recorded during this survey, with only one exhibiting confirmed red-tailed hawk use (White 1989). A subsequent survey was conducted October 21, 1992. Survey coverage extended through the permit area with a 1-mile buffer, along the Warm Creek/Benchtop Road right-of-way, and along the proposed 138-kV transmission line right-of-way. Survey results recorded 17 stick nests, possibly representing 6 red-tailed hawk territories in Wesses, Stony Point, and Smoky Hollow Canyons. Each territory contained one nest that had been active in 1992 (Haney 1992). No sign of ferruginous hawk nesting was recorded during either of these surveys; nesting ferruginous hawks would not be common in the Smoky Mountain area because of their habitat requirements.

- A number of occupied ferruginous hawk nests have been recorded in the vicinity of the proposed Iron Springs unit-train loadout (Utah DWR 1992). However, a site survey conducted at the proposed loadout site in September 1991 found no indication of ferruginous hawk nesting at that time (Tahoma Resources 1991).

Tables E-2 and E-3 provide common and scientific names for those plant and animal species in the Project area that are discussed in text.

E.5 PROBABILITY OF A COAL TRUCK ACCIDENT AT A SENSITIVE LOCATION (e.g., STREAM CROSSING)

Coal would be transported from the Smoky Hollow Mine to the Iron Springs and Moapa unit-train loadouts by standard double-trailer haul trucks, owned and operated by an independent trucking contractor (Appendix A, Section A.2.7.5, Haul Trucks). Coal loading and hauling operations could occur 24 hours per day, 365 days per year. With an average capacity of about 44 to 46 tons of coal per truck, production of about 2.5 to 3.0 million tons would require between 54,000 and 65,000 loads to be trucked to the Iron Springs and Moapa unit-train loadouts each year. This would require between 150 and 175 loads per day, with loaded haul trucks being dispatched from the Smoky Hollow Mine at about 8- to 10-minute intervals (Appendix A, Section A.2.7.6, Truck Haul).

The probability of a coal truck accident is estimated to be fewer than 0.32 but greater than 0.057 accidents over the 40-year life of the Project. Accidents resulting in a spill of coal would be expected at about one-half that frequency because these calculations were based on round-trips (full one way, empty one way).

Assumptions:

- Coal truck accident frequency (Utah DOT 1994c).

  All accidents: 0.61 per million vehicle miles traveled.
  Severe accidents: 0.11 per million vehicle miles traveled.

- Loads per year during full operation: 65,000.

- Crossings (each way) per year: 65,000 x 2 = 130,000.
- Length of sensitive area: 0.1 mile.
- Duration of coal transportation: 40 years.
- Miles traveled in a sensitive area:
  130,000 crossings per year x 0.1 mile/crossing x 40 years = 520,000 miles.

Total number of accidents at one sensitive location over the 40-year project life.

- All accidents:
  0.52 million miles x 0.61 accidents per million miles = 0.32 accidents.
- Severe accidents:
  0.52 million miles x 0.11 accidents per million miles = 0.057 accidents.

E.6 NOISE (LdN) LEVEL CALCULATIONS

Sound is technically described in terms of loudness (amplitude) and frequency (pitch). The standard unit of measurement of the loudness of sound is the decibel (dB). Since the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear (Chapter 3, Section 3.8.1, Introduction).

Sound levels decrease with distance from the source as a result of wave divergence, atmosphere absorption, and ground attenuation (e.g., the influence of topography and vegetation). The sound wave travels away from the source, and the sound energy is dispersed over a greater area, thereby dispersing the sound power of the wave (divergence). Atmospheric absorption also influences the levels that are received by the observer. The greater the distance traveled, the greater the influence and the resultant fluctuations. The degree of absorption is related to the frequency of the sound, as well as to the humidity and temperature of the air. Turbulence and gradients of wind, temperature, and humidity also play an important role in determining the degree of ground attenuation.

E.6.1 Coal Crushing and Loading Noise

Noise measurements from railroad car loading and coal crusher operations, made at Andalex's existing Wildcat Loadout Facility (Appendix B, Section B.2.3, Deadman Canyon Mine Complex), at Wildcat Canyon, west of Price, Utah, provide a set of normalized reference noise levels from which to project the potential noise impacts for railroad car loading operations at the Iron Springs and Moapa unit-train loadout sites (Acoustical Engineers, Inc. 1994).

Equipment used for the noise measurements at Price, Utah, conforms to ANSI type-one, precision standards, and was calibrated prior to, and following, the tests to standards traceable to the U.S. Bureau of Standards. Data recorded included the overall A - weighted decibels (dBA), as well as octave band spectrum analysis. Measurements were made in several typical positions surrounding various items of equipment. Large items, such as a railcar loader, were also measured at several different distances, to establish the near field-far field relationship, and to determine the characteristic attenuation with distance. The measurements were made during periods of normal operation of the machinery. In all tests, specific steps were taken to assure that the noise measured was due to the sources in question. Surface winds were minimal (less than 8 miles per hour), and the dominant noise under investigation was at least 10 decibels above any ambient conditions. It was assumed for railroad car loading operations that the noise would be present for less than 10 percent of the time, and that for the crusher the noise would be continuous. A radius surrounding the machinery was calculated where acceptable daytime and nighttime noise would not be exceeded (55 dBA and 48.6 dBA, respectively). The 1-hour "equivalent level" (Leq) for each operation at a distance of 500 feet was also calculated.

Measurements taken at the existing Wildcat Loadout were made at distances of up to 1,500 feet from the elevated tipple, conveyor, and train of hopper cars. In general, this noise source behaves as a line sound source, at least out to the measurement points observed.

The following acceptable dBA and Ldn reference points were calculated from the measurements, for distances from the car-loading tipple:

(1) At the side of the car-loading tipple system where the reclaim conveyor belt is exposed:

- 55 dBA at 850 feet,
- 48.6 dBA at 2,600 feet.

(2) At the side of the system where the reclaim conveyor belt is enclosed:

- 55 dBA at 700 feet,
- 48.6 dBA at 2,180 feet.

An Ldn of 55 would be achieved at 2,600 feet from the reclaim conveyor.

E.6.2 Mine Facilities Noise

Noise measurements, made at Andalex's existing Deadman Canyon Mine Facilities northeast of Price, Utah, (Appendix B, Section B.2.3, Deadman Canyon Mine Complex), provide a set of normalized reference noise levels from which to project the potential noise impacts from a coal crusher, mine ventilating fans, and truck loading operations at the proposed Smoky Hollow Mine areas (Acoustical Engineers, Inc. 1994).

It was assumed for the purpose of analysis that the noise at the Deadman Canyon Mine, truck loading operation would be present for less than 10 percent of the time and that noise at the ventilating fans would be continuous. The Deadman Canyon Mine coal crusher is somewhat more specifically defined noise source. In general, the sound radiation pattern behaves as a point source. The measurement site at the existing Deadman Canyon Mine was essentially an open, free field, with the measured data confirming a point-source condition. The following reference points were determined for distances having free line of sight access to the coal crusher; intervening coal piles or other blockages would reduce the noise levels somewhat in some directions:

- 55 dBA at 1,000 feet,
- 48.6 dBA at 2,089 feet.

The truck loadout structure at the mine is essentially a point noise source, similar to the crusher. There are two noise conditions: one during the initial phase of loading, when the coal impacts on the empty metal panels of the trailer; following this, the impact noise is reduced by about 10 decibels, due to the damping of the coal impact by the coal bed. The entire loading operation takes about 4 to 5 minutes, with about 10 to 12 seconds total at the higher noise level.

The calculated data is as follows, for both conditions:

(1) Initial phase of loading (10 to 12 seconds)

- 55 dBA at 1,800 feet,
- 48.6 dBA at 2,350 feet.

(2) Final phase of loading (4 to 5 minutes)

- 55 dBA at 400 feet,
- 48.6 dBA at 1,660 feet.

The noise radiation from the mine ventilating fan at the Deadman Canyon Mine had a pronounced directional character, with the noise level on the discharge axis about 8 to 10 decibels higher than that at the sides, at 90 degrees from the discharge.

The orientation indicated on the preliminary drawings for the proposed Smoky Hollow facility shows the discharge pointing into the end of the narrow canyon, with canyon walls extending upward about 600 feet on three sides. These conditions are similar to those measured at the existing Deadman Canyon Mine site. The canyon walls are very diffusive acoustically, with some potential for focusing.

In general, the radiation pattern would behave somewhat similar to a line source, with possible lobes occurring on a line centering on the canyon axis. The data below are based on the maximum radiation on the fan axis from the Deadman Canyon Mine fan:

- 55 dBA at 2,510 feet,
- 48.6 dBA at 4,940 feet.

E.6.3 Coal Truck Highway Noise

The EPA manual for the review of Highway Noise Impact (1977) worksheet A was used to calculate current and projected highway noise levels along the proposed coal haul route. That analysis assumed:

- An average speed of 55 miles per hour.
- An 18-foot distance between the centerlines of the inner lanes of a roadway and an 18-foot distance between the centerlines of the outer lanes.
- A distance of 50 feet from the observer (noise receptor) to the centerline of the nearest lane of the highway.
- A roadway grade of 0.
- Right angles (90 degrees) on roadway section ends.
- A grade factor of 1.4 for 2 to 6 percent grades.
- A percentage of vehicles during the peak hour of 0.1 percent.

E.7 ECONOMIC-DEMOGRAPHIC IMPACT MODELING

The socioeconomic component of the Warm Springs Project impact evaluation requires estimates of the employment and population effects associated with the proposed action, along with projections of the numbers of school age children and demand for additional housing. Beyond aggregate totals, the analysis also requires insights into the geographic distribution of the effects to support assessment of the effects on facilities and services and fiscal conditions of the affected communities. Because of the widely dispersed locations of the mine and the various transportation elements of the Warm Springs Project, the latter consideration adds an added degree of complexity to the economic-demographic modeling effort.

To satisfy the information needs for this analysis, a variation of an economic base/demographic multiplier approach was implemented. The approach is described briefly by the following steps:

Step 1: Key aspects of the mining and transportation operations are translated into corresponding estimates of annual expenditures, e.g., payroll, capital purchases, and other operating expenses. These monetary values reflect the direct economic stimulus into the regional economy. Information provided by Andalex Resources, Inc., serves as the source of most of these data.

Step 2: The direct employment, income, or purchases are assigned to one of the counties in the region of influence on the basis of anticipated residency of the direct workforce. Residency assumptions are based on reviews of prior work in the area, current population distributions in each county, labor force availability and skill requirements, proximity/access to the place of employment, insights gained from contacts with local officials, and professional judgment.

Step 3: Economic multipliers are applied to each of the direct expenditure amounts to estimate the indirect and induced (secondary) employment and income effects generated in other sectors as a consequence of the direct infusion. The multipliers are based on information from the U.S. Bureau of Economic Analysis, *Regional Input-Output Modelling System (RIMS II)*, for Utah. Different multipliers are applied to the various aspects of the Project to reflect differences in economic linkages between mining, transportation, and consumer/household sectors.

Step 4: Both the secondary income and employment estimates are adjusted to allow for leakage from the regional economy. The *RIMS II* multipliers reflect the total economic effect on a statewide level. Due to the limited infrastructure within the region to support underground coal mining and the relatively limited scale of retail and service centers within the region, it is unlikely that the full effect will be captured within the region of influence. Assumptions regarding the degree of local capture are based on analysis of economic data, with a range of projected local capture of 35 to 80 percent.

Step 5: To account for some of the dynamic forces at work in the region, allowances are provided to account for some capture of leakage from one community into neighboring, larger communities. For example, some consumer leakage from the Fredonia and Kanab area would likely be captured in St. George because of such factors as Dixie College, its more extensive retail trade and services sector, and scheduled air service. The estimated cross-flow of revenues acts as an additional stimulus in the local economy. The resultant incomes and employment are estimated using the *RIMS II* multipliers.

Step 6: Summing the adjusted secondary employment estimates from steps 4 and 5 with direct employment estimates provided by Andalex yields the total employment effects of the proposed Project.

Step 7: Indirect employment estimates are adjusted to allow for local hiring to fill the available employment opportunities. The allowances for local hiring, reflecting unemployment, underemployment, and advancement to higher paying jobs, are based on labor market information from the 1990 census and other sources.

Step 8: The unmet labor demand identified in step 7 is assumed to be satisfied by immigration. The number of immigrant workers establishes the basis for projecting immigrating population. This is accomplished by dividing the total employment need by an average number of workers per household to derive the number of additional households. Applying an average household size factor to the number of households yields the total population increase. The specific factors used in the analysis are as follows:

- Construction: 1.05 employees/household and 2.2 persons/household.
- Operations: 1.15 employees/household and 3.0 persons/household.

The factors for the operations employees are based on an analysis of the 1990 employee/household ratios among counties in Utah and the four neighboring States of Nevada, Arizona, New Mexico, and Colorado. Because of the skill requirements and rural western location of the proposed Project, it is believed that most of the immigrating employees would come from this broader region. The factors used are slightly above the overall average to provide some disproportionate influence for Utah demographic characteristics.

Assumptions for the construction employees reflect adjustments made to the operations factors, following the well-documented pattern observed over time among construction workforces at other projects.

Step 9: At the conclusion of step 8, the estimating approach provides estimates of total project-related employment and income, incremental population, and the number of additional households. There is a corresponding residency pattern associated with the estimates, but only at the county level. Sub-county allocations are made by combining residency assumptions for the direct employment and assumptions developed for the secondary population. The latter assumptions are based on 1990 census populations and the distribution of population growth between 1980 and 1990.

Step 10: Estimates of the project-related housing needs, on a community basis, are based on the number of households and a 1:1 relationship.

Step 11: Estimates of school age enrollments are derived by applying a constant factor of 22.5 percent to the projected population. This factor is based on the ratio of children aged 5 to 17 in the 1990 census in the region of influence, prorated to the assumed average household size.

The entire procedure outlined here is repeated for the peak employment period, which is the second year of Project activity, when construction and initial operations activities are ongoing simultaneously, and at stabilized operations. The process is also applied assuming a Hurricane location for the truck maintenance facility and then again assuming a Fredonia location for that facility.

The results of the process are shown in Tables E-4 to E-8.

E.8 PUBLIC FACILITIES AND SERVICES IN THE PROJECT AREA

Communities in southern Utah, northern Arizona, and southeastern Nevada are notable for both their diversity and their similarity. The communities differ in size, and their local economies vary in level of activity and composition. Social structures, lifestyles, and material facilities and services vary from place to place (Chapter 3, Section 3.9.3, Community Resources).

Table E-9 summarizes public facilities and services available in communities in the proposed Project area. These include; law enforcement, fire protection, emergency response, public utilities, education, health and social services, and housing.

E.9 FEDERAL AND STATE RECREATION PROPERTIES

E.9.1 Bryce Canyon National Park

Bryce Canyon National Park is located in southwestern Utah, about 87 miles east of Cedar City, Utah (Figure 1-1); the main entrance lies about 4 miles off Route 12 on Utah Route 63.

The 35,835-acre park, which is managed and operated by the National Park Service, is known for its eroded pinnacles, walls, and spires; geology; and panoramic views (National Park Foundation 1990). Bryce Canyon is open year-round; peak visitor months are June, July, and August. The total number of visitors in 1992 was 1.4 million; 1.6 million people visited the park in 1993. Visitors have increased 8 to 10 percent per year over the past 8 years (Colclazer 1994). Bryce Canyon National Park is a Class I Air Quality area.

E.9.2 Burning Hills Wilderness Study Area

The Burning Hills Wilderness Study Area (WSA) is located in south-central Utah, about 60 miles east of Kanab, Utah, north of Glen Canyon National Recreation Area. The area can be accessed by a county-maintained road, which goes north out of Big Water, Utah, off U.S. Hwy 89. The road proceeds from the south part of the WSA northward along the western border of the WSA (DOI 1990, 1991).

The 62,390-acre WSA is on the Kaiparowits Plateau and is managed by the Bureau of Land Management; 3,840 of the acres are in-holdings (State and private) (U.S. Department of the Interior 1990, 1991). The WSA was designated in November 1980 and is bounded on the west by Wahweap WSA and on the east by the Deathridge WSA.

Elevations range from 4,100 feet to 6,300 feet above mean sea level. The WSA is characterized by deeply incised channels, high knolls colored red by naturally occurring coal fires, and badland areas. Sensitive biological resources potentially inhabit or frequent the WSA. Historical resources may also be present within the WSA. The WSA is open year-round and air quality is good to excellent. It is estimated that the WSA experiences fewer than 100 visitor days per year (DOI 1990, 1991).

E.9.3 Cedar Breaks National Monument

Cedar Breaks National Monument is located in southwestern Utah; it is reached via Utah Route 14 and lies about 27 miles from U.S. Hwy. 89 at Long Valley Junction and 23 miles from Interstate-15 at Cedar City via Utah Route 14 (Figure 1-1) (National Park Foundation 1990).

The 6,155-acre monument consists of a huge natural amphitheater eroded into the variegated Pink Cliffs of the Wasatch Formation, which are 2,000 feet thick at this point. Camping, sightseeing, picnicking, interpretative talks, and snowmobiling are the main visitor activities at the monument, which is managed by the National Park Service. Depending on winter weather, the monument is open year-round (National Park Foundation 1990).

Peak visitor season is from June to September. In 1992, there were 406,477 visitors. In 1993, there were 578,268 visitors, a 17 percent increase over 1992. Average increases in visitor use are about 6 to 7 percent per year (Robinson 1994).

E.9.4 Cockscomb Wilderness Study Area

The Cockscomb WSA is located in south-central Utah, about 40 miles east of Kanab, Utah. Access is from U.S. Hwy. 89, which generally borders the southern and western parts of the WSA. Additional access is from the Cottonwood Canyon Road, which proceeds northward along the Paria River and Cottonwood Creek and borders the east edge of the WSA.

This 10,827-acre WSA is known for The Cockscomb and The Rimrocks, geologic features noted for their exceptional scenic qualities. About 10,080 acres of the WSA are managed by the Bureau of Land Management (BLM); 747 acres are split-estate, with BLM controlling only the surface.

Elevations in the WSA range from 4,500 feet along the Paria River floodplain to 5,700 feet on The Cockscomb. The Cockscomb and the western part of The Rimrocks offer the greatest opportunity for primitive recreation. The WSA is open year-round, and air quality is considered good.

The WSA experiences fewer than 100 visitor days per year, with 90 visitor days for off-road vehicle use and 10 visitor days for fossil collecting (DOI 1990, 1991).

E.9.5 Coral Pink Sand Dunes State Park

The Coral Pink Sand Dunes State Park is located about 19 miles west-northwest of Kanab, Utah, off U.S. Hwy. 89. The 3,700-acre State park, which is managed by the Utah Department of Natural Resources, Parks and Recreation Division, is a recreation area noted for its pink sand dunes, the product of erosion of the surrounding sandstone cliffs and ridges (Utah Scenic Byways and Backways no date).

Visitation has increased by 25 to 30 percent over the last 2 years. Visitation figures for 1992 increased by 35 percent over 1991 figures. About 170,160 people visited the Park between July 1992 and June 1993. All-terrain vehicle (ATV) use has been declining at the park: in 1990/1991 it was 14 percent of total visitor use; in 1992-1993 it was 6 percent. It is expected that ATV usage will level off to between 10 and 12 percent of total visitor use (Richards 1994).

E.9.6 Fiftymile Mountain Wilderness Study Area

The 146,143-acre Fiftymile Mountain WSA is one of the largest in Utah; it is about 24 miles long and 12 miles wide and lies generally north of the Glen Canyon National Recreation Area in several canyon systems of the Kaiparowits and Straight Cliffs areas. All but some 15,000 acres of the WSA are BLM-administered lands; 12,341 acres are State lands and 2,659 acres are split-estate lands (Federal surface and State minerals).

The WSA is best known as a location for viewing the panoramas of the lower Glen Canyon region and offers outstanding opportunities for hiking, backpacking, horseback riding, photography, and sightseeing. It is the highest large land mass in the area and exhibits a landscape and climate unique to the region. Fiftymile Mountain WSA also contains a 47,325-acre archaeological district that has been nominated to the National Register of Historic Places (DOI 1991). The WSA was established in November 1980 and receives about 100 visitors per year.

E.9.7 Glen Canyon National Recreation Area

The Glen Canyon National Recreation Area lies on the Colorado River and Lake Powell in northern Arizona and southern Utah. A visitor center is located at Glen Canyon Dam, about 2 miles north of Page, Arizona, on U.S. Hwy. 89 (Figures 1-1 and 1-2).

The recreation area includes Lake Powell, which stretches for 186 miles behind the Glen Canyon Dam. Camping, swimming, boating, fishing, water skiing, hunting, driving, sightseeing, hiking, Glen Canyon Dam tours, and picnicking are all activities available to visitors to the recreation area (National Park Foundation 1990).

The 1,255,400-acre recreation area is open year-round and is managed by the National Park Service. The recreation area is very busy from March through November, with peak visitation in June, July, and August. About 3,620,558 people visited the recreation area in 1992; this was a 13 percent increase over 1991. About 3,615,000 people visited the recreation area in 1993 (Gediman 1994a). Visitor use has increased dramatically over the past 2 to 3 years, although a leveling out is expected for the next several years; most of the increase is attributed to foreign visitors (Gediman 1994a, b).

E.9.8 Grand Canyon National Park

Grand Canyon National Park, which is managed by the National Park Service, is located in northern Arizona, on the Colorado River. The North Rim of the park is about 45 miles south of Jacob Lake and U.S. Hwy. 89, and is accessed by Arizona Hwy. 67 (Figure 1-1).

The main focus of the 1,218,375-acre park is the Grand Canyon of the Colorado River, which encompasses 277 miles of the 1,400-mile-long river and adjacent uplands, from the southern terminus of Glen Canyon National Recreation Area to the eastern boundary of Lake Mead National Recreation Area. Erosion has exposed a large variety of geologic formations in the canyon that illustrate long periods of geologic history. Interpretive exhibits, guided and self-guided tours, picnicking, camping, backcountry hiking, horseback riding, white water rafting and kayaking, fishing, biking, bus tours, mule trips, and river tours are all available in the park (National Park Foundation 1990).

The North Rim is closed during the winter. The peak visitor season is from June to August; however, the park is also very busy from April through May and from September to October. Just under 5 million people visited the park in 1993. Overall visitor use is increasing by about 6 to 7 percent each year (Price 1994).

E.9.9 Grosvenor Arch

Grosvenor Arch is a natural arch located about 80 miles northeast of Kanab, off Cottonwood Canyon Road. The arch is accessible by car from the road and lies about 300 feet from a parking area at the site. The number of visitors at the arch in 1993 was about 4,000, as determined from counts taken at the trailhead register in the parking lot. Visitation is expected to increase by about 5 percent over the next year. The area is generally used during the day, especially the picnic area, and mainly between April and November.

E.9.10 Kaibab National Forest

The Kaibab National Forest lies on the north and south rims of Grand Canyon National Park and is divided into four districts; one district lies north of the park, and three lie south. The northern district received about 415,000 visitors between October 1992 and November 1993. Visits in 1994 were about the same. Visitor use has increased over the last 5 years. The forest is open year-round. A cross-country skiing facility is open in the northern district from late November to early May, depending upon snowfall. Camping is available in the area (Martinet 1994).

E.9.11 Old Paria Townsite

The old Paria townsite is located about 7 miles north of U.S. Hwy. 89 and 30 miles east of Kanab, Utah, on BLM-administered land. The site is accessed by four-wheel-drive vehicles or by foot from a 2-mile-long road past the Paria movie set that ends at the Paria River (Section E.9.14). The townsite was settled by Mormons in the 1870s. From the early 1900s to the 1930s, silver and gold were mined in the area. The roughly 10-acre site, which is listed on the National Register of Historic Places, generally consists of the remains of rock buildings. BLM has restored one cabin at the site.

About 5,500 people visited the townsite in 1993, based upon trailhead register counts taken at the Paria movie set parking area. Use of the area is expected to increase by about 5 percent in the next several years. The area is used mostly during the day, with heaviest use between March and November. Some camping occurs in the vicinity.

A cemetery associated with the townsite lies about 2 miles south of the townsite on one-quarter acre of BLM-administered land. The site is adjacent to the Paria movie set and is fenced and accessible by car.

E.9.12 Paria Canyon/Vermilion Cliffs Wilderness Area

The Paria Canyon/Vermilion Cliffs Wilderness Area (WA) is located in south-central Utah and north-central Arizona, just west of Page, Arizona. Major access to the northern part of the wilderness area in Utah is off U.S. Hwy. 89 at the Paria entrance station. The wilderness area lies about 3 to 4 miles from U.S. Hwy. 89 at this point. Major access to the southern part of the wilderness area in Arizona is at Lees Ferry, which lies off U.S. Hwy. 89A near the Colorado River. U.S. Hwy. 89A skirts the southern border of the wilderness area as the highway proceeds west from Lees Ferry. A county-maintained seasonal road connects U.S. Hwys. 89 and 89A on the west side of the wilderness area.

This 110,000-acre WA, established in 1984 and managed by the Bureau of Land Management, is known for its deep canyons, colorful panoramic scenery, unusual geological features, and large quantity of historical and biological resources. The WA is open year-round; it experiences long, hot summers, mild winters, low annual precipitation with a low relative humidity, and a high number of sunny days. Air quality is good to excellent (U.S. Department of the Interior 1986).

Peak visitor months are April, May, and June. Fifty percent of yearly use occurs during these months. About 10,133 people visited the wilderness area in 1985 (U.S. Department of the Interior 1986). Based upon counts made at trailhead registers, 5,132 people visited the WA in 1993. Numbers may be higher since not all hikers register.

E.9.13 Paria-Hackberry Wilderness Study Area

The Paria-Hackberry WSA lies in south-central Utah, about 30 miles east of Kanab, Utah. Access is by way of the Cottonwood Canyon Road, which proceeds north off U.S. Hwy. 89 and borders the east edge of the WSA. The area can also be accessed off a county-maintained road that borders the west and northwest edge of the WSA. This road originates about 6 miles east of Kanab off of U.S. Hwy. 89 and proceeds north to Cannonville. A road that goes to the Old Paria townsite/movie set location (Sections E.9.11 and E.9.14), which is immediately adjacent to the WSA, also provides access to the WSA.

The 145,281-acre WSA includes a large part of the Paria River drainage, as well as the Hackberry Creek drainage. About 135,822 acres in the WSA are managed by the Bureau of Land Management; 400 acres are split-estate, with BLM managing the surface only; 9,059 acres are in-holdings (State and private). Elevations in the area range from 4,700 feet on the Paria River in the southern part of the WSA to 7,200 feet in the west-central and northern parts of the WSA. Varied landscape features in the WSA include colored bench formations, plateaus, sand dunes, exposed sandstone cliffs, and other unusual terrain. Historical resources are present within the WSA. The WSA also may be host to sensitive biological resources. The WSA is open year-round, and air quality is good to excellent.

Backcountry use of the WSA is estimated at 500 visitor days annually. Off-road vehicle use has been estimated at about 200 visitor days per year (DOI 1990, 1991).

E.9.14 Paria Movie Set

The 1- to 2-acre Paria Movie Set is located about 5 miles north of U.S. Hwy. 89 and 30 miles east of Kanab, Utah, and is accessible by car from U.S. Hwy. 89. The set consists of a replica of an old western main street. It was constructed in 1963 for the movie, "The Outlaw Josey Wales," filmed there in the mid- to late 1970s.

The area is primarily for day use, but some camping does take place in the combined picnic/camping area. The area generally is used between March and November. About 5,500 people visited the area in 1993, based upon trailhead counts taken from a register in the parking lot. A 5 percent increase in visitors occurred during 1994. The area lies on BLM-administered land.

E.9.15 Pipe Springs National Monument

Pipe Springs National Monument is located about 14 miles west of Fredonia, Arizona; the monument can be reached from Arizona Hwy. 389 (Figure 1-1). The monument consists of an historic fort and other structures built by pioneers in the 1870s and 1880s. Self-guided trails and walking tours, exhibits, and visual interpretation are available. The 40-acre monument, which is managed by the National Park Service, is open during daylight hours year-round (National Park Foundation 1990). The majority of visitor use occurs from May to October, with July being the peak visitation month. Visitation has decreased from 56,319 people in 1992 to 52,556 people in 1993, a decrease of almost 7 percent (Davis 1994).

E.9.16 Wahweap Wilderness Study Area

The Wahweap WSA lies in south-central Utah, about 40 miles east of Kanab, Utah. Primary access to the WSA is from the south off U.S. Hwy. 89 via the Cottonwood Canyon Road, which proceeds northward along the Paria River and Cottonwood Creek. The road borders the west edge of the WSA and connects U.S. Hwy. 89 with Cannonville.

The 144,761-acre WSA, which was established in November 1980, lies in a part of the Kaiparowits area that is bordered by improved and unimproved roads. BLM manages 134,400 acres of the WSA; 10,361 acres are in-holdings (State and private).

The Wahweap WSA generally consists of benches and south-facing cliffs that slope northward. Elevations range from 4,000 to 6,500 feet above mean sea level. The WSA is noted for its exposed sandstone formations, vegetation, and landscape features. Historical and biological resources include 1,400-year-old pinyon and juniper trees. The WSA also has a large potential for mineral development. Air quality is considered to be good to excellent. It is estimated that the WSA has fewer than 100 visitor days per year (U.S. Department of the Interior 1990, 1991).

E.9.17 Zion National Park

Zion National Park is located in southern Utah about 15 miles east of La Verkin, Utah. The park can be reached by Utah Routes 9 and 17, via Interstate-15 or U.S. Hwy. 89 (Figure 1-1).

The 147,500-acre park is a canyon and mesa area with dramatic scenery created by erosion, volcanic activity, and rockfall patterns. Interpretive films, exhibits, sight-seeing, hiking, mountain climbing, wading, camping, biking, horseback riding, and wildlife and bird watching are available at the park. The park is managed by the National Park Service, and is open year-round (National Park Foundation 1990).

The park is very busy from April through October; the peak visitation month is August, followed closely by July. Park visitation has increased an average of 8.2 percent per year over the past 10 years. In 1992, 2.67 million people visited the park; in 1993, about 2.4 million people visited. Changes in 1993 in the method of averaging numbers of people per vehicle entering the park account for the decrease in visitor totals in 1993; if old averaging systems had been used, the total number of visitors in 1993 would have been 2.87 million (Davies 1994).

E.10 CULTURAL RESOURCE INVENTORIES

A prehistoric cultural resource is defined as the physical remains of prior human activity that predates the advent of written records. A historic cultural resource is defined as the physical remains of prior human activity that followed the advent of written records. Sites may vary greatly in size and physical expression depending on their age, complexity, physical integrity, data content, and relationship to other archaeological/historical remains. Sites may be important because of their potential to yield information about preexisting cultures and now-extinct lifeways or because of their association with notable historical persons or events, or as examples of distinctive architectural styles (Chapter 3, Section 3.14.2, Prehistoric and Historic Cultural Resources.

This section describes all known cultural surveys of the Project area. Unless otherwise noted as Class I inventories (literature overviews), surveys described are of a Class III (intensive) nature. Table E-10 lists these sites along with some of their important characteristics including potential eligiblity to the NRHP.

- **Smoky Hollow life-of-mine area**: Eight surveys and two Class I studies have been conducted within the boundaries of the area; (MNA 1974; Zier 1974; McFadden 1987c; Thompson, R. A. 1990; Walling 1992a; Hauck and Hadden 1994a, b, c, d; Hauck and Hadden 1995). The surveys have not covered most of the lands within the proposed Smoky Hollow life-of-mine area, although all direct impact areas, such as proposed locations of surface facilities, have been covered. Thirty three sites eligible for the NRHP pending SHPO concurrence were identified by the surveys in this area.

- **138-kV Power Transmission Line**: The proposed powerline right-of-way and associated access roads have been surveyed in their entirety; eight other surveys have previously covered parts of the proposed right-of-way. Another seven surveys have been conducted within one-half mile of the right-of-way, and a previous Class I inventory covers the right-of-way (Harrill 1970; MNA 1974; Thompson, R. A. 1976, 1990; Simms and Rauch 1979; McFadden 1985b, 1987a, b, c, 1989a, 1993; Walling 1992a; Hauck and Hadden 1994a, b, c, d). Fifteen sites eligible for the NRHP pending SHPO concurrence were identified in the areas by these surveys.

- **Microwave communication system**: The three sites proposed for microwave facilities (Big Water terminal linkage facility, Spring Point reflector station, and Mustard Point repeater station), plus an access road to the Mustard Point repeater, have been surveyed in their entirety; two previous surveys also partially cover the area of the Big Water terminal linkage facility. In addition, 12 previous inventories were made within one-half mile of a relay station, and a previous Class I inventory encompasses one of the areas (Nielson 1984; McFadden 1985a, b, c, 1987a, c, 1988, 1989a, b; Thompson, R. A. 1990; Walling 1992a; Hauck and Hadden 1994a, b, c, d, e). Two sites eligible for the NRHP pending SHPO concurrence were identified in the area as a result of these surveys.

- **Smoky Mountain Road System, Warm Creek Road**: This road, proposed reconstruction and realignment areas, associated construction staging areas, and road fill/borrow areas have been surveyed in their entirety. Nine other surveys have covered parts of the route. Another five surveys have been conducted within one-half mile of the route, and a previous Class I inventory covers the route (MNA 1974; Thompson, R. A. 1976, 1990; Nielson 1984; McFadden 1985a, 1987c, 1988, 1989a; Geib 1986; Lancaster 1992; Walling 1992a; Hauck and Hadden 1994a, b, c, d, e). Seventeen sites eligible for the NRHP pending SHPO concurrence were identified by the surveys in this area.

- **Smoky Mountain Road System, Benchtop Road**: The proposed road and associated construction staging areas, side casting areas, culverts, and bridges have been surveyed in their entirety; seven other surveys have covered parts of the route. Another seven surveys have been conducted within one-half mile of the route, and a previous Class I inventory covers the route (Harrill 1970; MNA 1974; Thompson, R. A. 1976, 1990; Nielson 1984; McFadden 1985a, 1987c, 1988, 1989a, b; Walling 1992a; Hauck and Hadden 1994a, b, c, d, e). Sixteen sites eligible for the NRHP pending SHPO concurrence were identified by the surveys conducted in this area.

- **Iron Springs unit-train loadout**: The proposed loadout area has been surveyed in its entirety; two other surveys have been conducted within one-half mile of the facility (Nielson 1986, 1988; Walling 1992b). One site was identified as eligible for the NRHP pending SHPO concurrence.

- **Moapa unit-train loadout**: The proposed loadout area and an associated powerline and access road have been surveyed in their entirety in the course of two separate investigations; 11 other studies have covered parts of the loadout and/or associated facilities, of which 9 were field surveys, 1 an excavation, and 1 a Class I overview. Another four surveys have been conducted within one-half mile of the proposed loadout and associated facilities (Brooks 1973; Brooks et al. 1974; Brooks et al. 1975; Brooks et al. 1976; Brooks et al. 1977; Larson et al. 1978; Jenkins, D. L. 1980; Leavitt 1981; Tucker 1983; Knight and Leavitt 1985; Dames and Moore 1986; Rafferty and Blair 1986; Talbott et al. 1989; Edwards and Kimball 1990; McClenahan & Hopkins Associates, Inc. 1990; DuBarton and Edwards 1991; Blair 1992, 1994). In addition, one investigation with uncertain boundaries has been conducted in the immediate vicinity of the loadout (Osborne 1941; Colton 1945; McGregor 1945; Shutler and Shutler 1962). Three sites eligible for the NRHP pending SHPO concurrence were identified during these surveys.

- **Fredonia truck maintenance facility**: There have been no cultural surveys completed in or around the area of the hypothetical location for this facility.

- **Hurricane truck maintenance facility**: Two previous surveys traverse the hypothetical facility site and another investigation has occurred within one-half mile of it (Nielson and Southworth 1988; Tipp, B.L. et al. 1989; Horn 1991). Two sites eligible for the NRHP pending SHPO concurrence have been identified in this area.

E.11 NATIVE AMERICAN GROUPS

E.11.1 Paiute

The creation of reservations for various Paiute Bands in the latter 1800s provided territorial boundaries for groups whose range was only vaguely defined for much of the ethnohistoric period. Bands would follow subsistence resources, joining together when resources allowed, splitting when resources required. Band structure was weak and fluid; trade, intermarriage, and movement among the various Paiute Bands were common. Members of any of the Southern Paiute Bands may have historic or genetic ties to the southern Utah, northern Arizona, and southeastern Nevada area.

E.11.1.1 Five Bands of the Paiute Tribe of Utah

The Cedar City, Indian Peaks, Kanosh, Koosharem, and Shivwits Bands comprise the Five Bands of the Paiute Tribe of Utah. Each band has a governing council and sends a representative to the Tribal Council of the Five Bands of the Paiute Tribe of Utah (Ninkuna 1994). Reservations for these bands were terminated as a result of Public Law 83-762, effective March 1, 1957, and then reinstated in the early 1980s (Ninkuna 1994).

The Cedar City Band of Paiutes is an organization of Native Americans historically associated with the Cedar City Reservation. Its headquarters is in Cedar City, Utah.

The Kanosh Band of Paiutes has historic ties to the Kanosh Reservation, which is about 10 miles south of Fillmore, Utah, and some 90 miles northeast of the Cedar City, Utah, area.

The Koosharem Band of Paiutes is historically linked to the Koosharem Reservation, located about 40 miles south-southeast of Richfield, Utah. Richfield is about 90 miles northeast of the proposed haulage route at Cedar City and about 90 miles north-northwest of the proposed minesite.

The Shivwits Band of Paiutes is associated with the Shivwits Reservation, situated about 10 miles west-northwest of St. George, Utah. Headquarters for the Shivwits Band is in St. George.

E.11.1.2 Kaibab, Moapa River, and Southern Paiute

The Kaibab, Moapa River, and Southern Paiute are three tribes in the southern Utah, northern Arizona, and southeastern Nevada area.

The 120,413-acre Kaibab Reservation is located west of Fredonia, Arizona, along the Utah State border. Tribal headquarters are in Fredonia, Arizona. In 1990, 65 Native Americans resided on the Kaibab Reservation (U.S. Bureau of Census 1993). Six popularly elected members comprise the Kaibab Paiute Tribal Council, which is responsible for the policy decisions of the tribe. Members of the Kaibab Reservation are descendants, in part, of a Southern Paiute Band of the same name that occupied an area from about the Kolob Plateau on the northwest to the Colorado River on the southeast and the Paria River on the northeast to the Kanab Plateau on the southwest during the ethnohistoric period. Their traditional economy depended primarily on foraging.

The 1,174-acre Moapa River Reservation is located near Moapa, Nevada. In 1990, 177 people lived on the Moapa River Reservation (U.S. Bureau of Census 1993). The constitution and bylaws adopted by the tribe in 1942 established the Moapa Business Council as the tribe's governing body. The council's six members are elected to 3-year terms. Tribal headquarters are at Moapa, Nevada (Confederation 1986). The Moapa River Reservation was established for a local band of Paiute Indians in 1875. The groups that came to be residents of the Moapa River Reservation traditionally followed a foraging economy and traveled in small bands searching for food.

Offices of the Southern Paiute Tribe are in Tuba City, Arizona. Members of the Southern Paiute Tribe include descendants from the San Juan in addition to members through intermarriage with neighboring Native American groups. The Southern Paiute Tribe does not have, and never did have, a reservation. Ethnohistorically and historically, members of the Southern Paiute Tribe have strong historic and contemporary ties to southern Utah and northern Arizona. This group has occupied the northwest corner of what is now the Navajo Nation from the ethnohistoric period to the present (Kelly 1976; Weber 1980; Henderson).

E.11.2 Hopi

The 2.5-million-acre Hopi Reservation lies in west-central Arizona and is surrounded by the Navajo Nation. A part of the Hopi Reservation lies about 75 miles south-southeast of Page, Arizona. The Hopi people live predominantly in villages on three mesas across the central part of their reservation. Each village is organized independently and has either a hereditary village chief or an elected governor. The tribe also has a Tribal Council operating under a constitution. Tribal Headquarters are at Oraibi, Arizona (Confederation 1986). In 1990, 7,002 Native Americans resided on the Hopi Reservation (U.S. Bureau of Census 1993).

The Hopi people claim cultural and ancestral affinity to the prehistoric inhabitants of southern Utah and northern Arizona. This claim is based upon Hopi oral migration traditions, which state that the Hopi Bow, Greasewood, Reed, Arrow, Roadrunner, Snake, Lizard, Sand, and Flute Clans, among others, migrated through and inhabited this area. This claim includes both human remains and cultural manifestations of the Archaic, Basketmaker, and Pueblo cultures (Jenkins 1993). Hopi ancestral sites, now referred to as archaeological sites, are considered to be an integral part of the Hopi religion because they are the physical manifestation of a spiritual command given to the Hopi people by Ma'asaw. Also, many habitation sites contain village shrines that have not been "spiritually retired" but, rather, retain their original spiritualness. Therefore, all Hopi ancestral sites are considered to be protected under the considerations of the American Indian Religious Freedom Act (AIRFA) (Jenkins 1993).

E.11.3 Navajo

The main part of the Navajo Nation is located in northeastern Arizona; additional parts extend into adjoining sections of Utah and New Mexico. Three isolated Navajo Reservations (Alamo, Canoncito, and Ramah) are located in west-central New Mexico at some distance from the main part of the reservation. Part of the Navajo Nation lies about 17 miles south of Page, Arizona.

At about 24,000 square miles in size, the Navajo Nation approximates West Virginia in size and extends over an area of just less than 14 million acres (Confederation 1986). In 1990, 5,272 Native Americans lived on the Utah part of the Navajo Reservation and 87,578 Native Americans lived on the Arizona part of the Reservation (U.S. Bureau of Census 1993).

The Navajo Nation is governed by a 74-member council representing 96 chapters (geographic districts). Among the members of the council are representatives from the Eastern Administrative Area and the Alamo, Canoncito, and Ramah Reservations in New Mexico. Tribal headquarters are at Window Rock, Arizona (Confederation 1986).

From the ethnohistoric period to the present, the general area of southern Utah and northwestern Arizona has been used by members of the Navajo Nation (Roberts 1993).

Table E-1 — Soil Descriptions Associated With the Warm Springs Project Area

Project Component	Soils Unit	Average Soil Depth (Inches)	Average Salvageable Growth-Medium Depth[1] (Inches)	Growth-Medium Texture	Limiting Factors
Smoky Hollow Mine Surface Facilities Complex (Andalex Resources, Inc. 1994).	Rock Outcrop-Rubble Land (map unit 7).	--	--	Rock	Shallow soils, high erosion.
	Lithic Ustorthent, 20-45% slopes (map unit 1).	7	7	Stony sandy loam, gravelly sandy clay loam, weathered shale and sandstone.	Shallow soils, stony texture.
	Typic Ustifluvent, 0-4% slopes (map unit 2).	60	12	Very gravelly loamy sand, gravelly loamy sand, extremely gravelly sand, stony extremely gravelly sand.	Extremely gravelly soils below 12".
	Ustollic Calciorthid, 15-30% slopes (map unit 3).	39	17	Gravelly sandy loam, very gravelly loamy sand, weathered sandstone and shale.	Saline soils, high percentage of rock fragments, cryptogamic soils in limited area in this unit.
	Disturbed Land (map unit 4).	12-70	6	Sandy clay loam to a sandy loam, loam.	Rock fragments, low available water capacity.
	Typic Ustorthent, 20-45% slopes (map unit 5).	36	3	Gravelly sandy loam, very gravelly sandy loam, channery very gravelly sandy loam, stony channery very gravelly loamy sand.	Rock fragments, shallow soils, cryptogamic soils in limited area in this unit.

Table E-1 — Soil Descriptions Associated With the Warm Springs Project Area — (Continued)

Project Component	Soils Unit	Average Soil Depth (inches)	Average Salvageable Growth-Medium Depth[1] (inches)	Growth-Medium Texture	Limiting Factors
Smoky Hollow Mine Surface Facilities Complex (Andalex Resources, Inc.) Con.	Typic Ustorthent, 5-20% slopes (map unit 6).	32	32	Gravelly sand, gravelly sandy loam, extremely gravelly loamy sand.	Saline-sodic soil in A horizon.
Smoky Hollow Mine Topsoil Borrow Area (Andalex Resources, Inc. 1994).	Windwhistle-Palma-Rizno Complex.	12-60"	9-60"	Fine sandy loam, clay loam, gravelly loam, sandy loam, very gravelly loam.	Very gravelly loam below 9" in Rizno, high wind erosion in Palma, shallow depth to bedrock in Rizno.
Smoky Hollow Mine Mining Area (Andalex Resources, Inc. 1994).	Rock Outcrop.	--	--	Rock.	Shallow soils, high erosion.
	Windwhistle-Palma-Rizno Complex.	12-60"	9-60"	Fine sandy loam, clay loam, gravelly loam, sandy loam, very gravelly loam.	Very gravelly loam below 9" in Rizno, high wind erosion in Palma, shallow depth to bedrock in Rizno.
	Mellenthin-Rock Outcrop Complex.	0-8" gravelly sandy loam, 8-20" very gravelly sandy loam, 18-20" sandstone bedrock.	8	Gravelly sandy loam.	Shallow soils, shallow depth to rock, low organic matter content of surface layer, low available water capacity.
	Millenthin-Begay-Mespun Complex	13"-60"	13"-60"	Loamy firm sand, fine sandy loam	Shallow depth to rock (Millenthin) high wind erosion potential.
138-kV Power Transmission Line (Andalex Resources, Inc. 1994)	Milok-Begay-Palma Complex.	36-60"	36-60"	Fine sandy loam, sandy loam, loamy sand, loamy fine sand.	Low organic matter, severe wind erosion potential with Milok and Palma, severe water erosion potential with Begay, low available water capacity.
	Rizno-Rock Outcrop Complex.	0-9"	0-6"	Gravelly fine sandy loam, highly fragmented sandstone, sandstone bedrock.	Shallow soils, high water erosion potential, rock outcrops, slope, low available water capacity.

Table E-1 — Soil Descriptions Associated With the Warm Springs Project Area — (Continued)

Project Component	Soils Unit	Average Soil Depth (inches)	Average Salvageable Growth-Medium Depth[1] (inches)	Growth-Medium Texture	Limiting Factors
138-kV Power Transmission Line (Andalex Resources, Inc.) Con.	Pherson-Glenberg-Riverwash.	0-60" [no soil depths for Glenberg].	0-19" [no soil depths for Glenberg].	Fine sand loam, loamy fine sand, loam, extremely gravely loam sand, sand, cobblestone, gravel.	Moderate to high water erosion, moderate wind erosion, low organic matter, frequent flooding.
	Nakai-Shepard Complex.	60"	60"	Loamy fine sand, sandy loam, fine sandy loam, fine sand.	High wind erosion potential.
	Chipeta-Badland Complex.	0-22"	0-15"	Silty clay loam, nonweathered shale, weathered shale.	Shallow soils in Badland, high water erosion potential, moderate wind erosion potential, saline soils, low forage production.
	Casmos-Rock Outcrop-Avalon Family Association.	0-38"	0-38"	Fine sandy loam, channery loam, gravelly loam, loam sandstone bedrock, rock outcrop.	Shallow depth to bedrock in Casmos and rock outcrop, low available water capacity, steep slope in some areas.
	Rock Outcrop.	--	--	Rock outcrop.	Depth to bedrock, high water erosion potential, saline soils.
	Sazi-Milok-Rizno Complex. (45%-20%-15%)	16-60	16-60	Fine sandy loam, sandstone bedrock.	Moderate wind and water erosion potential for Milok and Rizno, shallow depth to bedrock in Rizno, low available water capacity.
	Windwhistle-Palma-Rizno Complex.	12-60"	9-60"	Fine sandy loam, clay loam, gravelly loam, sandy loam, very gravelly loam.	Very gravelly loam below 9" in Rizno, high wind erosion in Palma, shallow depth to bedrock in Rizno.

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Table E-1 — Soil Descriptions Associated With the Warm Springs Project Area — (Continued)

Project Component	Soils Unit	Average Soil Depth (inches)	Average Salvageable Growth-Medium Depth[1] (inches)	Growth-Medium Texture	Limiting Factors
Microwave Communication System (Andalex Resources, Inc. 1994).	Windwhistle-Palma-Rizno Complex (35%-20%-20%).	12-60"	9-60"	Fine sandy loam, clay loam, gravelly loam, sandy loam, very gravelly loam.	Very gravelly loam below 9" in Rizno, high wind erosion in Palma, shallow depth to bedrock in Rizno.
	Milok-Begay-Palma Complex	36"-60"	36"-60"	Fine sandy loam, sandy loam, loamy sand, loamy fine sand	Low organic matter, severe wind erosion potential with Milok and Palma, severe water erosion potential with Begay, low available water capacity.
Smoky Mountain Road System/Warm Creek Road (SCS 1984, Andalex Resources, Inc. 1994).	Casmos Family-Chipeta-Goblin Family Complex (40%-20%-20%).	Casmos: 0-2" fine sandy loam, 2-11" channery loam, 11" bedrock. Chipeta: 0-11" silty clay loam, 11" bedrock. Goblin: 0-2" fine sandy loam, 2-8" channery clay loam, 8-12" clay loam, 12" bedrock.	2	Fine sandy loam.	Casmos: Moderate wind erosion, shallow depth to bedrock, severe road building. Chipeta: Shallow depth to bedrock, high salinity, high erodibility (wind = 6), low strength for roads (severe), shrink-swell potential. Goblin: Shallow soil, high salinity, high erodibility (wind = 8), shrink-swell, low strength. All three: High corrosion to steel, concrete.
	Chipeta-Badland (60%-35%).	Chipeta: 0-11" silty clay loam, 11" bedrock. Badland: No soil.	11	Silty clay loam.	Chipeta: Shallow depth to bedrock, high salinity, high erodibility (wind = 6), low strength for roads (severe), shrink-swell potential. Badland: Highly erosive.

Table E-1 — Soil Descriptions Associated With the Warm Springs Project Area — (Continued)

Project Component	Soils Unit	Average Soil Depth (Inches)	Average Salvageable Growth-Medium Depth[1] (Inches)	Growth-Medium Texture	Limiting Factors
Smoky Mountain Road System/Warm Creek Road (SCS 1984, Andalex Resources, Inc. 1994) Con.	Myton, deep-Myton, moderately deep.	Myton, deep: 0-11" channery loam, 11-23" very channery loam, 23-60" very channery sandy loam, Myton, moderately deep: 0-7" gravelly clay loam, 7-24" very gravelly loam, 24" bedrock.	0	---	Moderate water erosion, high wind erosion.
	Rock Outcrop/Badland.	No soil.	---	---	High erosion, shallow depth to bedrock.
	Rock Outcrop/Casmos.	Rock outcrop: No soil. Casmos: 0-2" fine sandy loam, 2-11" channery loam, 11" bedrock.	---	---	Rock outcrop: No soil. Casmos: Moderate wind erosion, shallow depth to bedrock, severe rating for road building.
	Mellenthin-Rock Outcrop Complex (55% - 20%).	0-8" gravelly sandy loam, 8-20" very gravelly sandy loam, 18-20" sandstone bedrock.	8	Gravelly sandy loam.	Shallow soils, shallow depth to rock, low organic matter content of surface layer, low available water capacity.
	Pherson-Glenberg-Riverwash (25%-25%-25%).	0-60" [no soil depths for Glenberg].	0-19 [no soil depths for Glenberg]	Fine sand loam, loamy fine sand, loam, extremely gravelly loam sand, sand, cobblestone, gravel.	Moderate to high water erosion, moderate wind erosion, low organic matter, frequent flooding.
	Rock Outcrop.	---	---	---	Shallow soils, moderate to high water and wind erosion, depth to bedrock, saline, slopes.
Smoky Mountain Road System/Warm Creek Road (SCS 1984, Andalex Resources, Inc. 1994) Con.	Windwhistle-Palma-Rizno Complex (35%-20%-20%).	12-60"	9-60	Fine sandy loam, clay loam, gravelly loam, sandy loam, very gravelly loam.	Very gravelly loam below 9" in Rizno, high wind erosion in Palma, shallow depth to bedrock in Rizno.

Table E-1 — Soil Descriptions Associated With the Warm Springs Project Area — (Continued)

Project Component	Soils Unit	Average Soil Depth (inches)	Average Salvageable Growth-Medium Depth[1] (inches)	Growth-Medium Texture	Limiting Factors
Smoky Mountain Road System/Benchtop Road (Andalex Resources, Inc. 1994)	Milok-Begay-Palma Complex (35%-30%-20%).	36-60"	36-60"	Fine sandy loam, sandy loam, loamy sand, loamy fine sand.	Low organic matter, severe wind erosion potential with Milok and Palma, severe water erosion potential with Begay, low available water capacity.
	Rizno-Rock Outcrop Complex (55%-30%).	0-9"	0-6"	Gravelly fine sandy loam, highly fragmented sandstone, sandstone bedrock.	Shallow soils, high water erosion potential, rock outcrops, slope, low available water capacity.
	Pherson-Glenberg-Riverwash (25%-25%-25%).	0-60" [no soil depths for Glenberg].	0-19" [no soil depths for Glenberg].	Fine sand loam, loamy fine sand, loam, extremely gravely loam sand, sand, cobblestone, gravel.	Moderate to high water erosion, moderate wind erosion, low organic matter, frequent flooding.
	Casmos-Rock Outcrop-Avalon Family Association (50%-20%-20%).	0-38"	0-38"	Fine sandy loam, channery loam, gravelly loam, loam sandstone bedrock, rock outcrop.	Shallow depth to bedrock in Casmos and rock outcrop, low available water capacity, steep slope in some areas.
	Chipeta-Badland Complex (65%-30%).	0-22"	0-15"	Silty clay loam, nonweathered shale, weathered shale.	Shallow soils in Badland, high water erosion potential, moderate wind erosion potential, saline soils, low forage production.
Smoky Mountain Road System/Benchtop Road (Andalex Resources, Inc. 1994) Con.	Nakai-Shepard Complex (55%-40%).	60"	60"	Loamy fine sand, sandy loam, fine sandy loam, fine sand.	High wind erosion potential.
	Rock Outcrop.	—	—	Rock outcrop.	Depth to bedrock, high water, erosion potential, saline soils.

Table E-1 — Soil Descriptions Associated With the Warm Springs Project Area — (Continued)

Project Component	Soils Unit	Average Soil Depth (inches)	Average Salvageable Growth-Medium Depth[1] (inches)	Growth-Medium Texture	Limiting Factors
	Aichee-Parlette-Rock Outcrop Complex (45%-30%-10%).	0-30"	0-30"	Channery sandy loam, channery loam, unweathered sandstone, loam, clay loam, unweathered shale, slickrock.	Depth to hard rock, low available water capacity, channers.
	Windwhistle-Palma-Rizno Complex.	12-60"	9-60"	Fine sandy loam, clay loam, gravelly loam, sandy loam, very gravelly loam.	Very gravelly loam below 9" in Rizno, high wind erosion in Palma, shallow depth to bedrock in Rizno.
	Mellenthin-Rock Outcrop Complex.	0-8" gravelly sandy loam, 8-20" very gravelly sandy loam, 18-20" sandstone bedrock.	8	Gravelly sandy loam.	Shallow soils, shallow depth to rock, low organic matter content of surface layer, low available water capacity.
	Sevy-Taylorsflat Complex (~80%).	60"	60	Loam to gravelly loam.	Carbonate layer at 9" - 60", highly corrosive to steel and concrete, highly alkaline, K = 0.28-0.43, Wind = 3, erodes easily.
Iron Springs Unit-Train Loadout (SCS 1993).	Sevy Loam (~20%)[2].	60"	60	Loam to gravelly loam.	Carbonate layer at 6" - 60", moderate shrink-swell potential, moderate permeability, slightly alkaline, K = 0.37-0.43, Wind = 6, highly corrosive to steel, erodes easily.
	Sevy Taylorsflat Complex (~80%).	60"	60	Loam to gravelly loam.	Carbonate layer at 9" - 60", highly corrosive to steel and concrete, highly alkaline, K = 0.28-0.43, Wind = 3, erodes easily.
Moapa Unit-Train Loadout [SCS no date (a)].	Bard gravelly fine sandy loam (BHC).	0-14/19" fine sandy loam, 14/19" hardpan.	14	Fine sandy loam.	Cemented hardpan at 14" - 19", moderate to high alkalinity.

Table E-1 — Soil Descriptions Associated With the Warm Springs Project Area — (Continued)

Project Component	Soils Unit	Average Soil Depth (inches)	Average Salvageable Growth-Medium Depth[1] (inches)	Growth-Medium Texture	Limiting Factors
	Badland (BD).	0" (no soils).	—	—	Highly eroded, 50 to 100% slopes, no topsoil.
	Arizo gravelly fine sand (AVB).	0-8" gravelly fine sand, 8-60" very gravelly sand and very cobbly coarse sand.	8	Gravelly fine sand.	Frequent flooding, high wind erosion, moderate to high alkalinity.
Truck Maintenance Facility [SCS no date (b)] Fredonia.	Glenyon silty clay loam.	0-34" silty clay loam, 34-60" loamy fine sand.	60	Silty clay loam to loamy fine sand.	Severe wind erosion, moderate shrink-swell potential.
Truck Maintenance Facility (SCS 1977) Hurricane.	Bermesa fine sandy loam.	0-14" fine sandy loam, 14-21" very gravelly sandy loam, 21-26" very cobbly sandy loam clay, 26-28" cemented hardpan.	14	Fine sandy loam.	Moderate erosion hazard, cemented hardpan below 26".

[1] Growth medium to be salvaged for use in reclamation was assumed to be restricted to material lying above caliche/duripan layers, material lying above decomposed bedrock layers, and material that was not extremely gravelly, stony, or cobbly. Growth-medium depth ranges correspond to each specific soil series within an association. Salvageable growth-medium depths are average maximum obtainable depths based upon limiting factors in each soil unit.

[2]Soil unit percentages, or the percent of the total soils in a project component consisting of a particular soil unit, are provided where available.

Table E-2 — Selected Vegetation Species Associated with the Warm Springs Project Area

GRASSES	
Blue grama	*Bouteloua gracilis*
Bottlebrush squirreltail	*Sitanion hystrix*
Cheatgrass	*Bromus tectorum*
Fluffgrass	*Tridens pulchellus*
Galleta	*Hilaria jamesii*
Indian ricegrass	*Stipa hymenoides*
Red brome	*Bromus rubens*
Sand dropseed	*Sporobolus cryptandrus*
Threeawn	*Artistida longiseta*
FORBS	
Aster	*Aster* spp.
Atwoods penstemon	*Penstemon atwoodii*
Cattail	*Typha latifolia*
Common filaree	*Erodium cicutarium*
Desert plantain	*Plantago insularis*
Gooseberry-leaf globemallow	*Sphaeralcea grossulariifolia*
Goosefoot	*Chenopodium* spp.
Higgins biscuitroot	*Cymopterns higginsii*
Milkvetch	*Astragalus* spp.
Phacelia	*Phacelia pulchella*
Phlox	*Phlox* spp.
Rush	*Juncus* spp.
Russian thistle	*Salsola iberica*
Scarlet globemallow	*Sphaeralcea coccinea*
Smoky Mountain evening primrose	*Camissonia atwoodii*
Tansymustard	*Descurainia pinnata*
SHRUBS	
Big sagebrush (Wyoming)	*Artemisia tridentata wyomingensis*
Bigelov sagebrush	*Artemisia bigelovii*
Bitterbrush	*Purshia tridentata*
Blackbrush	*Coleogyne ramosissima*
Bottlebrush	*Eriogonum inflatum*
Broom snakeweed	*Gutierrezia sarothrae*
Bud sage	*Artemisia spinescens*
Buffaloberry	*Shepherdia* spp.
Cliffrose	*Purshia mexicana*
Creosotebush	*Larrea tridentata*
Four-wing saltbush	*Atriplex canescens*
Indigobush	*Psorothamnus* spp.

Table E-2 — Selected Vegetation Species Associated with the Warm Springs Project Area (Continued)

SHRUBS (Con.)	
Joint-fir ephedra	*Ephedra nevadensis*
Low rabbitbrush	*Chrysothamnus viscidiflorus*
Rubber rabbitbrush	*Chrysothamnus nauseosus*
Sand sagebrush, Old-man sagebrush	*Artemisia filifolia*
Shadscale	*Atriplex confertifolia*
Siler pincushion cactus	*Pediocactus sileri*
Spiney hopsage	*Grayia spinosa*
White bursage	*Ambrosia dumosa*
TREES	
Cottonwood	*Populus* spp.
Pinyon	*Pinus edulis*
Tamarisk	*Tamarix parviflora*
Utah juniper	*Juniperus osteosperma*
Willow	*Salix* spp.
OTHER	
Liverwort	*Chiloscyphus* (spp.)

Table E-3 — Selected Wildlife Species Associated with the Proposed Warm Springs Project Area

GAME SPECIES	
Desert bighorn sheep	*Ovis canadensis*
Mountain lion	*Felis concolor*
Mule deer	*Odocoileus hemionus*
Pronghorn (antelope)	*Antilocapra americana*
NONGAME SPECIES	
Allen's big-eared bat	*Idionycteris phyllotis*
Big free-tailed bat	*Nyctinomops macrotis*
Cave myotis	*Myotis velifer*
Desert tortoise	*Gopherus agassizii*
Gila monster	*Heloderma suspectum*
Kanab ambersnail	*Oxlyoma haydeni kanabensis*
Long-eared myotis	*Myotis evotis*
Long-legged myotis	*Myotis volans*
Pygmy rabbit	*Brachylagus idahoensis*
Small-footed myotis	*Myotis subulatus*
Spotted bat	*Euderma maculatum*
Townsend's big-eared bat	*Plecotus townsendii*
Utah prairie dog	*Cynomys parvidens*
Yuma myotis	*Myotis yumanensis*
BIRDS	
American kestrel	*Falco sparverius*
Bald eagle	*Haliaeetus leucocephalus*
Ferruginous hawk	*Buteo regalis*
Golden eagle	*Aquila chrysaetos*
Loggerhead shrike	*Lanius ludovicianus*
Mexican spotted owl	*Strix occidentalis luckia*
Peregrine falcon	*Falco peregrinus*
Prairie falcon	*Falco mexicanus*
Red-tailed hawk	*Buteo jamaicensis*
Rough-legged hawk	*Buteo lagopus*

Table E-4 — Projected Project-Related Change in Regional Population

County Community	Temporary Peak with TMF in Fredonia	Temporary Peak with TMF in Hurricane	Stabilized Operations with TMF in Fredonia	Stabilized Operations with TMF in Hurricane
CLARK, NEVADA				
Moapa Valley	32	32	11	11
Mesquite	32	32	11	11
County Total	64	64	22	22
COCONINO, ARIZONA				
Page	206	206	193	193
Fredonia	26	0	163	7
Other - East	58	58	56	56
Other - West	3	0	16	0
County Total	293	264	428	256
IRON, UTAH				
Cedar City	108	108	68	68
Other	47	47	29	29
County Total	155	155	97	97
KANE, UTAH				
Kanab	265	182	690	230
Big Water	80	80	95	95
Other	71	53	155	57
County Total	416	315	940	382
MOHAVE, ARIZONA	6	0	38	2
WASHINGTON, UTAH				
Hurricane	4	49	14	225
La Verkin	2	8	6	43
Toquerville	1	6	3	30
Washington	4	25	14	115
St. George	27	94	95	430
Other	3	17	12	83
County Total	41	199	144	926
TOTAL POPULATION	975	997	1,669	1,685

[1]Truck Maintenance Facility

Table E-5 — Projected Project-Related Change in Regional Public School Enrollment

County Enrollment Area	Temporary Peak with TMF in Fredonia	 Hurricane	Stabilized Operations with TMF in Fredonia	 Hurricane
CLARK, NV				
Moapa Valley	4	4	2	2
Mesquite	4	4	2	2
County Total	8	8	4	4
COCONINO, AZ				
Page	23	23	55	55
Fredonia	3	0	39	2
County Total	26	23	94	57
IRON, UT				
Cedar City	17	17	21	21
KANE, UT				
Kanab	37	26	186	63
Big Water	9	9	21	21
County Total	46	35	207	84
MOHAVE, AZ	1	0	8	0
WASHINGTON, UT				
Hurricane	1	7	5	66
Washington	0	3	3	25
St. George	3	12	24	113
County Total	4	22	32	204
TOTAL	102	105	366	370

TMF = Truck Maintenance Facility.

Table E-6 — Projected Project-Related Change in Regional Housing Needs

County Community	Temporary Peak with TMF in Fredonia	 Hurricane	Stabilized Operations with TMF in Fredonia	 Hurricane
CLARK, NV				
Moapa Valley	11	11	4	4
Mesquite	11	11	4	4
County Total	22	22	8	8
COCONINO, AZ				
Page	78	78	64	64
Fredonia	9	0	54	2
Other - East	23	23	19	19
Other - West	1	0	5	0
County Total	111	101	142	85
IRON, UT				
Cedar City	47	47	23	23
Other	20	20	10	10
County Total	67	67	33	33
KANE, UT				
Kanab	94	67	230	77
Big Water	30	30	32	32
Other	27	21	52	19
County Total	151	118	314	128
MOHAVE, AZ	6	0	13	1
WASHINGTON, UT				
Hurricane	1	17	5	75
La Verkin	1	3	2	14
Toquerville	0	2	1	10
Washington	1	8	5	38
St. George	9	31	32	143
Other	1	6	4	28
County Total	13	67	49	308
TOTAL	370	375	559	563

TMF = Truck Maintenance Facility

Table E-7 — Projected Project-Related Change in Regional Employment

County	Temporary Peak[2] with TMF in		Stabilized Operations with TMF in	
	Fredonia	Hurricane	Fredonia	Hurricane
Clark, NV	81	81	24	24
Coconino, AZ	110	58	329	48
Iron, UT	114	114	55	55
Kane, UT	256	237	355	249
Mohave, AZ	0	0	0	0
Washington, UT	16	92	69	446
TOTAL	577	582	832	822

[1]Employment changes are reported on a place-of-work basis and include direct, indirect, and induced jobs.
[2]Temporary peak assumes simultaneous employment of both the construction and initial operations employees.
TMF = Truck Maintenance Facility.

Table E-8 — Projected Project-Related Increase in Wage and Salary Income[1]

[Millions of Constant Dollars]

County	Temporary Peak[2] with TMF in Fredonia	Temporary Peak[2] with TMF in Hurricane	Stabilized Operations with TMF in Fredonia	Stabilized Operations with TMF in Hurricane
Clark, NV	$2.34	$2.34	$0.99	$0.99
Coconino, AZ	4.53	3.88	6.84	3.92
Iron, UT	3.14	3.14	1.88	1.88
Kane, UT	5.77	4.57	12.63	5.81
Mohave, AZ	0.00	0.00	0.22	0.22
Washington, UT	0.28	1.96	0.97	10.77
TOTAL	$16.06	$15.89	$23.53	$23.59

[1]Wage and salary impacts are reported on a place-of-residence basis and include direct, indirect, and induced jobs.

[2]Temporary peak assumes simultaneous employment of both the construction and initial operations employees. No allowances are included for nonemployment-related personal income.

TMF = Truck Maintenance Facility.

Table E-9 — Public Facilities and Services in Selected Communities

Type of Services/Jurisdiction	Description of Services	Adequate to Meet Existing Population Needs?
PUBLIC SAFETY		
Law Enforcement		
Page, Arizona	14 to 16 officers; need 2 more officers.	No.
Fredonia, Arizona	1 marshall, 1 deputy, and 1 part-time officer.	Yes.
Utah State Patrol	1 sergeant, 3 troopers, adding 1 trooper in Sept. 1994.	Yes.
Kane County Sheriff's Dept., Utah	5 deputies, 5 jailers, 1 dispatcher, 1 administrator, 6 offices, dispatch center, 24-bed jail.	Yes.
Big Water, Utah	No police station; Kane County Sheriff patrols 2 hours per week.	No.
Kanab, Utah	4 police officers and 1 chief; need 2 additional officers and equipment now.	No.
Hurricane, Utah	5 full-time officers, 5 reserve officers, and 1 animal control; need 3 to 6 additional officers and equipment in next 5 years.	No.
Toquerville, Utah	Contracts with Washington County Sheriff's Department, which is understaffed.	No.
Fire Protection		
Page	• Combined fire and ambulance service. • 50 volunteers, 3 fire trucks; need new fire truck.	Yes.
Fredonia	• Volunteer personnel; new station will be built in 1996.	Yes.
Big Water	• 6 to 10 volunteer personnel. • Equipment consists of one 1957 duplex pumper.	No.
Kanab	• 22 volunteer personnel. • Equipment consists of 3 pumpers and 2 brush-fire trucks.	Yes.
Hurricane	• 21 volunteer personnel and 1 salaried fire chief. • Equipment consists of two 1,250-gpm pumpers, one 700-gpm pumper, two 250-gpm pumpers, and two ambulances.	Yes.
Toquerville	• Served by Hurricane Fire deptartment.	Yes.

Table E-9 — Public Facilities and Services in Selected Communities (Continued)

Type of Services/Jurisdiction	Description of Services	Adequate to Meet Existing Population Needs?
PUBLIC SAFETY (Con.)		
<u>Emergency Response</u>		
Page City Ambulance	• 4 full-time employees. • 3 ambulances. • 50-sq.-mile to 7,500-sq.-mile service area.	Yes.
Kane County Ambulance	• 29 volunteer Emergency Medical Technicians (EMTs). • 3 ambulances. • 60-mile-diameter service area.	Yes.
Hurricane Ambulance	• 15 volunteer EMTs and 1 salaried chief. • 2 ambulances.	Yes.
PUBLIC UTILITIES		
<u>Water and Sewer</u>		
Page	• Federal allocation of 3 million gallons/day from Lake Powell; 4.5 million gallon (Mgal) storage. • Exceeds allocation at times by as much as 40%. • Sewer treatment will be adequate when plant expansion is completed in 9 months.	No.
Fredonia	• Water provided in 15-Mgal reservoir and 2 storage tanks fed by 3 wells. • Septic System.	Yes.
Big Water	• Water provided by 2 wells; 0.1 Mgal storage. • Septic System.	Yes.
Kanab	• 2 springs, 8 wells; chlorination of 5 wells and 1 spring; storage 3.5 Mgal. • Lagoon treatment, adequate capacity.	Yes.
Hurricane	• 2 springs, 1 well; both springs chlorinated; 3.25-Mgal storage. • Ash Creek Sewer and Sanitation District (SSD) lagoon treatment; sewer treatment expansion needed.	No.

Table E-9 — Public Facilities and Services in Selected Communities (Continued)

Type of Services/Jurisdiction	Description of Services	Adequate to Meet Existing Population Needs?
PUBLIC UTILITIES (Con.)		
Water and Sewer (Con.)		
Toquerville	• 1 spring, chlorination treatment, 0.354-Mgal storage; adequate capacity. • Ash Creek SSD lagoon treatment; sewer treatment plant expansion needed.	No.
Natural Gas, Electricity, Telephone	• All services generally available throughout the study area.	Yes.
Solid Waste		
Glendale Landfill (Alton, Long Valley, Cedar Mountain)	• 20 to 50-year capacity. • Meets all EPA standards. • May need well for water quality monitoring.	Yes.
Kanab Landfill (Kanab, Johnson Canyon, surrounding area)	• 20 to 50-year capacity. • Complies with most EPA standards.	Yes.
Big Water Landfill (eastern Kane County)	• Does not meet EPA standards. • Kanab landfill will be used to dispose of most of the solid waste generated in east Kane County.	No.
EDUCATION		
Page Unified School District	• Has adequate capacity for existing students and growth in elementary and middle school. • High school near capacity, needs to expand soon.	Yes.
Fredonia/Moccasin School District	• Has excess capacity because of slowdown in Energy Fuels and logging activity.	Yes.
Kane School District	• Big Water has more than adequate capacity for growth. • Kanab elementary, middle school, and high schools at capacity. • Can reconfigure classes to increase capacity somewhat.	Yes. No.
Washington School District	• District moving to year-round schools, which increases capacity. • Toquerville is year-round; elementary schools in Hurricane are year-around.	Yes.

Table E-9 — Public Facilities and Services in Selected Communities (Continued)

Type of Services/Jurisdiction	Description of Services	Adequate to Meet Existing Population Needs?
HEALTH AND SOCIAL SERVICES		
Page Hospital	• Full-service hospital. • 25 beds. • 10 physicians.	Yes.
Kane County Hospital, Kanab (Kane County, Utah, and north Coconino County, Arizona)	• 3 physicians, 1 physician's assistant. • 33 beds; limited care service. • New hospital planned in next 2 years.	Yes.
Dixie Regional Medical Center, St. George (Washington County and outlying areas)	• 70 physicians, plus specialists. • 137 beds. • Major full-service hospital facility.	Yes.
Southwest Utah Mental Health/Alcohol and Drug Center	• Comprehensive service for mentally ill and alcohol/drug abuse. • Several treatment centers and outpatient care throughout area. • 21 locations available for mental health services within 5-county area.	Yes.
HOUSING[1]		
Page	• About 2,539 units (1994); 1,259 modular houses (M.H.); rentals represent 20% of stock. • 1.6% vacancy. • Development slow because of lack of financing.	No.
Fredonia	• About 461 units (1992); very low vacancy rate; few rentals. • Adequate land for development.	Yes.
Big Water	• 1990 Census 173 units, 122 modular houses; 3.4% vacancy. • Land available for development.	Yes.
Kanab	• 1990 Census 1,258 units; 273 modular houses; 4.3% vacancy. • Land available for development; new development is occurring.	Yes.
Hurricane	• 1990 Census 1,325 units; 299 modular houses; 1.6% vacancy. • High growth rate; retirement/resort development.	Yes.
Toquerville	• 1990 Census 192 units; 29 Modular Houses; 0.8% vacancy. • Low profile community; experiencing some growth.	Yes.

[1] Water supply affects housing growth, particularly in Hurricane and Toquerville.

Table E-10 — Potentially Eligible or Eligible Cultural Sites Associated with the Warm Springs Area

Project Component/Site Number	Site Description	National Register Status	Impact Associated with Project	Reference
SMOKY HOLLOW MINE				
42KA112	Lithic and ceramic scatter	Eligible	Direct	None; cf. Hauck and Hadden 1995
42KA1408	Lithic scatter	Eligible	Direct	MNA 1974
42KA1409	Lithic scatter	Eligible	Direct	MNA 1974
42KA1410	Lithic scatter	Eligible	Direct	MNA 1974
42KA1416	Lithic scatter	Eligible	Direct	MNA 1974
42KA1417	Lithic scatter	Eligible	Direct	MNA 1974
42KA1421	Lithic scatter	Eligible	Direct	MNA 1974
42KA1422	Lithic scatter with possible hearth	Eligible	Direct	MNA 1974
42KA1423	Lithic scatter	Eligible	Direct	MNA 1974
42KA1424	Lithic scatter with hearth	Eligible	Direct	MNA 1974
42KA1425	Lithic and ground-stone scatter with possible hearth	Eligible	Direct	MNA 1974
42KA1426	Lithic scatter	Eligible	Direct	MNA 1974
42KA1427	Lithic scatter	Eligible	Direct	MNA 1974
42KA1428	Lithic scatter	Eligible	Direct	MNA 1974
42KA1429	Rock shelter complex; historic stock pen, camp, and trash	Eligible	Direct	MNA 1974
42KA1430	Rock shelter complex	Eligible	Direct	MNA 1974
42KA1431	Rock shelter complex	Eligible	Direct	MNA 1974
42KA1433	Lithic scatter with hearths	Eligible	Direct	MNA 1974
42KA1434	Lithic scatter	Eligible	Direct	MNA 1974
42KA1435	Lithic scatter	Eligible	Direct	MNA 1974
42KA1611	Ground-stone scatter	Eligible	Direct	MNA 1974
42KA1612	Lithic and ceramic scatter with hearth	Eligible	Direct	MNA 1974
42KA1613	Lithic, ground-stone, and ceramic scatter with hearths	Eligible	Direct	MNA 1974
42KA1614	Lithic scatter with hearth	Eligible	Direct	MNA 1974
42KA1615	Lithic and ground-stone scatter with ash	Eligible	Direct	MNA 1974
42KA1616	Lithic scatter with possible hearth	Eligible	Direct	MNA 1974

Table E-10 — Potentially Eligible or Eligible Cultural Sites Associated with the Warm Springs Project Area (Continued)

Project Component/Site Number	Site Description	National Register Status	Impact Associated with Project	Reference
SMOKY HOLLOW MINE (Con.)				
42KA1617	Lithic scatter; hearth and petroglyph	Eligible	Direct	MNA 1974
42KA1618	Lithic scatter	Eligible	Direct	MNA 1974
42KA1619	Lithic scatter with ash	Eligible	Direct	MNA 1974
42KA1620	Brush fence (in two parts)	Eligible	Direct	MNA 1974
42KA3060	Lithic, ground-stone, and ceramic scatter with hearths	Eligible	Direct	None, cf. Hauck and Hadden 1995
42KA3061	Masonry granary	Eligible	Direct	None; cf. Hauck and Hadden 1995
42KA4028	Lithic and ground-stone scatter with hearths, fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994a, 1994b
42KA4080	Lithic scatter	Not Eligible	Direct	Hauck and Hadden 1994d
1422RX/50	IF: Biface	Not Eligible	Direct	Hauck and Hadden 1994a, 1994b
138-kV POWERLINE TRANSMISSION LINE				
42KA1329-1330, 1332, 1339, 1346-1348	Lithic scatter	Unknown	Direct	MNA 1974
42KA1340	Rock shelter	Unknown	Direct	MNA 1974
42KA1342	Inscription	Unknown	Direct	MNA 1974
42KA1345	Rock shelter	Unknown	Direct	MNA 1974
42KA1975	Lithic and ground-stone scatter with fire-cracked rock	Eligible	Direct	Simms and Rauch 1979
42KA4049	Rock shelter with lithic scatter, hearths, and rock alignment	Eligible	Direct	Hauck and Hadden 1994c
42KA4052	Lithic scatter with hearths, slab feature, and fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994c
42KA4053	Lithic scatter with hearth	Eligible	Direct	Hauck and Hadden 1994c
42KA4055	Rock shelters with lithic, ground stone, and ceramic scatter, and fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994c
42KA4056	Rock shelter with lithic scatter	Eligible	Direct	Hauck and Hadden 1994c

Table E-10 — Potentially Eligible or Eligible Cultural Sites Associated with the Warm Springs Project Area (Continued)

Project Component/Site Number	Site Description	National Register Status	Impact Associated with Project	Reference
138-kV POWER TRANSMISSION LINE (Con.)				
42KA4057	Rock shelters with lithic, ground-stone, and ceramic scatter, hearths and fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994c
42KA4062	Lithic scatter with fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994c
42KA4066	Lithic and ground-stone scatter	Eligible	Direct	Hauck and Hadden 1994c
AZ-C:2:34	Lithic and ground-stone scatter with fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994c (Secondary)
AZ-C:2:35	Ground-stone scatter with structure	Eligible	Direct	Hauck and Hadden 1994c (Secondary)
AZ-C:2:36 (NA 15,897)	Lithic, ground-stone and ceramic scatter with hearths and fire-cracked rock	Eligible	Direct	Simms and Rauch 1979; Hauck and Hadden 1994c
AZ-C:2:37	Lithic and ground-stone scatter with ash, fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994c (Secondary)
NA 10,999	Lithic and sherd scatter	Eligible	Direct	Harrill 1970
NA 11,000	Rock overhang with ground stone and sherd scatter, charcoal, and fire-cracked rock	Eligible	Direct	Harrill 1970
MICROWAVE COMMUNICATION SYSTEM				
42KA2815-2816	Lithic scatter	Unknown	Indirect	McFadden 1985a
42KA4071	Lithic scatter with fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994e
42KA4074	Lithic scatter	Eligible	Direct	Hauck and Hadden 1994e
SMOKY MOUNTAIN ROAD SYSTEM (WARM CREEK ROAD)				
42KA1426-1428	Lithic scatter	Eligible	Direct	MNA 1974
42KA2815-2817	Lithic scatter	Unknown	Indirect	McFadden 1985a
42KA3226	Lithic scatter	Unknown	Direct (?)	Geib 1986
42KA3821	Mine with three adits	Eligible	Direct (?)	Lancaster 1992
42KA4028	Lithic scatter with hearths, fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994b
42KA4029	Rock shelter with lithic, ground-stone, and ceramic scatter, fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994a

Table E-10 — Potentially Eligible or Eligible Cultural Sites Associated with the Warm Springs Project Area (Continued)

Project Component/Site Number	Site Description	National Register Status	Impact Associated with Project	Reference
SMOKY MOUNTAIN ROAD SYSTEM (WARM CREEK ROAD) (Con.)				
42KA4030	Lithic scatter with hearths, fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994a
42KA4031	Rock shelter with lithic and ceramic scatter, fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994a
42KA4033	Lithic and ground-stone scatter with hearths, fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994a
42KA4034	Lithic scatter with fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994a
42KA4035	Rock shelter with lithic, ground-stone, and ceramic scatter, hearth and fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994a
42KA4036	Lithic scatter with hearth	Eligible	Direct	Hauck and Hadden 1994a
42KA4037	Roasting pit	Eligible	Direct	Hauck and Hadden 1994a
42KA4038	Lithic and ground-stone scatter with fire-cracked rock, shelter	Eligible	Direct	Hauck and Hadden 1994a
42KA4039	Ground stone scatter with fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994a
42KA4071	Lithic scatter with fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994e
42KA4074	Lithic scatter	Eligible	Direct	Hauck and Hadden 1994e
SMOKY MOUNTAIN ROAD SYSTEM (BENCHTOP ROAD)				
42KA1325, 1327	Lithic scatter	Eligible	Direct	MNA 1974
42KA1328	Lithic scatter with fire-cracked rock	Eligible	Direct	MNA 1974
42KA1426-1428	Lithic scatter	Eligible	Direct	MNA 1974
42KA2815-2816	Lithic scatter	Unknown	Indirect	McFadden 1985a
42KA4028	Lithic scatter with hearths, fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994a, 1994b
42KA4040	Lithic and ground-stone scatter with hearths, fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994b
42KA4043	Lithic and ground-stone scatter with fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994b

Table E-10 — Potentially Eligible or Eligible Cultural Sites Associated with the Warm Springs Project Area (Continued)

Project Component/Site Number	Site Description	National Register Status	Impact Associated with Project	Reference
SMOKY MOUNTAIN ROAD SYSTEM (BENCHTOP ROAD) (Con.)				
42KA4046	Lithic and ground-stone scatter with hearth	Eligible	Direct	Hauck and Hadden 1994b
42KA4047	Game drive	Eligible	Direct	Hauck and Hadden 1994b
42KA4071	Lithic scatter with fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994e
42KA4074	Lithic scatter	Eligible	Direct	Hauck and Hadden 1994e
42KA4075-4076	Lithic and ground stone with fire-cracked rock	Eligible	Direct	Hauck and Hadden 1994e
NA11,001	Fire-cracked rock with ground stone	Eligible	Indirect	Harrill 1970
IRON SPRINGS UNIT-TRAIN LOADOUT				
42IN1062	Tent foundations, depressions, trash	Eligible	Indirect	Nielson 1986
MOAPA UNIT-TRAIN LOADOUT				
26CK29	Pithouse with lithic and ceramic scatter	Unknown	?	Shutler (?) (SW Museum)
26CK159	Rock shelter with lithic and ceramic scatter (Black Dog Cave)	Unknown	Direct	Shulter and Shulter 1962
26CK354	Rock shelter (Bird Track Cave)	Unknown	Direct	Brooks et al. 1976
26CK1182	Lithic and ground-stone scatter	Unknown	Direct	Brooks et al. 1975
26CK1344	Railroad camp	Unknown	?	No report association
26CK1348	Historic trash dump	Unknown	Direct	Brooks et al. 1976
26CK1350	Lithic scatter with depressions	Unknown	Direct	Brooks et al. 1976
26CK1353	Rock shelter with lithic and ground-stone scatter	Unknown	Direct	Brooks et al. 1976
26CK1354	Rock shelters with lithic scatter	Unknown	Direct	Brooks et al. 1976
26CK1355	Rock shelter with lithic scatter, cane arrow shaft, and possible features.	Unknown	Direct	Brooks et al. 1976
26CK1502 (May coincide with 26CK1203)	Historic trash concentration, possibly railroad related	Unknown	Direct	Brooks et al. 1976
26CK1505	Trash concentrations with features, possibly railroad related	Eligible	Indirect	DuBarton and Edwards 1991

Table E-10 — Potentially Eligible or Eligible Cultural Sites Associated with the Warm Springs Project Area (Continued)

Project Component/Site Number	Site Description	National Register Status	Impact Associated with Project	Reference
MOAPA UNIT-TRAIN LOADOUT (Con.)				
26CK3404	Lithic scatter with circular depressions	Unknown	?	Clark 1982
26CK3407	Lithic and ceramic scatter with 13 circular depressions	Unknown	?	Clark 1982
26CK4429	Abandoned railroad grade with associated features, artifacts	Eligible	Direct	McClenahan and Hopkins Associates, Inc. 1990
26CK4580	Lithic scatter with corn cobs	Eligible	Indirect	DuBarton and Edwards 1991
TRUCK MAINTENANCE FACILITY (FREDONIA[1])				
None				
TRUCK MAINTENANCE FACILITY (HURRICANE[1])				
42WS54	Pueblo with associated artifacts; Paiute habitation	Eligible	Indirect	Horn 1991
42WS2353	Trash dump	Eligible	Direct	Tipps et al. 1989

[1]The proposed truck maintenance facility locations are hypothetical for purposes of the EIS analysis (Chapter 4, Section 4.1.1, Assumptions for Approval Alternative).