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# Final Environmental Impact Statement: Ferron Natural Gas Project

United States Department of the Interior

Bureau of Land Management, Utah

USDA Forest Service

Utah Division of Oil, Gas, and Mining

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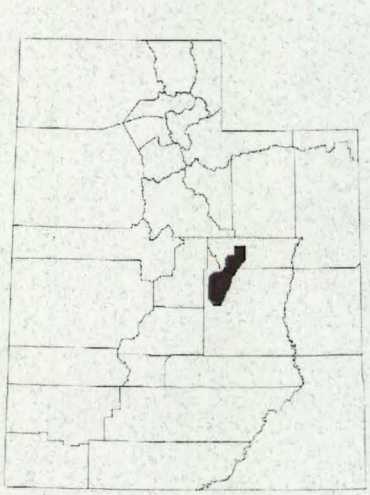
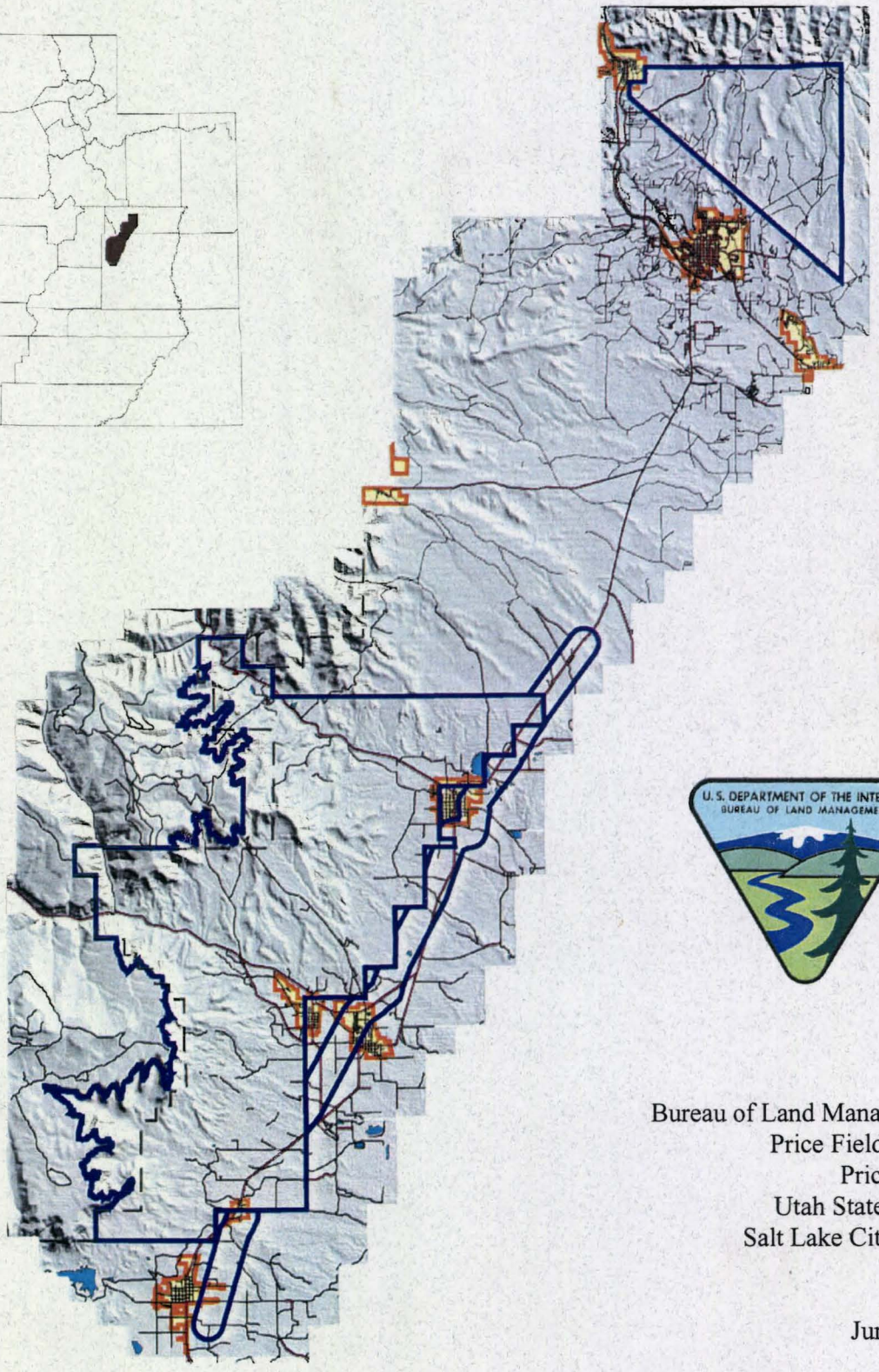
VOLUME I

# FINAL ENVIRONMENTAL IMPACT STATEMENT
# FERRON NATURAL GAS PROJECT





Bureau of Land Management
Price Field Office
Price, Utah
Utah State Office
Salt Lake City, Utah

June 1999

# United States Department of the Interior

## BUREAU OF LAND MANAGEMENT

Price Field Office
125 South 600 West
Price, Utah 84501

IN REPLY REFER TO:

1790
(UT070)

Dear Reader:

The Bureau of Land Management (BLM) has prepared this Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) for your review. The FEIS has been completed to analyze impacts from a proposed gas development project on Federal, State and private lands near Price, Utah. Anadarko Petroleum Corporation, Chandler and Associates, LLC, and Texaco Exploration and Production, Inc. propose to develop natural gas from coal beds in the area. Questar Pipeline Company proposes to construct, maintain and operate a natural gas transmission pipeline. Although the four proposals are separate projects, they were combined for the purpose of environmental analysis.

The Bureau of Land Management (BLM) is the lead agency for preparation of this EIS. The U. S. Forest Service and Utah Division of Oil Gas and Mining participate in the process as cooperating agencies. The ROD accompanying this document applies only to public lands administered by the Bureau of Land Management. A separate ROD by the U. S Forest Service would be necessary for consideration of proposed gas development activities in the Project Area within the boundaries of the Manti - La Sal National Forest.

A Draft EIS (DEIS) was issued in October, 1998, analyzing impacts and identifying alternatives and mitigation measures. A 55 day public comment period and three public hearings were held to receive comments on the DEIS. A total of 57 comment letters were received on the DEIS, and several verbal comments were received ant the public hearings. These comments have been analyzed, and appropriate changes have been made in the FEIS. The public comments have been summarized and printed in the FEIS, along with the BLM's responses.

A 30 day review period will be provided on the FEIS/ROD. This 30 day period will commence when the Notice of Availability of the FEIS is printed in the Federal Register by the Environmental Protection Agency.

If you have any questions about the FEIS, please contact George Diwachak, EIS Team Leader, BLM at (801) 539-4043. We appreciate your interest in the management of public lands.

Sincerely,

Richard Manus
Price Field Office Manager

# Final Environmental Impact Statement
# Ferron Natural Gas Development Project
# Carbon and Emery Counties, Utah

| | |
|---|---|
| Lead Agency: | Bureau of Land Management<br>Utah State Office<br>Salt Lake City, Utah |
| Cooperating Agencies: | USDA Forest Service<br>Manti-La Sal National Forest<br>Price, Utah |
| | Utah Division of Oil, Gas, and Mining<br>Salt Lake City, Utah |
| For Further Information, Contact: | George Diwachak<br>Bureau of Land Management<br>Utah State Office<br>P.O. Box 45155<br>Salt Lake City, Utah 84145-0155<br>(801)539-4043 |

## Abstract

Anadarko Petroleum Corporation, Chandler and Associates, LLC, and Texaco Exploration and Production, Inc. propose to develop two separate areas northeast and southwest of Price, Utah and extract natural gas. Questar Pipeline Company proposes to develop a new natural gas transmission pipeline as part of the Proposed Action. With the pipeline corridor, the Proposed Action encompasses a total of about 111,781 acres. The developments would involve drilling a maximum of 285 natural gas wells on Federal, State and private lands, constructing roads and gathering pipelines for natural gas and produced water, drilling wells for disposing of produced water, and construction of compressor stations to move the gas to the natural gas transmission pipeline. Construction would begin during 1999 and extend for five years. Production is expected to last 20 years.

Three alternatives were considered in detail. They were Alternative 1 — Proposed Action, Alternative 2 — Proposed Action with Additional Environmental Protection Measures, and Alternative 3 — No Action. Additionally, Alternatives 1 and 2 include an option to operate the facilities with electrical power instead of natural gas. Alternative 1 consisted of the Companies' proposals for extracting and transporting natural gas. Alternative 2 was developed in response to issues raised during the public and agency scoping process. This alternative would incorporate the same construction and operational components as the Proposed Action with additional Environmental Protection Measures applied to those actions taking place on federal lands. The No Action Alternative is required by the National Environmental Policy Act for comparison to other alternatives analyzed in the EIS. For this project, the No Action Alternative would not authorize additional natural gas development on Federal leases within the Project Area. Drilling could continue on State and private leases and access and pipelines across Federal lands to reach such proposed State and fee wells would be granted as required by BLM policy.

The Utah State Director is the Bureau of Land Management's Authorized Officer responsible for preparing this Draft Environmental Impact Statement.

# *SUMMARY*

The Bureau of Land Management, Price Field Office (BLM) prepared an Environmental Impact Statement (EIS) in response to proposals filed by four companies to produce and transport natural gas in Carbon and Emery Counties in central Utah. Anadarko Petroleum Corporation (Anadarko); Chandler and Associates, LLC. (Chandler); and Texaco Exploration and Production, Inc. (Texaco) have proposed to develop two separate areas northeast and southwest of Price, Utah totaling about 111,520 acres. These two areas (the Project Area), called the North Area and the South Area, are adjacent to the area where River Gas Corporation is implementing the Price Coalbed Methane Project, which was approved by the BLM in 1997. Also, Questar Pipeline Company (Questar) has proposed to develop a new pipeline as part of the Proposed Action. The corridor for this pipeline encompasses about 261 acres, which brings the total area encompassed by the Proposed Action to 111,781 acres. For purposes of environmental analysis, the BLM combined the proposals of these four companies into the Ferron Natural Gas Development Plan. **Figure 1–1** shows the location of the proposed Ferron Natural Gas Project.

The Companies hold valid federal, state, and private oil and gas leases in the Project Area. The leases have created contractual and property rights for the Companies from the United States, the State of Utah, and private mineral landowners to develop natural gas resources. The purpose of the Companies' proposal is to produce and transport natural gas at a profit from the portions of the Project Area leased by them.

The EIS addresses the effects of implementing a level of natural gas development within the Project Area that is conceptual in nature. The locations of wells, roads, pipelines, and ancillary facilities depicted in the EIS represent a maximum level of development and tentative locations. The final location for each component of this proposed project would be determined through future site-specific analyses that would be required for each facility. These analyses would occur when applications, such as an Application for Permit to Drill (APD), a Forest Service Special Use Permit, or a BLM Right-of-Way Grant, are filed by the Companies for each project component. Therefore, the EIS serves two purposes. It provides the basis to analyze and disclose the impacts of the level of development proposed within the Project Area. It also identifies mitigation measures to address issues and approval conditions for the subsequent site-specific applications for individual locations.

The BLM, Price Field Office in Price, Utah is the responsible federal agency for preparing this EIS. The USDA Forest Service, Manti-La Sal National Forest and the Utah Division of Oil, Gas, and Mining, are cooperating agencies.

The EIS is not a decision document; it documents the process used to analyze the potential environmental consequences of implementing the proposed natural gas development project and alternatives to the Proposed Action. The decisions regarding the proposed project are documented in separate Records of Decision (ROD) signed by the responsible BLM and Forest Service officials. The BLM and Forest Service decisions will apply primarily to federal lands and leases. Decisions by other jurisdictions to issue or not to issue approvals related to this proposal may be aided by the disclosure of impacts available in this analysis.

The RODs associated with the EIS are not the final review nor the final approvals for all actions associated with the Ferron Natural Gas Project. While the RODs would approve a level of natural gas development and its general location, the analysis of each project component that involves surface disturbance to federal lands must be approved on a site-specific basis by the BLM and, if applicable, the Forest Service.

# LAND STATUS, LEGAL AND POLICY CONSIDERATIONS

## Land Status

The North and South areas encompass approximately 111,520 acres. Surface and mineral estate ownership within these areas is divided among federal (BLM and Forest Service administered), School and Institutional Trust Lands Administration (SITLA), Utah Division of Wildlife Resources (UDWR), and private entities. BLM-administered federal surface lands account for approximately 44,240 acres (40 percent of the Project Area); National Forest System lands total 10,976 acres (10 percent); state surface lands total 28,041 acres (25 percent); and the remaining 28,263 acres (25 percent) are held in private ownership. Mineral ownership within the Project Area is split roughly equally between federal and state/private ownership.

Surface ownership along the pipeline corridor also is divided among the BLM, State of Utah, and private entities. BLM-administered federal surface lands account for about 62 acres. The State of Utah's lands encompass about 3 acres. The remaining 196 acres are held in private ownership.

The Companies currently hold leases on federal, state, and private lands within the Project Area. Within the Project Area, unleased lands and leases held by others also exist.

## Land Exchange/U.S. Government and State of Utah

The DEIS identified and described an exchange of lands proposed by the U.S. Government and State of Utah. This exchange included some federally-owned lands in the Project Area. The exchange was proposed in an agreement signed on May 8, 1998 by the Secretary of the Interior Bruce Babbitt and Utah Governor Mike Leavitt. Before the DEIS' publication, legislation supporting the agreement was passed by the U.S. House of Representatives (June 24, 1998). Since the DEIS' publication, the U.S. Senate passed the same legislation (October 9, 1998) and the President signed the legislation into law (October 31, 1998). The legislation required completion of the exchange within 70 days of the President's date of signature.

With implementation of the exchange, about 17,400 acres of BLM-administered surface and mineral estates in the Project Area were conveyed to the State of Utah. Because the exchange was completed before the FEIS' completion, the FEIS was revised to incorporate the exchange into the analysis fully. Consequently, all figures, plates, and the results of all analyses presented in this document were based on post-exchange patterns of land ownership.

## Conformance with Federal Management Plans

The Proposed Action and all alternatives described in this EIS would take place within the Price River Resource Area and the San Rafael Resource Area of the BLM. The Price River Resource Area is managed under a Management Framework Plan (MFP) (BLM 1984a), an MFP Supplement (BLM 1984b), and the subsequent Environmental Assessment (EA) Supplement (BLM 1988). The San Rafael Resource Area is managed under a Resource Management Plan (RMP) approved in 1991.

The decision in the Price MFP pertaining to oil and gas development states: "Establish oil/gas production as the priority land use for Known Geologic Structures that have been or may be identified." The San Rafael RMP decision states: "Management Objective is to lease public lands for oil and gas development and to

allow geophysical activity to occur, only so long as the RMP goals are met; and to administer operational aspects of federal oil and gas leases where BLM does not manage the surface."

The Proposed Action and all alternatives analyzed in the EIS have been determined to be in conformance with both land use plans. Consequently, a plan amendment would not be required for either plan.

While development of natural gas resources is in conformance with both the Price River MFP and San Rafael RMP, the scale of development for the Ferron Natural Gas Project exceeds the scale of development analyzed by either plan. This EIS will update the 1983 Environmental Assessment supplement for the Price River MFP and the "Reasonable Foreseeable Development Scenario" for the San Rafael RMP, by analyzing the higher level of natural gas development in the Project Area.

The Manti-La Sal National Forest is managed under its Land and Resource Management Plan (LRMP), which was approved in 1986. Oil and gas leasing decisions were made for the Forest in the LRMP as modified by the Record of Decision associated with the Oil and Gas Leasing EIS, which was completed in 1992.

## Consistency with Local Plans

Carbon and Emery counties have completed Master Plans that recognize oil and gas development in the area. Cooperation among the counties, land management agencies, and the companies, is emphasized in the plans for the minimization, mitigation, and compensation of the impacts from natural gas development. The Carbon County plan identifies the need to monitor public land use decisions through the creation of the Public Lands Committee. Emery County has a Public Lands Council, which is tasked with monitoring and participating in land use decisions.

Zoning regulations and requirements for both counties allow oil and gas development in all identified zones encompassing the Project Area. In Emery County, site plans require approval and fees to the county for permits before construction of facilities. Carbon County requires site plan approval by the County Commission for activities in certain zoned areas.

As identified in the plans, the Counties' objectives are to maintain and protect rural, recreational, cultural, and water resources. Concerns include the reclamation of the Project Area and the preservation of the open spaces, cultural resources, and recreation resources contained within the counties.

In the North Area, the Carbon County Trails Plan (Trails Plan), prepared in 1995, set out to establish an organized and formal trails system throughout the county (Keleher 1995). The Utah Centennial Trail System is a series of trails (interconnected and separate) that are within and around the North Area. The Wood Hill/ Kenilworth Loop is a series of dirt and gravel roads that has developed into a traditional community trail system. The Trails Plan identifies this area as the most important for implementation due to user needs and the proximity to communities. The Wood Hill/Kenilworth Loop would be the hub for the entire Trails Plan and could connect all the other trails systems throughout the county.

An inconsistency exists between the Proposed Action and the Trails Plan in that both intend to develop the area for separate and in some cases incompatible purposes. Oil and gas leases were issued under the provisions of Price River MFP. The Federal leases grant valid rights to develop the lands. The inconsistency between the proposed development and the Trails Plan is further affected by the number of different landowners and management agencies present within the affected area. Some trails within this area have

already been affected by natural gas development on private, State, and Federal leases. Roads have been transformed to allow larger vehicle and heavy equipment travel and vehicle use has increased.

The Trails Plan calls for several actions to help in facilitating trail implementation where other competing development exists. Joint planning, identification of trails corridors through areas of development, and funding as a form of mitigation from developing companies are identified as methods available to help with implementation of the Plan. The Trails Plan calls for designation of priorities for trail development. The Wood Hill/Kenilworth Loop is designated the first area of concern by the county. The Trails Plan suggests that the developed areas be mitigated by creating parallel trails along affected roads. The Trails Plan also mentions requesting funding from companies pursuing CBM projects as possible mitigation in the affected area.

## PUBLIC INVOLVEMENT/SCOPING OF ISSUES

In February 1997, the BLM conducted public and internal scoping to solicit input to identify the environmental issues and concerns associated with the proposed Ferron Natural Gas Project. A Notice of Intent (NOI) to prepare an EIS was published in the Federal Register on January 28, 1997. An amendment to the NOI was published in the Federal Register on February 3, 1998, which adjusted the western boundary of the South Area to the location evaluated in this EIS. The BLM prepared a scoping information packet and provided copies of it to federal, state, and local agencies; Native American groups; and members of the general public. In addition, the BLM conducted public scoping meetings in Price, Utah; Castle Dale, Utah; and Salt Lake City, Utah on February 11, 12, and 13, 1997, respectively. The environmental issues identified for the proposed project are described in the following sections. A summary of the results of scoping is available for review in the Price Office of the BLM.

### Geology and Minerals

- Effect of seismic activity on project facilities, such as pipelines, and the risks to public safety.
- Potential for conflicts between gas drilling and existing or potential underground coal mining.
- Effect of irretrievable commitment of natural gas.

### Water Resources

- Effects of underground disposal of produced water on the natural flow and quality of water in the target and shallower formations.
- Effect of dewatering the Ferron coal zone on shallower groundwater sources and surface waters.
- Advantages, disadvantages, and feasibility of available produced water disposal methods.
- Effects of potential spills at various locations and the means to prevent and control spills.
- Consumption of domestic and irrigation waters during the project and the effects on current users.
- Control of stormwater runoff.
- Erosion effects on surface waters.
- Effects of surface water quality and quantity in the project area and leaving the project area.
- Effectiveness of monitoring to detect and quantify potential surface water impacts.
- Effects of the project on existing water users rights.
- Effects of the project on the value of water rights.

## Air Quality

- Effects of fugitive dust from construction, drilling, production and abandonment operations, and traffic.
- Effects of criteria pollutant emissions from construction, drilling, production, and abandonment operations and vehicles.
- Effects on atmospheric visibility.

## Soils

- Effects of surface disturbance operations on soil stability, structure, texture and biotic components.
- Effects of increased sedimentation and runoff, including soil and salt loads increases.
- Effects of disturbed soils on rehabilitation potential.

## Vegetation and Riparian/Wetland

- Effects of the loss of vegetative productivity.
- Effects of fugitive dust on vegetation and crops near roads.
- Effects of noxious weed infestation and control.
- Effects to wetlands and riparian areas from road, pipeline and well site construction.

## Reclamation

- Reclamation potential of disturbed areas.
- Bonding adequacy.

## Terrestrial and Aquatic Wildlife

- Displacement of wildlife from development operations and increased human presence.
- Effects on wildlife habitat suitability.
- Effects of the loss of high value and critical winter range for big game (mule deer and elk) from disturbances associated with the development.
- Offsite mitigation of critical winter range for big game.
- Effects on raptors.

## Threatened, Endangered, Candidate, and Special-Status Species

- Effects on Federally listed species.
- Effects on BLM, Forest Service, and UDWR identified sensitive species.

## Livestock Management

- Effects of vegetation loss on livestock productivity.
- Effects of road construction, well sites and facilities, and increased human presence on rangeland improvements and livestock management.
- Effects on livestock management facilities.

## Cultural Resources

- Effects of project activities on Native American sites with religious or cultural significance.
- Effects of the project on historic landscapes, including the Emery County irrigation system.
- Effects of ground disturbances and indirect impacts to cultural resources including archaeological sites.
- Effects on cultural resources on private lands.

## Land Use

- Effect of project-related traffic on local roads used by the public.
- Private property owner rights in relation to the project.
- Effects on existing land uses, including residential and agricultural.
- Coordination with local governments for land and road use and local plans.
- Consistency with adopted plans and policies of federal, state and local agencies.
- Need for a transportation plan that would eliminate/minimize duplication of existing roads.

## Recreation

- Effects of the development on recreational opportunities and amenities, particularly those close to towns and residential areas.
- Effects of the development on recreational activities.
- Potential for change in the quality of recreational experiences.

## Visual Resources

- Effects of the development on scenic qualities.
- Regional haze effects on visual resources.
- Effects of night lighting of facilities (skyshine).
- Effects on Visual Resource Management classifications.

## Noise

- Effects of the development and vehicular traffic on ambient noise levels.

## Social and Economic Values

- Effects of demographic changes.
- Effects of employment changes.
- Effects on infrastructure.
- Costs and benefits of the proposed project.
- Effects of a possible economic boom/bust cycle.
- Effects of the project taxes and mineral royalties.
- Effects on "quality of life."
- Effects on tourism.

## Health and Safety

- Effects of project activities on public health and safety.
- Effects of increased traffic associated with the development on public safety.
- Effects of potential methane seeps in soils and at the Ferron outcrop.
- Effects of increased human use of the lands on wildfire ignitions.

## Hazardous Materials and Waste

- Hazardous materials identification.
- Waste disposal.
- Pollution prevention.
- Potential for hazardous substance releases and effects on the public and the environment.

# ALTERNATIVES

Three alternatives were considered in detail. They were Alternative 1 — Proposed Action, Alternative 2 — Proposed Action with Additional Environmental Protection Measures, and Alternative 3 — No Action. The alternatives are graphically shown on **Plates 2–1, 2–4, and 2–6** found at the end of this summary. Additionally, the electric power option for Alternatives 1 and 2 are graphically shown on **Plates 2–2** and **2–5**, respectively. **Table S–1** summarizes and contrasts the three alternatives in terms of their physical characteristics.

## Alternative 1 — Proposed Action

The Proposed Action consists of the development of 353 natural gas wells, various ancillary facilities, and a transmission pipeline. Sixty-five new wells would be developed in the 18,350-acre North Area and 220 new wells would be developed in the 93,170-acre South Area. Of these 353 wells, 68 have already been drilled and 285 are proposed. The development of the wells involves the development of ancillary facilities including access roads, pipelines for gathering gas and produced water, electrical utilities, central production facilities (CPFs) for treating and compressing gas and disposing of produced water, and pipelines for delivering gas under high pressure to a transmission pipeline which would be 20 inches in diameter and almost 27 miles in length and would transport gas from the field to production facilities and ultimately to consumers.

Although the Companies would prefer to use gas-fired compressors and pumps, their proposals include the optional use of electric compressors, electric pumps, or both instead of gas-fired equipment. Under this option of the Proposed Action, all electric lines would be installed aboveground on 30-foot tall poles, which would look similar to telephone poles. Poles would be required approximately every 300 feet. Approximately 187 miles of aboveground power lines and 3,302 power line poles would be installed in the Project Area. The distribution of the lines is shown on **Plate 2–2**. **Table S–2** shows the linear extent of the power lines and the number of poles required for each classification of land ownership.

## Table S–1
## Comparison of Alternatives Considered in Detail

| Parameter | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| **Facilities** | | | |
| *Number of Natural Gas Wells* | | | |
| Existing on | | | |
| Federal lands | 30 | 30 | 30 |
| State lands | 18 | 18 | 18 |
| Private lands | 20 | 20 | 20 |
| Total | 68 | 68 | 68 |
| Proposed new on | | | |
| Federal lands | 130 | 112 | 0 |
| State lands | 100 | 100 | 100 |
| Private lands | 55 | 55 | 55 |
| Total | 285 | 267 | 155 |
| Total number of wells | 353 | 335 | 223 |
| *Roads (miles)* | | | |
| Potentially upgraded on | | | |
| Federal lands | 47 | 47 | 26 |
| State lands | 34 | 34 | 31 |
| Private lands | 23 | 23 | 18 |
| Total | 104 | 104 | 75 |
| Proposed new on | | | |
| Federal lands | 48 | 36 | <1 |
| State lands | 36 | 35 | 34 |
| Private lands | 14 | 13 | 10 |
| Total | 98 | 84 | 44 |
| Total for all roads | 202 | 188 | 119 |
| *Number of proposed water disposal wells* | 11 | 11 | 7 |
| *Proposed Compressors* | | | |
| Number of existing CPFs | 4 | 4 | 4 |
| Number of proposed CPFs | 7 | 7 | 4 |
| Number of proposed compressor stations | 3 | 3 | 0 |
| Total horsepower | 37,650 | 37,650 | 23,850 |

**Table S–1 (continued)**
**Comparison of Alternatives Considered in Detail**

| Parameter | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| **Short-term Disturbance (acres)** | | | |
| *Proposed Wells on* | | | |
| Federal lands | 179 | 154 | 0 |
| State lands | 138 | 138 | 138 |
| Private lands | 76 | 76 | 76 |
| Total | 393 | 368 | 214 |
| *Proposed Roads on* | | | |
| Federal lands | 458 | 341 | 3 |
| State lands | 339 | 331 | 323 |
| Private lands | 129 | 118 | 91 |
| Total | 926 | 790 | 418 |
| *Proposed CPFs* | 43 | 43 | 25 |
| *Proposed Compressor Stations* | 9 | 9 | 0 |
| *Total for all facilities* | 1,371 | 1,210 | 657 |
| **Long-term Disturbance (acres)** | | | |
| *Proposed Wells on* | | | |
| Federal lands | 107 | 93 | 0 |
| State lands | 83 | 83 | 83 |
| Private lands | 45 | 45 | 45 |
| Total | 236 | 221 | 128 |
| *Proposed Roads on* | | | |
| Federal lands | 235 | 175 | 2 |
| State lands | 174 | 170 | 166 |
| Private lands | 66 | 61 | 47 |
| Total | 475 | 405 | 214 |
| *Proposed CPFs* | 43 | 43 | 25 |
| *Proposed Compressor Stations* | 9 | 9 | 0 |
| *Total for all facilities* | 763 | 678 | 367 |
| **Workforce Requirements** | | | |
| *Construction and Installation (number of workdays for the project)* | 117,768 | 110,600 | 58,544 |
| *Operation and Maintenance (number of workdays for the project)* | 206,800 | 206,800 | 206,800 |
| *Reclamation and Abandonment (number of workdays for the project)* | 14,616 | 14,152 | 8,424 |
| **Water Requirements (acre-feet)** | 84 | 77 | 42 |
| **Sand and Gravel Requirements (cubic yards)** | 553,393 | 518,397 | 312,030 |

**Table S–2**
**Summary of Above Ground Power Lines for the Proposed Action**

| | Land Ownership | | | |
|---|---|---|---|---|
| **Facility/Area** | **BLM** | **State** | **Private** | **Total** |
| **Miles of Power Line** | | | | |
| North Area | 30 | 10 | 3 | 43 |
| South Area | 59 | 56 | 29 | 144 |
| Total | 89 | 66 | 32 | 187 |
| **Number of Poles** | | | | |
| North Area | 525 | 182 | 55 | 762 |
| South Area | 1,040 | 990 | 510 | 2,540 |
| Total | 1,565 | 1,172 | 565 | 3,302 |

The primary targeted reservoir for the Project is coal bed methane gas from the Ferron Sandstone Member of the Mancos Formation. The wells are proposed to be developed on a 160-acre well density pattern (four wells per square mile with one well in each quadrant of the section). Construction of the Ferron Natural Gas Project would begin during 1999 and, generally, construction would be completed within five years (by the end of 2004). The production lifetime of the wells is expected to be about 20 years and final reclamation is expected to be completed during the two to three years following the end of production.

The construction, operation, maintenance, and abandonment of CBM natural gas wells requires that the pressure in the coal seam be reduced by the removal of water before the gas can flow to the surface. The water production rates are the highest and the CBM gas rates are the lowest when a well is first brought on line. Over time, water production decreases steadily after reaching a peak during the first one to two years. The gas production increases steadily for a few years, then gradually declines. For this project, the produced water will come from the Ferron Sandstone and disposed of into the Navajo-Nugget Aquifer.

## Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Alternative 2 was developed in response to issues raised during the public and agency scoping process. This alternative would incorporate the same construction and operational components as the Proposed Action with the addition of Environmental Protection Measures applied to proposed activities on Federal lands. None of the Environmental Protection Measures would disallow lawful access to develop a Federal lease, but they may require relocation of well pads, roads, or ancillary facilities within the lease, restrict development during certain periods of the year, or require special construction, operational and reclamation methods to reduce potential environmental impacts. A full description of the Environmental Protection Measures is contained in Section 2.2 of the FEIS. Under Alternative 2's electrical equipment option, 97 miles of power lines would be installed aboveground on 1,704 poles (30 feet tall) spaced at approximately 300-foot intervals and 73 miles would be buried. The distribution of the lines is shown on **Plate 2–5** and summarized on **Table S–3**.

**Table S–3**
**Summary of Above Ground and Buried Power Lines for Alternative 2**

| | Land Ownership | | | |
|---|---|---|---|---|
| Facility/Area | BLM | State | Private | Total |
| Aboveground Power Lines | | | | |
| Miles of Power Lines | | | | |
| North Area | 6 | 3 | 2 | 11 |
| South Area | 23 | 47 | 16 | 86 |
| Total | 29 | 50 | 18 | 97 |
| Number of Poles | | | | |
| North Area | 113 | 48 | 28 | 189 |
| South Area | 412 | 821 | 282 | 1,515 |
| Total | 525 | 869 | 310 | 1,704 |
| Buried Power Lines | | | | |
| Miles of Power Lines | | | | |
| North Area | 20 | 7 | 2 | 29 |
| South Area | 26 | 8 | 10 | 44 |
| Total | 46 | 15 | 12 | 73 |

## Alternative 3 — No Action

The No Action Alternative is required by NEPA for comparison to other alternatives analyzed in the EIS. For this project, the No Action Alternative would not authorize additional natural gas development on Federal leases within the Project Area. Drilling could continue on State and private leases and access and pipelines across Federal lands to reach such proposed State and fee wells would be granted as required by BLM policy.

## ALTERNATIVES CONSIDERED BUT NOT EVALUATED IN DETAIL

In addition to Alternatives 1, 2 and 3, several alternatives were considered as a result of issues raised during scoping. However, these alternatives were not evaluated in detail for various technical, legal, and environmental reasons, which are fully described in Section 2.4 of the FEIS. The alternatives considered but not evaluated in detail included alternative well densities, the Proposed Action with certain areas excluded from development, specific buffers around residences, no disposal wells, deeper disposal wells, alternate produced water disposal methods, directional drilling, staged development, and alternative transmission pipeline routes.

## AFFECTED ENVIRONMENT

The Project Area is in Carbon and Emery Counties, Utah. Elevations in the North Area range from 5,770 feet to 7,300 feet. Elevations in the South Area range from 5,670 feet to 9,090 feet. Both the North Area and South Area lie near the San Rafael Swell, which is a large, elongate, asymmetric anticline that plunges to the northeast.

The Project Area lies within the watersheds of the Price River (North Area) and San Rafael River (South Area). No perennial surface waters exist in the North Area. However, four tributaries of the San Rafael River in the South Area (Huntington, Cottonwood, Rock Canyon, and Ferron Creeks) flow perennially. The Price and San Rafael Rivers drain into the Green River, which eventually drains into the Colorado River.

Groundwater in the Project Area occurring in geohydrologic units have been categorized into a series of major aquifers separated by confining units. Beginning at the surface and extending downward, these units are the Quaternary Alluvium (actually a group of discontinuous aquifers), the Mesaverde Aquifer, the Mancos confining unit, the Dakota Aquifer, the Morrison confining unit, the Morrison Aquifer, the Curtis-Stump confining unit, the Entrada-Preuss Aquifer, the Carmel-Twin Creek confining unit, the Navajo-Nugget Aquifer, and the Chinle-Moenkopi confining unit (Freethey and Cordy, 1991). The Ferron Sandstone member of the Mancos Shale, from which natural gas and associated produced water would be extracted, is an aquifer in the Project Area. In general, units designated as aquifers are composed of sandstone, while confining units consist principally of shale, siltstone, limestone, and claystone (although confining units may include interbedded sandstone). In the project area, both the Ferron and Navajo-Nugget Aquifers are saline.

Overall, air quality in the Project Area is good. Based on measured data, the region's remoteness, and a lack of major urban communities, the region around Price is designated as an attainment area for all criteria pollutants. That means all criteria pollutants are below the designated levels of the National Ambient Air Quality Standards (NAAQS) established by the U.S. Environmental Protection Agency and the Utah Department of Environmental Quality. Concentrations of criteria pollutants greater than the NAAQS are considered potentially harmful.

Eleven vegetation types have been identified in the Project Area. They include pinyon/juniper, salt desert shrub, sagebrush/grassland, barren land, spruce fir, mountain fir, agriculture, wetland and riparian, aspen, mountain shrub, and urban. The sagebrush/grassland, pinyon/juniper, and salt desert shrub cover about 90 percent of the Project Area.

The Project Area supports a variety of wildlife. Two species of big game occur regularly in the Project Area: elk and mule deer. Various species of raptors, upland game, furbearers, songbirds, waterfowl, and reptiles and amphibians also frequent the area. Aquatic species are present in the South Area in the four perennial streams. About 48 species that have a special-status designation (e.g., threatened, endangered, or sensitive) may occur in the Project Area.

Carbon and Emery Counties offer varied scenic terrain, which provides a setting for many forms of outdoor recreation. Public lands in the Project Area provide opportunities for camping, backpacking, hiking, mountain biking, fishing, picnicking, hunting, horseback riding, all-terrain vehicle and motorcycle riding, and winter sports. The primary users of recreational resources in the Project Area are local residents.

Historically, the economies of Carbon and Emery Counties were founded on resource extraction and have been subject to changes in the coal mining and energy markets. Presently, the counties' economies differ somewhat in composition. The government, trade, services, and mining industries comprise more than 70 percent of Carbon County's total employment. In contrast, employment in the mining and utilities sectors characterize Emery County's economy. Per capita income in Carbon County is lower than both the Utah and national averages, whereas per capita income in Emery County is higher than both the Utah and national averages.

The principal land uses in the Project Area include range, agriculture, residential, coal mining, oil and gas development and utility corridors. Current land ownership in the Project Area includes BLM, State, National Forest, and private lands.

Livestock grazing is a primary use for both public and private lands in the region. While livestock grazing has had a historic presence in the area, its economic success has been marginal due to the low carrying capacity of the land. This restrictive carrying capacity is due to the arid vegetation types within the area ranging from pinyon-juniper and sagebrush grassland to salt desert. Grazing patterns are typically managed to maximize what production does exist. The higher altitudes are utilized in the growing season, and the valley floor is grazed from spring to early summer, and during the fall and winter.

Soils within the area have developed on mesas, benches, hill slopes, to slopes, and outwash plains. Parent materials are residuum, colluvium, alluvium, and glacial outwash which, were derived from sandstone and shale. These soils have formed on nearly level to moderately steep slopes. They range from shallow to very deep and are well-drained. They have developed in the semi-arid to arid climatic regime of this area.

For cultural resources, the general area that includes Castle Valley is known for numerous rock art sites and many Fremont period sites in the canyons and closely adjacent ecotone settings. The comparatively brief history of the region has been dominated by Mormon settlement beginning in the 1870s, the arrival of the railroad, coal mining made feasible by the railroad, and the development of farming and ranching. The known prehistory and history of the region has been summarized by Spangler (1993) from the perspective of research in Nine Mile Canyon to the northeast. The latter treatment is much more exhaustive than is possible within the constraints of this environmental impact document.

## ENVIRONMENTAL CONSEQUENCES

The likely environmental consequences of Alternatives 1, 2 and 3 are summarized in **Table S–4**. In general, all three alternatives would have similar kinds of effects. However, the effects' magnitudes would vary according to the number of wells and other facilities that would be constructed.

## Table S–4
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| **GEOLOGY AND MINERALS** | | | |
| Removal of natural gas resources | 680 bcf Project total | 645 bcf Project total | 430 bcf Project total |
| Conflict with exiting coal leases or KCRA | No conflict with active coal leases; one potential conflict with KCRA on State land. | No conflict with active coal leases; one potential conflict with KCRA on State land. | No conflict with active coal leases; no conflict with KCRA. |
| **WATER RESOURCES** | | | |
| Effects to groundwater | Disposal of produced water would transfer saline groundwater from the Ferron Sandstone to the Navajo Aquifer. Shallow alluvial aquifers could be affected by spills and construction activities. Blasting near springs and water wells could affect flows. | Similar to Alternative 1. Produced water would be transferred from the Ferron Sandstone to the Navajo Aquifer. Environmental protection measures would limit construction near streams and in floodplains to reduce effects on shallow aquifers. Protection measures for avoidance of construction and blasting near springs would protect springs and seeps and reduce impacts. | Same effects as the Proposed Action, but at a proportionally lower rate as 130 fewer wells would be drilled. |
| Effects to surface water | Increased sedimentation and salinity due to surface disturbances. Sedimentation and salinity would be more pronounced from construction near water courses and from pipelines and roads that cross streams and ephemeral drainages. Sediment delivery would be 4.5 tons/acre/yr. Salinity delivery would be 0.319 tons/acre/yr. These rates would occur on 763 acres of long-term disturbance. Increased risk of spills of chemicals, drilling fluids, fuels and produced water from wells and facilities near streams and drainage. | Similar impact to Alternative 1, but protection measures would safeguard springs and reduce spill impacts. Sediment delivery would be reduced to 4.0 tons/acre/yr. Salinity delivery would be 0.239 tons/acre/yr. These rates would occur on 678 acres of long-term disturbance. | Same effects as the proposed action but at a proportionally lower rate. Sediment delivery would be 4.4 tons/acre/year. Salinity delivery would be 0.306 tons/acre/yr. These rates would occur on 367 acres of long-term disturbance. Increased risk of spills of chemicals, drilling fluids, fuels and produced water from wells and facilities near streams and drainage. |
| **AIR QUALITY** | | | |
| Construction dust effects | Construction dust would be controlled per Utah Air Conservation Rules by watering, chemical application, wind breaks, vegetative or synthetic covering. Companies are not proposing dust control on roads during operations. Dust levels from operational vehicles may be locally high. | Construction dust would be controlled per Utah Air Conservation Rules by watering, chemical application, wind breaks, vegetative or synthetic covering. BLM would require dust suppression techniques to be applied on roads near residences and high traffic volume. | Construction dust would be controlled per Utah Air Conservation Rules by watering, chemical application, wind breaks, vegetative or synthetic covering. Dust levels from operational vehicles may be locally high if dust suppression is not applied to roads near residences and high traffic volume. |

## Table S–4 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| Operational compressor effects | Ambient air levels of $NO_2$ would be moderate on elevated terrain within one mile of compressors. Maximum levels would be below NAAQS in all cases. Maximum levels of $NO_2$ would exceed Class II PSD increment near compressors at elevated terrain nearby. No other standards would be exceeded. If recommended mitigation are implemented, no $NO_2$ Class II incremental increase would be exceeded. With the electric power option, no $NO_x$ or CO emissions would occur. | Ambient air levels of $NO_2$ would be moderate on elevated terrain within one mile of compressors. Maximum levels would be below NAAQS in all cases. Maximum levels of $NO_2$ would exceed Class II PSD increment near compressors at elevated terrain nearby. No other standards would be exceeded. If recommended mitigation are implemented, no $NO_2$ Class II incremental increase would be exceeded. With the electric power option, no $NO_x$ or CO emissions would occur. | Ambient air levels of $NO_2$ would be moderate on elevated terrain within one mile of compressors. Ambient air levels of $NO_2$ may exceed PSD Class II increment if compressors are constructed near elevated terrain. |
| Effects to regional haze. | Regional visibility may be reduced by 10 percent 4 days per year at Capitol Reef National Park. If recommended mitigation measures are implemented, visibility at Capitol Reef would not be reduced by more than 10 percent on any days. With the electric power option, the Proposed Action would not affect regional visibility. | Regional visibility may be reduced by 10 percent 4 days per year at Capitol Reef National Park. If recommended mitigation measures are implemented, visibility at Capitol Reef would not be reduced by more than 10 percent on any days. With the electric power option, this alternative would not affect regional visibility. | Regional visibility would not be reduced by more than 10 percent at any of the nearby National Parks. |
| **SOILS** | | | |
| Erosional effects from facilities located on critical soils with slopes greater than 6 percent | 178 wells and portions of the access roads would be on critical soils with slopes in excess of 6 percent. Water and wind erosion would increase, especially with disturbances on critical soils. Soil loss from 763 acres of long-term disturbances would be 11.2 tons/acre/year. | Environmental protection measures would reduce impacts to soils by avoiding critical soils on slopes where possible. 160 wells and portions of the access roads would be on critical soils with slopes greater than 6 percent. Water and wind erosion would increase. Increased soil loss from 678 acres of long-term disturbance would be 9.9 tons/acre/year. Overall soil loss is projected to be about 88 percent of loss associated with the Proposed Action. | Effects similar to Alternative 1, but proportionally less. 39 wells would be constructed on critical soils with slopes in excess of 6 percent. Soil loss increase from 367 acres of long-term disturbance would be 6.6 tons/acre/year. Overall soil loss would be 59 percent less than the Proposed Action. |
| Facility location of slopes greater than 25 percent | 44 wells and portions of their access roads would be located on slopes greater than 25 percent. Water and wind erosion would increase and reclamation success would be difficult on these well pads and roads. | No wells or roads would be located on slopes greater than 25 percent. Wells and access roads would be relocated to exclude construction on slopes greater than 25 percent. | Effects similar to Alternative 1, but proportionately less. No roads would be constructed on slopes greater than 25 percent on BLM lands. |

## Table S–4 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| Effects on soil properties | Soil compaction, loss of soil productivity and soil profile and a breakdown in soil structure from facility and road construction, and surface disturbances. | Same as Proposed Action, but slightly less, as 18 fewer wells would be drilled. | Same as the Proposed Action but, proportionally less because 155 new wells would be drilled instead of 285. |
| **VEGETATION** | | | |
| Loss of vegetation | 1,633 acres of vegetation (1.5 percent of the Project Area) would be removed for construction. After partial reclamation, long-term vegetation loss would be 763 acres (0.7 percent of the project Area). 46 percent of disturbance would be on BLM land. 97 percent of vegetation would be pinyon-juniper, sagebrush/grassland, and salt desert shrub. | 1,472 acres of vegetation (1.3 percent of the Project Area) would be removed for construction. After partial reclamation, long-term vegetation loss would be 679 acres (0.6 percent of the project Area). 41 percent of disturbance would be on BLM land. 98 percent of vegetation would be pinyon-juniper, sagebrush/grassland, and salt desert shrub. | 916 acres of vegetation (0.8 percent of the Project Area) would be removed for construction. All vegetation removal would be on State and private land. After partial reclamation, long-term vegetation loss would be 367 acres (0.3 percent of the project Area). 96 percent of vegetation would be pinyon-juniper, sagebrush/ grassland, and salt desert shrub. |
| Invasion of noxious weeds | Disturbance would increase potential for spread of noxious weeds. Implementation of the Weed/ Vegetation Management Plan would reduce potential for establishment of noxious weeds. | Disturbance would increase potential for spread of noxious weeds. Implementation of the Weed/Vegetation Management Plan would reduce potential for establishment of noxious weeds. | Disturbance would marginally increase potential for spread of noxious weeds. Noxious weeds would be controlled by Companies in accordance with State and County laws. |
| **RIPARIAN AREAS** | | | |
| Riparian communities loss | Construction would remove 10.3 acres of riparian communities in South Area. One-half would be on BLM land. Effects would be long-term after the project ends because of the long time required for regrowth of riparian overstory. | Construction would remove 9.3 acres of riparian communities in South Area. About 18 percent would be on BLM land. Effects would be long-term after the project ends because of the long time required for regrowth of riparian overstory. | Construction would remove 6.9 acres of riparian communities in South Area. Almost all would be on private land. Effects would be long-term after the project ends because of the long time required for regrowth of riparian overstory. |
| **WILDLIFE** | | | |
| Effects on aquatic species | 12 wells would be located in floodplains adjacent to perennial streams. Increased sedimentation could occur during heavy precipitation. | Because of other environmental restraints, 6 wells would not be constructed adjacent to perennial streams. Sedimentation potential would be reduced by 50 percent. | Potential impacts would be similar to other alternatives because State and private lands contain most of the wells that would be constructed along perennial streams. |

## Table S–4 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| Effects on mule deer winter range | 65 new wells would be constructed in North Area. Development would directly disturb 229 acres (1.2 percent of North Area winter range). Indirect disturbance to habitat would affect 4,235 acres (22.9 percent of winter range within the North Area) within 200 meters of facilities during operations. Deer normally using winter range may vacate these areas of indirect disturbance.<br>177 new wells in South Area would be constructed on winter range. Development would directly disturb 890 acres (1.5 percent of South Area winter range). Indirect disturbance to habitat would affect 13,505 acres (24 percent of winter range within the South Area) within 200 meters of facilities during operations. Deer normally using winter range may vacate these areas of indirect disturbance. | No construction would occur when animals are using winter range. 61 new wells in North Area would be constructed on winter range. Development would directly disturb 201 acres. Indirect disturbance to habitat would affect 3,534 acres within 200 meters of facilities during operations.<br>163 new wells in South Area would be constructed on winter range. Development would directly disturb 740 acres (1.3 percent of South Area winter range). Indirect disturbance to habitat would affect 11,082 acres (19 percent of winter range within the South Area) within 200 meters of facilities during operations. Deer normally using winter range may vacate these areas of indirect disturbance. Mitigation would involve direct payments for loss of winter range to enhance adjacent winter range habitat. | 19 new wells on private and State land would be constructed in North Area on winter range. Development would directly disturb 67 acres (0.4 percent of North Area winter range). Indirect disturbance to habitat would affect 521 acres (2.8 percent of winter range within the North Area) within 200 meters of facilities during operations. Deer normally using winter range may vacate these areas of indirect disturbance.<br>105 new wells on State and private land in South Area would be constructed on winter range. Development would directly disturb 428 acres (0.7 percent of South Area winter range). Indirect disturbance to habitat would affect 6,844 acres (12 percent of winter range within the South Area) within 200 meters of facilities during operations. Deer normally using winter range may vacate these areas of indirect disturbance. |
| Effects on elk winter range | No elk winter range occurs in the North Area. 50 wells would be constructed in winter range in the South Area directly disturbing 207 acres (0.8 percent of the winter range). Construction would occur when animals are using winter range and would drive animals away from construction during winter range times. Indirect disturbance to habitat would affect 11,969 acres (49 percent of winter range within the South Area) within 800 meters of facilities during operations. Elk normally using winter range may vacate these areas of indirect disturbance. | No construction would be allowed during time elk use winter range. 49 wells would be constructed within winter range directly disturbing 128 acres 0.5 percent of winter range within the South Area). Indirect disturbance would affect 11,011 acres (45 percent of winter range within the South Area) within 800 meters of facilities during operations. Elk normally using winter range may vacate these areas of indirect disturbance. Mitigation would involve direct payments by Companies for loss of winter range to enhance adjacent winter range habitat. | 46 wells would be constructed within winter range directly disturbing 179 acres (0.7 percent of winter range within the South Area). Indirect disturbance would affect 10,096 acres (41 percent of winter range within the South Area) within 800 meters of facilities during operations. Elk normally using winter range may vacate these areas of indirect disturbance. |

## Table S–4 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| Effects on raptors | No construction would occur within ½ mile of raptor nests during the breeding season, February 1 through August 15. Construction during breeding season would not occur within ½ mile of 140 known and active nests. This restriction would affect 59 proposed wells. Operational activities within ½ mile of active nests could lead to nest abandonment, increased disturbance from Companies and public using roads, and temporary reduction in prey populations. With the electric power option, additional disturbance would be minor and the power lines would be constructed according to the APLIC's guidelines, so the potential for electrocuting raptors would be minimized. | Same as Alternative 1 for timing restrictions. Environmental protection measure would preclude permanent surface occupancy within ½ mile of an active raptor nest precluding the construction of 12 wells in the South Area. With the electric power option, additional disturbance would be minor and the power lines would be constructed according to the APLIC's guidelines, so the potential for electrocuting raptors would be minimized. | No seasonal or construction restrictions within ½ mile of raptor nests. 22 wells could be constructed within ½ mile of known raptor nest. |
| **SPECIAL STATUS SPECIES** | | | |
| Effects to Special-status species | 5 wells and 1,800 feet of access roads would be constructed in or near Winkler cactus populations. 6 wells and 6,120 feet of access road would be constructed in or near known populations of Creutzfeldt-flower. Pre-construction surveys would identify exact location and facilities would be re-located to avoid these species. 12 wells and access roads are proposed for construction within the one-mile buffer around peregrine falcon aerie. Impact should be minimal because of widespread hunting habitat on adjacent Forest Service lands. With the electric power option, disturbance associated with construction of the power lines would be minor because the power lines could be moved to avoid known populations. Power lines would be constructed according to the APLIC's guidelines, so the potential for electrocuting special-status raptors would be minimized. | Same as Alternative 1 except one-mile buffer would be imposed around peregrine falcon aerie. 8 fewer wells and access roads would be constructed on federal lands because of the no surface occupancy within one mile of a peregrine falcon aerie. With the electric power option, disturbance associated with construction of the power lines would be minor because the power lines could be moved to avoid known populations. Power lines would be constructed according to the APLIC's guidelines, so the potential for electrocuting special-status raptors would be minimized. | Four wells would be constructed on State lands within the one-mile of a peregrine falcon aerie buffer. Populations of special status plants, if present, may be uprooted by development. |

## Table S–4 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| **CULTURAL RESOURCES** | | | |
| Effects to Cultural resources | Construction activities could affect 77 sites in addition to the 10 known significant sources in the Project Area. Some of these sites could be destroyed before they are discovered. Four sites eligible for the NRHP could be inadvertently destroyed. If found, construction would cease, authorities would be notified, and mitigation of site would be carried out according to the Ferron Natural Gas Project Cultural Resource Treatment Plan. Pre-construction surveys would allow the opportunity to find and evaluate previously unknown cultural resources. With the electric power option, an additional six sites could be affected directly or indirectly. Also, one additional site may be affected by inadvertent destruction. | Construction activities could affect 69 sites in addition to the 10 known significant sources in the Project Area. Some of these sites could be destroyed before they are discovered. Four sites eligible for the NRHP could be inadvertently destroyed. If found, construction would cease, authorities would be notified, and mitigation of site would be carried out according to the Ferron Natural Gas Project Cultural Resource Treatment Plan. Pre-construction surveys would allow the opportunity to find and evaluate previously unknown cultural resources. With the electric power option, an additional six sites could be affected directly or indirectly. Also, one additional site may be affected by inadvertent destruction. | Construction activities could affect 40 sites in addition to the 10 known significant sources in the Project Area. Some of these sites could be destroyed before they are discovered. Two sites eligible for the NRHP could be inadvertently destroyed. If found, construction would cease, authorities would be notified, and mitigation of site would be carried out according to the Ferron Natural Gas Project Cultural Resource Treatment Plan. Pre-construction surveys would allow the opportunity to find and evaluate previously unknown cultural resources. With the electric power option, an additional six sites could be affected directly or indirectly. Also, one additional site may be affected by inadvertent destruction. |
| **LAND USE** | | | |
| Effects to land use | Total long-term disturbance would be 763 acres, or 0.7 percent of the Project Area. About 50 percent of disturbance would be on BLM land. Most of disturbance would be on rangeland. 53 wells would be constructed within one mile of residences. Dust levels and noise at these residences would be temporarily elevated during construction activities at these residences. | Total long-term disturbance would be 678 acres, or 0.6 percent of the Project Area. 41 percent of disturbance would be on BLM land. Most of disturbance would be on rangeland. 53 wells would be constructed within one mile of residences. Dust levels and noise at these residences would be temporarily elevated during construction activities at these residences. | All wells and most access roads would be constructed on State and private lands. 26 wells would be constructed within one mile of residences. Dust levels and noise at these residences would be temporarily elevated during construction activities at these residences. |
| Effects to transportation | Construction related traffic would average 110 trips per day, an increase of 1 to 5 percent over present levels, from Price area to Project Area. Operational traffic would average less than one percent of present levels. Slight increase of traffic accident potential (2 to 5 percent) during construction activities where project traffic would enter paved highways. | 18 fewer wells would be drilled. Effects would be similar, but slightly less, to Alternative 1. | Construction traffic would be similar to the Proposed Action for the three years required for construction. Operational traffic would be considerably less than the Proposed Action because only 82 wells would be operated. |

## Table S–4 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| **LIVESTOCK MANAGEMENT** | | | |
| Effects to livestock management | During construction, grazing would be reduced by almost 70 AUMs, (49 AUMs BLM) a decrease of less than 1 percent. Grazing would be reduced by 46 AUMs (33 AUMs BLM) during the operational phase. Increased traffic and access may lead to harassment and minor loss of livestock. | Effects on grazing would be similar to the Proposed Action. Environmental protection measure dictates range improvements must meet BLM standards and reduce the potential for traffic-related conflicts. Increased traffic and access may lead to harassment and minor loss of livestock. | Grazing on State and privately-owned land would be reduced by about 13 AUMs. |
| **RECREATION** | | | |
| Effects to recreation opportunities | Construction activities would alter the recreational experience for users through a loss of solitude and the natural setting. After construction, the loss of solitude would be less because of greatly reduced traffic. Installation and operation of facilities would still affect the natural setting of the Project Area for the life of the project. BLM recreation management objectives would not be met in Semi-primitive Motorized areas. | Construction activities would alter the recreational experience for users through a loss of solitude and the natural setting. After construction, the loss of solitude would be less because of greatly reduced traffic. Installation and operation of facilities would still affect the natural setting of the Project Area for the life of the project. BLM recreation management objectives would not be met in Semi-primitive Motorized areas. | No impacts to recreation on BLM lands would occur. Loss of solitude and natural setting could occur on State lands. |
| **VISUAL RESOURCES** | | | |
| Effects to visual resources | 114 wells, associated access roads, and 5 CPFs would be constructed on VRM Class III areas and the Class III management objectives may not be met. With the electric power option, about 187 miles of aboveground power lines and 1,532 power poles would be constructed in VRM Class III areas and may not meet management objectives. | 114 wells, associated access roads, and 5 CPFs would be constructed on VRM Class III areas and the Class III management objectives may not be met. With the electric power option, about 32 miles of aboveground power lines and 552 power poles would be constructed in VRM Class III areas and may not meet management objectives. | BLM Class II and III objectives designated for non-federal lands may not be met on State and private lands. |

## Table S–4 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| **NOISE** | | | |
| Noise effects | Construction noise would be above 55 dBA within 1,500 feet of activities. 5 residences would experience noise above 55 dBA from construction on BLM land. 14 residences would experience noise above 55 dBA from construction on private land. Noise from drilling would be above 55 dBA at distances out to 2,000 feet. Noise would be short-term (1 to 4 days) but would occur 24 hours per day at the 14 residences. Operational noise from pumping units would be below 55 dBA at distances beyond 200 feet from these units. Therefore, after construction activities, noise levels would not be significant. | Noise effects would be similar to the Proposed Action. The location of the 18 fewer wells would be far away from residences. | Noise levels would be above 55 dBA for the 14 residences within 2,000 feet of wells constructed on State and private land. |
| **SOCIOECONOMICS** | | | |
| Effects to employment | 98 people would be employed for construction activities. 40 percent would be locally hired and 60 percent would be specialists from outside the area. Employment would be seasonal during the 8-month construction period. Construction period would be 5 years. Secondary activities (services, supply) would create about 25 jobs annually during construction phase. 43 people would be permanently employed during the operational phase of the Project. | With 18 fewer wells, 94 people would be employed for construction activities. 40 percent would be locally hired and 60 percent would be specialists from outside the area. Employment would be seasonal during the 8-month construction period. Construction period would be 5 years. Secondary activities (services, supply) would create about 25 jobs annually during construction phase. 43 people would be permanently employed during the operational phase of the Project. | Since 155 new wells would be constructed, employment level would occur only for three years. |
| Effects to wages | Combined annual payroll of the three Companies would average about $900,000 during initial construction phase. This amount would be less than one percent of Carbon and Emery counties. The combined payroll during the operational phase would average about $1,150,000. | Combined annual payroll of the three Companies would average about $867,000 during initial construction phase. This amount would be less than one percent of Carbon and Emery counties. The combined payroll during the operational phase would average about $999,000. | Combined annual payroll would be reduced to $621,000 because a maximum of 155 wells would be constructed. |
| Effects on housing and community services | Small influx of transient employees (59 people) would not have significant effect. Workers would tend to live in spread out communities in and near the Project Area. | Influx of transient employees (56 people) would not have significant effect. Workers would tend to live in spread out communities in and near the Project Area. | Small flux of transient employees would only occur for the three-year construction period. |

## Table S–4 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| Royalties generated | Federal royalties would be $53 million over life of project. $27 million would be paid to State of Utah of which $6.8 million would be distributed directly to Carbon and Emery Counties. With the electric power option, employment would increase an additional three percent. | Federal royalties would be $50 million over life of project. $23 million would be paid to State of Utah of which $6.6 million would be distributed to Carbon and Emery Counties. With the electric power option, employment would increase an additional three percent. | There would be no federal royalties. Therefore, none would be distributed to Carbon and Emery counties. All wells would be constructed on State and private land. |
| **HEALTH AND SAFETY** | | | |
| Risk associated with construction and operations | Risks to employees, subcontractors and public would be similar to those associated with heavy construction and industry. | Risks wold be similar to Proposed Action but slightly less because 18 fewer wells would be constructed and operated. | Risks less than Proposed Action because only 154 wells would be constructed and operated. |
| **RECLAMATION** | | | |
| Reclamation potential | 1,633 acres disturbed. 77 percent of disturbance would involve soils unsuitable for reclamation. Reclamation in these areas would require multiple growing seasons and reseeding to generate vegetative cover similar to cover that currently exists. | 1,473 acres disturbed. About 75 percent of disturbance would involve soils unsuitable for reclamation. Reclamation in these areas would require multiple growing seasons and reseeding to generate vegetative cover similar to cover that currently exists. | 917 acres disturbed on State and private lands. 68 percent of disturbance would involve soils unsuitable for reclamation. Reclamation in these areas would require multiple growing seasons and reseeding to generate vegetative cover similar to cover that currently exists. |

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# CHAPTER 1

# PURPOSE AND NEED

# CHAPTER 1
# PURPOSE AND NEED

## 1.1 PROJECT OVERVIEW

Three companies have proposed to develop natural gas in Carbon and Emery Counties in central Utah. Anadarko Petroleum Corporation (Anadarko); Chandler and Associates, LLC. (Chandler); and Texaco Exploration and Production, Inc. (Texaco) have proposed to develop two separate areas northeast and southwest of Price, Utah totaling about 111,520 acres. These two areas, called the North Area and the South Area, are adjacent to the area where River Gas Corporation (River Gas) is implementing the Price Coalbed Methane Project, which was approved by the Bureau of Land Management (BLM) in 1997. Also, Questar Pipeline Company (Questar) has proposed to develop a new pipeline as part of the Proposed Action. The corridor for this pipeline encompasses about 261 acres, which brings the total area encompassed by the Proposed Action to 111,781 acres. For purposes of this environmental analysis, the proposals of these four companies have been combined into the Ferron Natural Gas Development Plan. **Figure 1–1** shows the location of the proposed Ferron Natural Gas Project. **Chapter 2** of this Environmental Impact Statement (EIS) provides a detailed description of the proposed project.

The proposed project would involve private lands, state lands, National Forest System lands, and public lands administered by the BLM. The BLM, as lead federal agency, has determined that the proposed project constitutes a major federal action requiring the development of an EIS.

## 1.2 PURPOSE AND NEED

The Companies hold valid federal, state, and private oil and gas leases in the Project Area. The leases have created contractual and property rights for the Companies from the United States, the State of Utah, and private mineral landowners to develop natural gas resources. The purpose of the Companies' proposal is to extract and transport natural gas at a profit from the portions of the Project Area leased by them.

Private exploration and development of federal oil and gas reserves are integral parts of the BLM's oil and gas leasing programs under the authority of the Mineral Leasing Act of 1920, as amended by the Federal Land Policy and Management Act (FLPMA) of 1976 and the Federal Onshore Oil and Gas Leasing Reform Act of 1987. The BLM's oil and gas leasing program encourages development of domestic oil and gas reserves and the reduction of U.S. dependence on foreign energy sources. Natural gas is considered essential to supplying the Nation's future energy needs. Domestic demand is increasing and expected to reach 24.8 trillion cubic feet (tcf) per year in 2010 (Gas Research Institute 1993). Increased development of natural gas in an environmentally-responsible manner is necessary to satisfy federal energy policy (U.S. Department of Energy 1998). The project also would provide a source of clean-burning energy.

This EIS addresses the effects of implementing a level of natural gas development within the Project Area that is conceptual in nature. The wells, roads, pipelines, and ancillary facilities depicted in this EIS represent a proposed level of development and tentative locations for these facilities. The final location for each component of this proposed project would be determined through future site-specific analyses that would be required for each facility. These analyses would occur when applications, such as an Application for

Permit to Drill (APD), a Forest Service Special Use Permit (SUP), or a BLM Right-of-Way Grant, are filed by the Companies for each project component.

Therefore, this EIS serves two purposes. It provides the basis to analyze and disclose the impacts of the level of development proposed within the Project Area. It also identifies mitigation measures to address issues and approval conditions for the subsequent site-specific applications for individual locations.

## 1.3 ENVIRONMENTAL ANALYSIS PROCESS

The BLM and Forest Service are required by the National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) directives to analyze proposed actions involving federal lands and leases in terms of their potential effects on the human environment (40 Code of Federal Regulations (CFR) Parts 1500–1508). The BLM and Forest Service are further required, by the regulations implementing the Mineral Leasing Act of 1920, to review and act on APDs and attached Surface Use Plans of Operations (SUPO) and to decide on the requirements for surface occupancy provided by the SUPO. The BLM also issues right-of-way (ROW) grants to construct and operate linear transportation facilities, such as roads and pipelines, across federal lands under Title V of FLPMA and the Mineral Leasing Act.

The analysis of impacts to the human environment discloses the potential environmental consequences of the Proposed Action and alternative actions. Another responsibility of the BLM and Forest Service is establishing provisions for ensuring the reclamation of facilities and disturbed lands if an oil and gas operator would fail to complete adequate reclamation efforts. Bonds are required for oil and gas operations on federal leases to indemnify the government for safe rehabilitation, royalty payments, and civil penalties. Bonds are also required for ROWs on federal lands.

The BLM, Price Field Office in Price, Utah is the responsible federal agency for preparing this EIS. The USDA Forest Service, Manti-La Sal National Forest, is a cooperating agency and is responsible for protecting non-mineral resources on National Forest System lands. The development of the Proposed Action and the alternatives was conducted through a cooperative effort among the Companies, the BLM, the Forest Service, and the project interdisciplinary team. Interdisciplinary participation included specialists provided by a third-party contractor, a private consulting firm working under the direction of, and in cooperation with, the BLM. In addition, the Utah Division of Oil, Gas, and Mining(UDOGM) participated as a cooperating agency.

The EIS provides the responsible agencies with information upon which to base a final decision that considers factors relevant to the proposal. Scoping issues and concerns raised by the public and agencies drove the development of alternatives and focused the impact analysis process. The EIS documents (1) the analysis of impacts that could result from implementation of the proposal and alternatives and (2) the development of environmental protection measures necessary to reduce or eliminate environmental consequences.

The EIS is not a decision document; it documents the process used to analyze the potential environmental consequences of implementing the proposed natural gas development project and alternatives to the Proposed Action. The decisions regarding the proposed project are documented in separate Records of Decision (ROD) signed by the responsible officials of the BLM and Forest Service. The BLM and Forest Service's decisions will apply primarily to federal lands and leases administered by them. Decisions by other jurisdictions to issue or not to issue approvals related to this proposal may be aided by the disclosure of impacts available in this analysis.

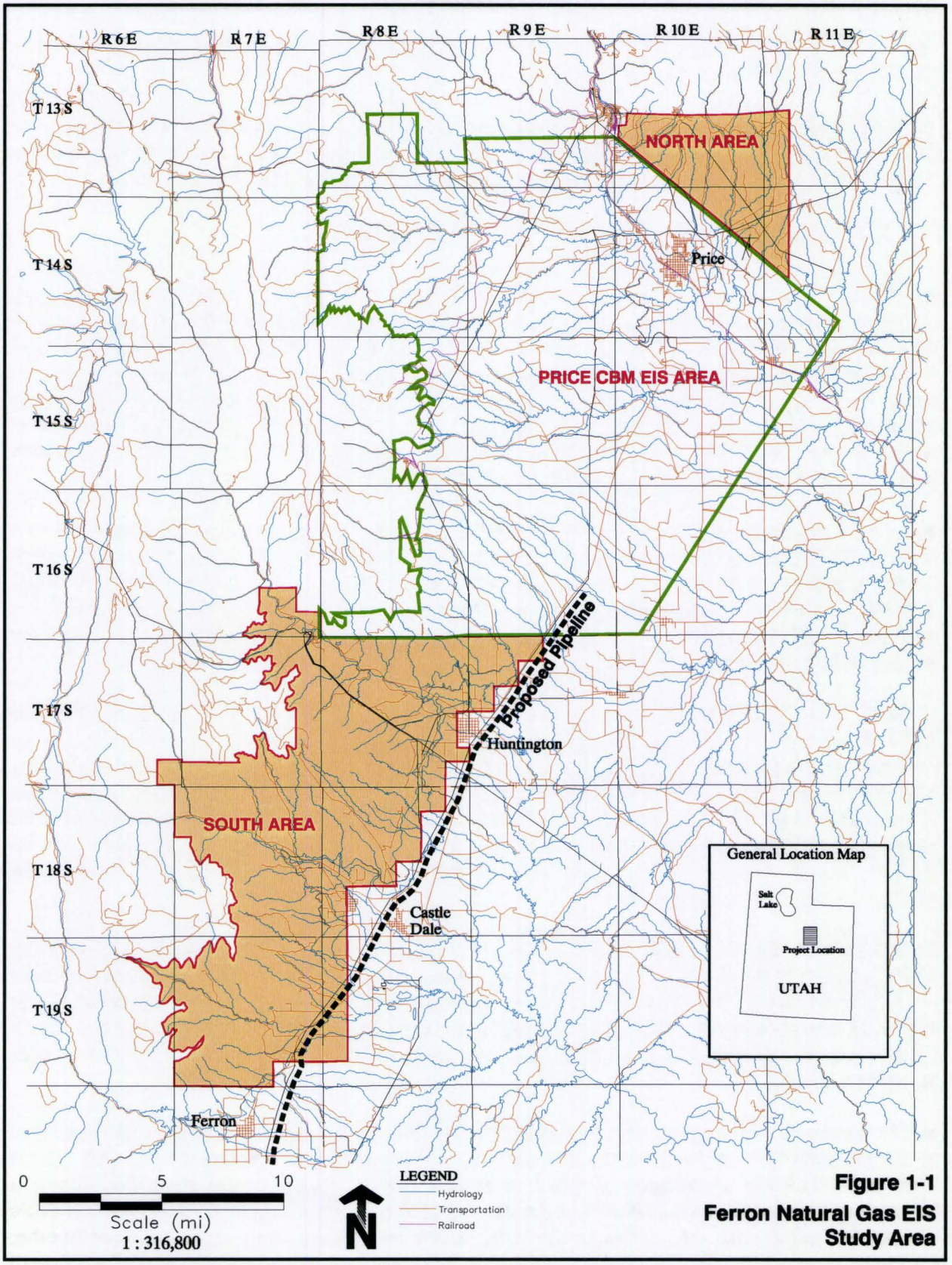


**Figure 1-1**
**Ferron Natural Gas EIS**
**Study Area**

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## 1.4 DECISIONS TO BE MADE AFTER THE EIS PROCESS

The RODs associated with this EIS are not the final review nor the final approvals for all actions associated with the Ferron Natural Gas Project. Although the RODs would approve a maximum level of natural gas development and its general location, the analysis of each project component that involves surface disturbance to federal lands must be approved on a site-specific basis by the BLM and the Forest Service. The method used to evaluate each surface-disturbing activity is the APD or right-of-way application/special use permit, which would be required before any construction can occur.

The APD includes a surface use program and a drilling plan. The detailed information to be submitted under each program is identified in Onshore Oil and Gas Order No. 1 and 43 CFR 3162.3. An on-site inspection of the locations proposed for the well, access road, pipelines, and other areas of proposed surface use would be conducted before approval. The inspection team would include the BLM, a Forest Service representative (if the construction would occur on National Forest System lands), the lessee or their designated representative, and the Company's primary drilling and construction contractors. The purpose of the on-site inspection would be to identify potentially-sensitive areas and the environmental impacts associated with the proposal at each specific location and site-specifically apply the methods needed to mitigate those impacts. The on-site could include site-specific surveys for cultural resources or threatened and endangered species, if the potential for occurrence of these resources exists on or near the proposed disturbance. After the site inspection, the APD may be revised or site-specific mitigation may be added as Conditions of Approval of the APD for protection of surface and/or subsurface resource values near the proposed activity. These may include adjusting the proposed locations of well sites, roads, and pipelines; identifying the construction methods to be employed; and identifying reclamation standards for the lands.

The BLM is responsible for conducting an environmental analysis on BLM lands, preparing the documentation, and providing mitigation measures to protect surface resources for APD approval. The Forest Service would have similar responsibilities on National Forest System lands. The BLM is responsible for approval of the drilling program, protection of groundwater and other subsurface resources, and final approval of the APD on both BLM and National Forest System lands.

The operator can initiate the APD process either by filing an APD or a Notice of Staking (NOS). The NOS would consist of an outline of the operator's proposal, including a location map and a sketched site plan.

Access roads and pipelines on BLM-managed land outside an applicant's lease would require a ROW Grant. Likewise, these facilities on National Forest System lands would require an SUP. The APD could be acceptable as an application for a ROW Grant or SUP for off-lease facilities, if it provides sufficient detail of the entire proposal.

After drilling, routine well operations would not require approval. However, the BLM would have approval authority for a variety of related activities. Any changes to an approved APD, certain subsequent well operations, and all subsequent new surface disturbances, such as workover pits, would require prior approval. Complete details of subsequent well operations are contained in 43 CFR 3162.3–2. Disposal of produced water from Federal leases would require prior approval, as outlined in Onshore Oil and Gas Order No. 7. The BLM also would approve plugging and abandonment of wells, hydrogen sulfide protection measures (if necessary), gas venting, gas flaring, and certain measures for handling production. Other permits, approvals, authorizing actions, and consultations required by Federal, State of Utah, and local agencies are discussed in **Section 1.8**.

# 1.5 LAND STATUS, LEGAL AND POLICY CONSIDERATIONS

## 1.5.1 Land Status

The North and South areas encompass approximately 111,520 acres. Surface and mineral estate ownership within these areas is divided among federal (BLM and Forest Service administered), School and Institutional Trust Lands Administration (SITLA), Utah Division of Wildlife Resources (UDWR), and private entities. BLM-administered federal surface lands account for approximately 44,240 acres (40 percent of the Project Area); National Forest System lands total 10,976 acres (10 percent); state surface lands total 28,041 acres (25 percent); and the remaining 28,263 acres (25 percent) are held in private ownership. Mineral ownership within the Project Area is split roughly equally between federal and state/private ownership.

Surface ownership along the pipeline corridor also is divided among the BLM, State of Utah, and private entities. BLM-administered federal surface lands account for about 62 acres. The State of Utah's lands encompass about 3 acres. The remaining 196 acres are held in private ownership.

The Companies currently hold leases on federal, state, and private lands within the Project Area. Within the Project Area, unleased lands and leases held by others also exist.

## 1.5.2 Land Exchange/U.S. Government and State of Utah

The DEIS identified and described an exchange of lands proposed by the U.S. Government and State of Utah. This exchange included some federally-owned lands in the Project Area. The exchange was proposed in an agreement signed on May 8, 1998 by the Secretary of the Interior Bruce Babbitt and Utah Governor Mike Leavitt. Before the DEIS' publication, legislation supporting the agreement was passed by the U.S. House of Representatives (June 24, 1998). Since the DEIS' publication, the U.S. Senate passed the same legislation (October 9, 1998) and the President signed the legislation into law (October 31, 1998). The legislation required completion of the exchange within 70 days of the President's date of signature.

With implementation of the exchange, about 17,400 acres of BLM-administered surface and mineral estates in the Project Area were conveyed to the State of Utah. **Table 1–1** identifies the distribution of these estates within the Project Area. Because the exchange was completed before the FEIS' completion, the FEIS was revised to incorporate the exchange into the analysis fully. Consequently, all figures, plates, and the results of all analyses presented in this document were based on post-exchange patterns of land ownership.

## 1.5.3 Lease Categories

Resource management planning direction for issuance of Federal oil and gas leases is specified in Bureau Manual 1624, "Supplemental Program Guidance for Energy and Mineral Resources (BLM 1986a) issued in 1986. Under this system, four leasing categories exist for Federal lands:

1. Open Subject to Standard Lease Terms and Conditions — These are areas where it has been determined through the planning process that the terms and conditions of the standard lease form are sufficient to protect other land uses or resource values.

## Table 1–1
## Locations of Land and Mineral Estates Included in the 1998 Land Exchange

| Surface and Mineral Estate | Acres | Surface Estate Only | Acres | Mineral Estate Only | Acres |
|---|---|---|---|---|---|
| T. 18 S., R. 7 E., SLM, Utah | | | | | |
| Sec 1, all; | | | | | |
| Total | 665 | | 0 | | 0 |
| T. 17 S., R. 8 E., SLM, Utah | | | | | |
| Sec. 1, lots 1–4, S½N½, N½SW, SWSW, SE; | | | | | |
| Secs. 3, and 4, all; | | | | | |
| Sec. 5, lots 1, 2, 6–12, N½SW; | | | | | |
| Sec. 6, lots 6, 7, SESW, SWSE; | | | | | |
| Sec. 7, all; | | | | | |
| Sec. 8, lots 1–12, NWNE, N½NENW, N½S½NENW, SWSWNENW, SESENENW, W½NW; | | | | Sec. 8, SESWNENW, SWSENENW; | |
| Sec. 9, SENE, NENW, SW, NESE; | | | | | |
| Sec. 10, N½, N½S½; | | | | | |
| Sec. 11, N½NE, SENE, W½; | | Sec. 11, SWNE | | | |
| Sec. 12, N½NENE, NESENENE, N½NWNE, SWNWNE, W½SENWNE, W½NW; | | | | | |
| Sec. 14, S½SW, SWSE; | | | | | |
| Sec. 15, S½NW, S½; | | | | | |
| Secs. 17, through 22, all | | | | | |
| Sec. 23, NWNE, NENW, W½W½, SESW, SWSE; | | | | | |
| Sec. 26, NWNE, NW; | | | | | |
| Secs. 27, through 31, all; | | | | | |
| Secs. 33, and 34, all. | | | | | |
| Total | 14,587 | | 40 | | 5 |
| T. 18 S., R. 8 E., SLM, Utah | | | | | |
| Secs. 5, and 6, all. | | | | | |
| Total | 1,282 | | 0 | | 0 |
| T. 17 S., R. 9 E., SLM, Utah | | | | | |
| Sec. 6, lots 1–7, S½NE, SENW, E½SW, W½SE, SESE; | | | | | |
| Sec. 7, lot 1, N½NE, SWNE, E½NW. | | | | | |
| Total | 836 | | 0 | | 0 |
| Total | 17,371 | | 40 | | 5 |
| Ferron Natural Gas Project Total | 17,416 | | | | |

2. Open Subject to Seasonal or Other Minor Constraints — These are areas where it has been determined that moderately-restrictive lease stipulations may be required to mitigate impacts to other land uses or resource values.

3. Open Subject to No Surface Occupancy or Other Major Constraint — These are areas where it has been determined through the planning process that highly-restrictive lease stipulations are necessary to protect resources.

4. Closed to Leasing — These are areas where it has been determined that other land uses or resource values cannot be adequately protected and appropriate protection can only be ensured by closing the land to leasing.

Before 1986, a similar system of categories was used to issue leases. Management Framework Plans and Environmental Assessments used as foundation for lease issuance were based on a 1973 DOI EIS published on the Federal Upland Oil and Gas Leasing Program.

The Forest Service conducted an oil and gas analysis for the Manti-La Sal National Forest in 1992. This analysis identifies areas that are available for leasing and lease stipulations required for specific areas needed to protect surface resources. In the consideration to lease National Forest System lands for oil and gas development, six options are available for each parcel of land. These options are:

1. No Lease (NL) — No lease would be authorized.

2. Standard Lease terms (SLT) — No special limitations would be applied. Operations are only restricted by current laws, regulations, and Onshore Orders. Under the SLT, facilities could be moved up to 200 meters (219 yards) or rescheduled for up to 60 days to protect resources.

3. Lease Notice (LN) — Provides information to a lessee concerning resources that are protected by law or regulation, thereby making a specific lease stipulation unnecessary. Examples of this information are threatened and endangered species protected under Section 7 of the Endangered Species Act and historic sites protected under the National Historic Preservation Act.

4. No Surface Occupancy (NSO) — Neither exploration nor production facilities (well pads, drilling rigs, etc.) would be allowed to be constructed.

5. Controlled Surface Use (CSU) — Surface occupancy and use are permitted, but are restricted to mitigate effects to particular resources. The CSU stipulation provides for mitigation measures that would not normally be met by relocating the drilling site 200 meters under the SLT. It is assumed that the well could be located within ½ mile of the proposed location and the targeted reservoir could be reached by directional drilling.

6. Timing Limitation (TL) — Construction activities would be restricted or prohibited during certain periods to protect resources. An example is to restrict construction in an area during a time when big game inhabit the area as a designated Big Game Winter Range.

Leases on Federal mineral estate have been granted within the Project Area to the Companies and others in conformance with applicable land use plans. A list of the proponents' leases and their associated stipulations is available for review at the Price Field Office of the BLM.

### 1.5.4 Conformance with Federal Management Plans

The Proposed Action and all alternatives described in this EIS would take place within the Price River Resource Area and the San Rafael Resource Area of the BLM. The Price River Resource Area is managed under a Management Framework Plan (MFP) (BLM 1984a), an MFP Supplement (BLM 1984b), and the subsequent Environmental Assessment (EA) Supplement (BLM 1988). The San Rafael Resource Area is managed under a Resource Management Plan (RMP) approved in 1991.

The decision in the Price MFP pertaining to oil and gas development states: "Establish oil/gas production as the priority land use for Known Geologic Structures that have been or may be identified." The San Rafael RMP decision states: "Management Objective is to lease public lands for oil and gas development and to allow geophysical activity to occur, only so long as the RMP goals are met; and to administer operational aspects of federal oil and gas leases where BLM does not manage the surface."

The Proposed Action and all alternatives analyzed in the EIS have been determined to be in conformance with both land use plans. Consequently, a plan amendment would not be required for either plan. The analysis of conformity with these plans is found in Section 4.10 of Chapter 4.

While development of natural gas resources is in conformance with both the Price River MFP and San Rafael RMP, the scale of development for the Ferron Natural Gas Project exceeds the scale of development analyzed by either plan. This EIS will update the 1983 Environmental Assessment supplement for the Price River MFP and the "Reasonable Foreseeable Development Scenario" for the San Rafael RMP, by analyzing the higher level of natural gas development in the Project Area.

The Manti-La Sal National Forest is managed under its Land and Resource Management Plan (LRMP), which was approved in 1986. Oil and gas leasing decisions were made for the Forest in the LRMP as modified by the Record of Decision associated with the Oil and Gas Leasing EIS, which was completed in 1992.

### 1.5.5 Consistency with Local Plans

Carbon and Emery counties have completed Master Plans that recognize oil and gas development in the area. Cooperation among the counties, land management agencies, and the companies, is emphasized in the plans for the minimization, mitigation, and compensation of the impacts from natural gas development. The Carbon County plan identifies the need to monitor public land use decisions through the creation of the Public Lands Committee. Emery County has a Public Lands Council, which is tasked with monitoring and participating in land use decisions.

Zoning regulations and requirements for both counties allow oil and gas development in all identified zones encompassing the Project Area. In Emery County, site plans require approval and fees to the county for permits before construction of facilities. Carbon County requires site plan approval by the County Commission for activities in certain zoned areas.

As identified in the plans, the Counties' objectives are to maintain and protect rural, recreational, cultural, and water resources. Concerns include the reclamation of the Project Area and the preservation of the open spaces, cultural resources, and recreation resources contained within the counties.

In the North Area, the Carbon County Trails Plan (Trails Plan), prepared in 1995, set out to establish an organized and formal trails system throughout the county (Keleher 1995). The Utah Centennial Trail System is a series of trails (interconnected and separate) that are within and around the North Area. The Wood Hill/ Kenilworth Loop is a series of dirt and gravel roads that has developed into a traditional community trail system. The Trails Plan identifies this area as the most important for implementation due to user needs and the proximity to communities. The Wood Hill/Kenilworth Loop would be the hub for the entire Trails Plan and could connect all the other trails systems throughout the county.

An inconsistency exists between the Proposed Action and the Trails Plan in that both intend to develop the area for separate and in some cases incompatible purposes. Oil and gas leases were issued under the provisions of Price River MFP. The Federal leases grant valid rights to develop the lands. The inconsistency between the proposed development and the Trails Plan is further affected by the number of different landowners and management agencies present within the affected area. Some trails within this area have already been affected by natural gas development on private, State, and Federal leases. Roads have been transformed to allow larger vehicle and heavy equipment travel and vehicle use has increased.

The Trails Plan calls for several actions to help in facilitating trail implementation where other competing development exists. Joint planning, identification of trails corridors through areas of development, and funding as a form of mitigation from developing companies are identified as methods available to help with implementation of the Plan. The Trails Plan calls for designation of priorities for trail development. The Wood Hill/Kenilworth Loop is designated the first area of concern by the county. The Trails Plan suggests that the developed areas be mitigated by creating parallel trails along affected roads. The Trails Plan also mentions requesting funding from companies pursuing CBM projects as possible mitigation in the affected area.

## 1.6 PUBLIC INVOLVEMENT/SCOPING OF ISSUES

In February 1997, the BLM conducted public and internal scoping to solicit input to identify the environmental issues and concerns associated with the proposed Ferron Natural Gas Project. A Notice of Intent (NOI) to prepare an EIS was published in the Federal Register on January 28, 1997. An amendment to the NOI was published in the Federal Register on February 3, 1998, which adjusted the western boundary of the South Area to the location evaluated in this EIS. The BLM prepared a scoping information packet and provided copies of it to federal, state, and local agencies; Native American groups; and members of the general public. In addition, the BLM conducted public scoping meetings in Price, Utah; Castle Dale, Utah; and Salt Lake City, Utah on February 11, 12, and 13, 1997, respectively. The environmental issues identified for the proposed project are described in the following sections. A summary of the results of scoping is available for review in the Price Office of the BLM.

### 1.6.1 Geology and Minerals

- Effect of seismic activity on project facilities, such as pipelines, and the risks to public safety.
- Potential for conflicts between gas drilling and existing or potential underground coal mining.
- Effect of irretrievable commitment of natural gas.

### 1.6.2 Water Resources

- Effects of underground disposal of produced water on the natural flow and quality of water in the target and shallower formations.
- Effect of dewatering the Ferron coal zone on shallower groundwater sources and surface waters.
- Advantages, disadvantages, and feasibility of available produced water disposal methods.
- Effects of potential spills at various locations and the means to prevent and control spills.
- Consumption of domestic and irrigation waters during the project and the effects on current users.
- Control of stormwater runoff.
- Erosion effects on surface waters.
- Effects of surface water quality and quantity in the project area and leaving the project area.

- Effectiveness of monitoring to detect and quantify potential surface water impacts.
- Effects of the project on existing water users rights.
- Effects of the project on the value of water rights.

### 1.6.3 Air Quality

- Effects of fugitive dust from construction, drilling, production and abandonment operations, and traffic.
- Effects of criteria pollutant emissions from construction, drilling, production, and abandonment operations and vehicles.
- Effects on atmospheric visibility.

### 1.6.4 Soils

- Effects of surface disturbance operations on soil stability, structure, texture and biotic components.
- Effects of increased sedimentation and runoff, including soil and salt loads increases.
- Effects of disturbed soils on rehabilitation potential.

### 1.6.5 Vegetation and Riparian/Wetland

- Effects of the loss of vegetative productivity.
- Effects of fugitive dust on vegetation and crops near roads.
- Effects of noxious weed infestation and control.
- Effects to wetlands and riparian areas from road, pipeline and well site construction.

### 1.6.6 Reclamation

- Reclamation potential of disturbed areas.
- Bonding adequacy.

### 1.6.7 Terrestrial and Aquatic Wildlife

- Displacement of wildlife from development operations and increased human presence.
- Effects on wildlife habitat suitability.
- Effects of the loss of high value and critical winter range for big game (mule deer and elk) from disturbances associated with the development.
- Offsite mitigation of critical winter range for big game.
- Effects on raptors.

### 1.6.8 Threatened, Endangered, Candidate, and Special-Status Species

- Effects on Federally listed species.
- Effects on BLM, Forest Service, and UDWR identified sensitive species.

## 1.6.9 Livestock Management

- Effects of vegetation loss on livestock productivity.
- Effects of road construction, well sites and facilities, and increased human presence on rangeland improvements and livestock management.
- Effects on livestock management facilities.

## 1.6.10 Cultural Resources

- Effects of project activities on Native American sites with religious or cultural significance.
- Effects of the project on historic landscapes, including the Emery County irrigation system.
- Effects of ground disturbances and indirect impacts to cultural resources including archaeological sites.
- Effects on cultural resources on private lands.

## 1.6.11 Land Use

- Effect of project-related traffic on local roads used by the public.
- Private property owner rights in relation to the project.
- Effects on existing land uses, including residential and agricultural.
- Coordination with local governments for land and road use and local plans.
- Consistency with adopted plans and policies of federal, state and local agencies.
- Need for a transportation plan that would eliminate/minimize duplication of existing roads.

## 1.6.12 Recreation

- Effects of the development on recreational opportunities and amenities, particularly those close to towns and residential areas.
- Effects of the development on recreational activities.
- Potential for change in the quality of recreational experiences.

## 1.6.13 Visual Resources

- Effects of the development on scenic qualities.
- Regional haze effects on visual resources.
- Effects of night lighting of facilities (skyshine).
- Effects on Visual Resource Management classifications.

## 1.6.14 Noise

- Effects of the development and vehicular traffic on ambient noise levels.

## 1.6.15 Social and Economic Values

- Effects of demographic changes.
- Effects of employment changes.

- Effects on infrastructure.
- Costs and benefits of the proposed project.
- Effects of a possible economic boom/bust cycle.
- Effects of the project taxes and mineral royalties.
- Effects on "quality of life."
- Effects on tourism.

### 1.6.16 Health and Safety

- Effects of project activities on public health and safety.
- Effects of increased traffic associated with the development on public safety.
- Effects of potential methane seeps in soils and at the Ferron outcrop.
- Effects of increased human use of the lands on wildfire ignitions.

### 1.6.17 Hazardous Materials and Waste

- Hazardous materials identification.
- Waste disposal.
- Pollution prevention.
- Potential for hazardous substance releases and effects on the public and the environment.

## 1.7 CRITICAL ELEMENTS ANALYSIS

In addition to issues and concerns brought out in the public scoping process, the BLM requires that potential impacts be addressed for the following critical elements:

- Water Quality
- Floodplains
- Wetlands/Riparian Zones
- Air Quality
- Farmlands, Prime/Unique
- Rangeland Standards
- Threatened and Endangered Species
- Cultural Resources
- Paleontological Resources
- Areas of Critical Environmental Concern
- Wild and Scenic Rivers
- Wilderness Areas
- Native American Religious Concerns
- Native American Trust Resources
- Hazardous Materials/Waste
- Environmental Justice

Of the 16 critical elements required to be addressed, areas of critical environmental concern, prime or unique farmlands, wild and scenic rivers, and wilderness/wilderness study areas do not occur within the Project Area. Also, there are no interests or properties held in trust for Tribes by the United States government in the Project Area. Therefore, an impact analysis is not applicable for these resources.

Environmental Justice and Native American Religious Concerns were not identified as elements for analysis in this EIS. During scoping of this EIS, the Spanish Assembly of God Church and 70 Native American Tribes/Groups/Bands were contacted. The only expression of interest was from the Uintah and Ouray Tribe of Fort Duchesne, Utah. The Tribe requested to be placed on the EIS mailing list for receipt of mailings and the Draft EIS. No additional interest was expressed.

A separate Rangeland Health analysis has not been prepared as the soils, riparian/wetlands, special-status species, and water resource conditions were addressed in their respective sections of Chapters 3, 4, and 5 of the EIS.

## 1.8 AUTHORIZING ACTIONS

Federal, state, county and local permitting actions required to implement any of the alternatives would generally be the same for any alternative selected. These permit requirements, which are listed in **Table 1-2**, represent most of the permitting actions required for the Ferron Project, but the list is not necessarily conclusive.

## Table 1–2
## Major Permits, Approvals, and Consultations Potentially Required for the Ferron Natural Gas Project

| Issuing Agency/Permit Approval Name | Nature of Permit Action | Applicable Project Component |
|---|---|---|
| **FEDERAL PERMITS, APPROVALS, AND AUTHORIZING ACTIONS** | | |
| *USDI - Bureau of Land Management* | | |
| Permit to Drill, Deepen, or Plug Back (APD) and Sundry Notice, plugging and abandonment, venting, and flaring | Controls drilling and production for oil and gas on federal onshore leases | Wells and production facilities |
| Rights-of-Way Grant and Temporary Use Permit | Right-of-way grant on BLM-managed lands | Oil and gas pipelines, roads, facilities, etc. on BLM-managed lands. |
| Cultural Resource Use Permit | Archaeological surveys and limited testing on public lands. Archaeological data recovery (excavation) of sites on public lands | All surface-disturbing activities |
| Pesticide Use Permit | Control of pests | Wells, roads, and ancillary facilities |
| National Noxious Weed Act Compliance | Controls noxious weeds | Any occurrence of noxious weeds on and near project facilities |
| Material Sales | Sales of sand, gravel, and riprap | Construction activities |
| *USDA - U.S. Forest Service* | | |
| Special Use Permit | Surface disturbance on Forest Service-managed lands | Wells, roads, pipelines, and facilities on Forest Service land |
| Special Use Permit (Cultural Resources) | Archaeological surveys and limited testing on public lands. Archaeological data recovery (excavation) of sites on public lands | All surface-disturbing activities |

**Table 1–2 (continued)**
**Major Permits, Approvals, and Consultations Potentially Required for the Ferron Natural Gas Project**

| Issuing Agency/Permit Approval Name | Nature of Permit Action | Applicable Project Component |
|---|---|---|
| *USDI - U.S. Fish and Wildlife Service* | | |
| Endangered Species Act Compliance (Section 7) | Protects threatened and endangered species | Any activity potentially affecting listed or proposed threatened or endangered species |
| Migratory Bird Treaty Act | Protects migratory birds | All ground-disturbing activities |
| Bald Eagle Protection Act | Protects bald and golden eagles | All ground-disturbing activities |
| *Advisory Council on Historic Preservation* | | |
| Cultural Resource Compliance (Section 106) | Protects cultural and historic resources; coordinated with the Utah State Historic Preservation Officer (SHPO) | All ground-disturbing activities |
| *U.S. Department of Army Corps of Engineers* | | |
| Permit to Discharge Dredged or Fill Material (Section 404 Permit) | Authorized placement of fill or dredged material in waters of the United States or adjacent wetlands | All surface disturbing activities affecting waters of the United States or wetlands, such as roads and pipeline crossings. Waters of the U.S. include streams, lakes, playas, wetlands, and other identified aquatic resources. |
| *U.S. Department of Transportation* | | |
| Construction and operation of natural gas pipelines | Prescribes minimum safety requirements for pipeline facilities and the transportation of gas, including pipeline facilities | Natural gas pipelines. |

## Table 1–2 (continued)
## Major Permits, Approvals, and Consultations Potentially Required for the Ferron Natural Gas Project

| Issuing Agency/Permit Approval Name | Nature of Permit Action | Applicable Project Component |
|---|---|---|
| *Utah Department of Environmental Quality* | | |
| Utah Pollutant Discharge Elimination System (UPDES) Permit | Authorizes discharge of pollutants to surface waters of the state | Any point-source surface discharge |
| UPDES General Permit for Storm Water Discharges | Controls discharge of storm water pollutants associated with industrial and construction activities | Construction activities disturbing more than five acres of land; and gas production facilities that have had a discharge of a reportable quantity |
| New Source Review (NSR) Permit (non-Prevention of Significant Deterioration (PSD) | Controls emissions from new or modified sources | All pollutant emission sources and construction activities associated with Proposed Action or alternative |
| Fugitive Dust Control | Control fugitive dust emissions | Construction of facilities and vehicle traffic |
| *Utah Department of Transportation* | | |
| Transport Permit | Authorizes oversize, overlength, and overweight loads | Transportation of equipment and materials on state highways |
| Encroachment Permit | Authorized pipeline crossings or access roads tying into state or federal highways | Construction of pipeline across state or federal highways; construction of project roads that tie into state or federal highways |
| *Utah Department of Natural Resources* | | |
| Application to Store and Use Explosives | Permit to use, store, or transport explosives | All Proposed Action and alternative components |
| Right-of-Way of Special Use Permit | Authorizes activities on land purchased by Utah Division of Wildlife Resources for wildlife management objective | Facilities on land owned by Utah Division of Wildlife Resources |

**Table 1–2 (continued)**
**Major Permits, Approvals, and Consultations Potentially Required for the Ferron Natural Gas Project**

| Issuing Agency/Permit Approval Name | Nature of Permit Action | Applicable Project Component |
|---|---|---|
| *Utah Division of Water Rights* | | |
| Change in Nature of Use Application | Authorizes change of use on water rights | Non-consumptive and consumptive water uses |
| Stream Alteration Permit | Approves construction plans | Perennial stream crossings |
| *Utah Division of Oil, Gas, and Mining* | | |
| Permit to Drill, Deepen, or Re-enter and Operate an Oil and Gas or Disposal Well | Approves drilling on all lands within the state | Wells (production and disposal) |
| Underground Injection Control Permit | Regulates underground disposal wells | Underground disposal wells |
| Disposal facility permit | Waste disposal | Waste and disposal facilities |
| Safety Regulations for Oil and Gas Activities | Regulates oil and gas activities to protect public safety | All Proposed Action and alternative components |
| Permit to Flare Gas | Regulates flaring up to 30 days of testing or 50 MMcf, whichever is less | Flaring of gas wells |
| *Utah Division of State History, Antiquities Section* | | |
| Antiquities Annual Permit: Blanket Permit to Conduct Archaeological Investigations | Regulates all archaeological investigations on state and private lands | All surface-disturbing activities on state and private lands |
| Antiquities Projects Permit (Excavation) | Regulates all archaeological excavations on state and private lands | All surface-disturbing activities on state and private lands |
| *Utah Division of State History Preservation Section (SHPO)* | | |
| Section 106 Cultural Resources Consultation | Determines significance of cultural resources potentially affected by surface-disturbing activities | All surface-disturbing activities |

**Table 1–2 (continued)**
**Major Permits, Approvals, and Consultations Potentially Required for the Ferron Natural Gas Project**

| Issuing Agency/Permit Approval Name | Nature of Permit Action | Applicable Project Component |
|---|---|---|
| *Utah School and Institutional Trust Lands Administration (SITLA)* | | |
| Compliance with Rules | Compliance with applicable general and program rules | Facilities on SITLA lands |
| **LOCAL PERMITS, APPROVALS, AND AUTHORIZING ACTIONS** | | |
| *Carbon County* | | |
| Conditional Use Permit | Authorizes extraction and processing on private lands | Any project activities in residential or critical environment zones |
| Road Use Permit | Authorizes overweight and overlength loads on county roads | Transportation of equipment and materials on county roads |
| Road Opening Permit | Authorizes pipeline crossings, routing of pipelines parallel to county roads, and tying a project access road into a county road | Pipelines or project roads that cross or intersect with a county road |
| Solid Waste Ordinance | Regulates disposal of wastes in the County | Construction and operational waste |
| Building Permit | Controls construction of all structures in the County | Construction of all buildings in Carbon County |
| Noxious Weed Act Compliance | Controls listed noxious weeds | Any occurrence of noxious weeds on and near project facilities |

**Table 1–2 (continued)**
**Major Permits, Approvals, and Consultations Potentially Required for the Ferron Natural Gas Project**

| Issuing Agency/Permit Approval Name | Nature of Permit Action | Applicable Project Component |
|---|---|---|
| *Emery County* | | |
| Conditional Use Permit | Authorizes extraction and processing activities in Emery County | All project components in Emery County |
| Road Use Permit | Authorizes overweight and overlength loads on county roads | Transportation of equipment and materials on county roads |
| Encroachment Permit | Authorizes pipeline crossings, routing of pipelines parallel to county roads, and tying a project access road into a county road | Pipelines or project roads that cross or intersect with a county road |
| Solid Waste Permit | Regulates disposal of wastes in the County | Construction and operational waste |
| Building Permit | Controls construction of all structures in the County | All project structures that will have human occupants in Emery County |
| Noxious Weed Act Compliance | Controls listed noxious weeds | Any occurrence of noxious weeds on and near project facilities |
| Gas Well Permit | Authorizes installation of gas wells | Gas wells on non-federal lands |
| Large Site Plan Approval | Regulates the construction of large projects | All project components in Emery County |
| Road Encroachment Permit | Authorizes pipeline crossings or access roads tying into local roads | Construction of pipelines across county roads; construction of project roads that tie into county roads; use of county roads by the Companies or their contractors |

# CHAPTER 2

# PROPOSED ACTION AND ALTERNATIVES

# CHAPTER 2
# PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action and alternatives for the development of the Ferron Natural Gas Project. The alternatives described in this chapter include alternatives analyzed in detail and alternatives that were considered but dismissed from detailed analysis. The environmental effects of each alternative considered in detail, including the No Action alternative, are summarized and compared at the end of this chapter.

## 2.1 ALTERNATIVE 1 — PROPOSED ACTION

The Proposed Action consists of the development of 353 natural gas wells, various ancillary facilities, and a transmission pipeline. Sixty-five new wells would be developed in the 18,350-acre North Area and 220 new wells would be developed in the 93,170-acre South Area (**Plate 2–1**).

During the past several years, drilling activity and road construction/upgrading has occurred in both the North and South areas. Anadarko has completed 15 wells within the North Area: seven on federal leases and eight on state leases. Additionally, Anadarko has completed six wells on state leases and two wells on private land with federal minerals south of the North Area (**Plate 2–1**). Texaco and Chandler have completed 53 wells in the South Area; 23 on federal leases, 10 on state leases, and 20 on private leases (**Plate 2–1**). Therefore, the total number of wells at full development of the Ferron Natural Gas Project would be 353 wells, including the 68 already drilled and 285 proposed.

The ancillary facilities include access roads, pipelines for gathering gas and produced water, electrical utilities, central production facilities (CPFs) for treating and compressing gas and disposing of produced water, and pipelines for delivering gas under high pressure to a transmission pipeline. The numbers of proposed wells, roads and facilities are shown in **Table 2–1**. The transmission pipeline, which would be 20 inches in diameter and almost 27 miles in length, would transport gas from the field to production facilities and ultimately to consumers.

The description of the Proposed Action in the following sections includes a description of the proposed well field development (both the overall project and features specific to each company) and a description of the proposed transmission pipeline.

### 2.1.1 Well Field Development

#### 2.1.1.1 Overall Field Development Proposal

This section describes the general field development process. A detailed description follows this section.

The proposed locations of wells, access roads, pipelines, electrical utilities, and CPFs are shown on **Plate 2–1**. The primary targeted reservoir for the Project is coal bed methane gas from the Ferron Sandstone Member of the Mancos Formation. However, primary natural gas also may be extracted from the Ferron Sandstone at different depths than the coal seams. The wells are proposed to be developed on a 160-acre well density

## Table 2–1
## Alternative 1 Ferron Natural Gas Project Facilities

| Facility | Company | | | Total[1] |
|---|---|---|---|---|
| | Anadarko | Chandler | Texaco | |
| **Number of Existing and New Wells** | | | | |
| *Existing on* | | | | |
| Federal lands | 7 | 5 | 18 | 30 |
| State lands | 8 | 4 | 6 | 18 |
| Private lands | 0 | 1 | 19 | 20 |
| Total | 15 | 10 | 43 | 68 |
| *Proposed on* | | | | |
| Federal lands | 46 | 44 | 40 | 130 |
| State lands | 9 | 27 | 64 | 100 |
| Private lands | 10 | 12 | 33 | 55 |
| Total | 65 | 83 | 137 | 285 |
| Total number of natural gas wells | 80 | 93 | 180 | 353 |
| **Lengths of Roads (miles)** | | | | |
| *Potentially upgraded[2] on* | | | | |
| Federal lands | 24.4 | 11.4 | 11.4 | 47.2 |
| State lands | 5.0 | 14.6 | 14.6 | 34.1 |
| Private lands | 1.8 | 10.4 | 10.4 | 22.7 |
| Total[1] | 31.2 | 36.4 | 36.4 | 104.0 |
| *Proposed new on* | | | | |
| Federal lands | 9.6 | 22.0 | 16.8 | 48.4 |
| State lands | 2.5 | 10.7 | 22.7 | 35.9 |
| Private lands | 2.7 | 3.1 | 7.9 | 13.6 |
| Total | 14.8 | 35.8 | 47.4 | 98.0 |
| Total lengths of upgraded or new roads[1] | 46.0 | 72.2 | 83.8 | 202.0 |
| **Number of Disposal Wells** | 3 | 3 | 5 | 11 |
| **Compressors** | | | | |
| Existing Central Production Facilities[3] | 1 | 1 | 2 | 4 |
| Proposed Central Production Facilities[4] | 1 | 1 | 3 | 7 |
| Proposed Compressor Stations[4] | 3 | 0 | 0 | 3 |
| Total Horsepower | 20,400 | 5,250 | 12,000 | 37,650 |

Note:

1. Totals may not match precisely with values obtained by adding unit numbers due to rounding conventions.
2. Both Texaco and Chandler would use the upgraded roads in the South Area. Therefore, the total lengths of upgraded roads in the South Area were split evenly between Chandler and Texaco.
3. Chandler and Texaco would decommission their existing CPFs once the proposed CPFs are on line. However, they would continue to use the disposal wells associated with the existing CPFs.
4. One amine unit and one dehydration unit would be installed at each facility or station.

Source: Companies' proposals.

pattern (four wells per square mile with one well in each quadrant of the section). The facilities shown on **Plate 2–1** serve as the basis of the environmental analysis in this EIS, evaluating the effects of implementation of the proposed field development, i.e., the total number of wells, roads, and other facilities. The site-specific analysis of the exact locations of all facilities would be determined subsequent to the EIS,

based on a further refinement of environmental and engineering constraints at each site during the APD stage (as discussed in **Chapter 1**).

Construction of the Ferron Natural Gas Project would begin during 1999. Generally, construction would be completed within five years (by the end of 2004). The production lifetime of the wells is expected to be about 20 years and final reclamation is expected to be completed during the two to three years following the end of production. Thus, the Ferron Natural Gas Project is expected to be completed around 2027.

Most of the proposed wells in the Project Area would be coal bed methane (CBM) wells. Although construction, operation, maintenance, and abandonment of CBM natural gas wells are similar to that of conventional natural gas wells, two notable differences exist. First, the pressure in the coal seam must be reduced by the removal of water before CBM can flow to the surface. The water production rates are the highest and the CBM gas rates are the lowest when a well is first brought on line. Over time, water production decreases steadily after reaching a peak during the first one to two years. The gas production increases steadily for a few years, then gradually declines. Secondly, requirements for operational maintenance is higher with CBM wells. Coal fines from the target seams tend to migrate into CBM wells and plug up the wells and water pumps. Consequently, workovers are typically needed within the first few months after initial completion to remove these coal fines. Workovers for these types of problems are not required for conventional natural gas wells.

Development of the Ferron Natural Gas Project would include the following general categories of activities:

- construction of facilities,
- drilling and completion of wells(including the plugging of unsuccessful wells),
- production and maintenance of extracting CBM gas resources,
- construction and operation of the transmission pipeline,
- safety and emergency procedures incorporated into the project, and
- decommissioning and reclamation of the project's facilities.

The first step in the development of a well would be the construction of a rough access road to the location of the well pad. Vegetation would be cleared, topsoil would be stockpiled, and the well pad would be leveled. A mud pit then would be constructed adjacent to the proposed well bore. A portable drilling rig would be installed and drilling would begin. A typical well would be drilled to a depth of approximately 1,500 to 4,500 feet, which would take one to six days to drill. Upon successful completion, the well would be shut in or gas-flared/vented awaiting development of the infrastructure needed to transport the gas to a commercial transmission pipeline. The drilling rig would be removed and the mud pit would then be reclaimed. If the well is determined to be capable of economic production, the well would be stimulated and produced water and gas gathering pipelines generally would be constructed along the access road. If economically feasible, electric utility lines also may be installed to the well site.

Concurrently with the drilling of production wells, deep wells for the disposal of produced water would be drilled. These disposal wells would be drilled in a similar manner as production wells, except they would be drilled to depths of about 6,000 feet using drilling mud, a larger drilling rig would be needed, and drilling would take about one month. An additional week would be needed to complete the disposal well.

After a group of wells has been completed, the wells would be interconnected by gas and produced water pipelines to transport gas and water to the CPF. The CPF would consist of a water disposal well, a compressor station, an amine unit (to remove carbon dioxide), and a dehydration unit (to remove water from the gas stream). The purpose of the CPF would be to dispose of the produced water and attain the ultimate

pressure required to transport the gas to the proposed transmission pipeline. Concurrently, a high-pressure gas delivery pipeline would be constructed to transport gas from the CPF to existing or proposed transmission pipeline.

When ancillary facilities for a cluster of wells are functional, the field would be ready for production. At each well, a pumping unit, a water separation system, a gas meter, and connections to the gas and water collection systems would be constructed. Gas and produced water would then be transported to the CPF via the pipeline network and processed. Then, the gas would be transported to the sales pipeline. The pumping unit would be maintained at each well until the coal seams are dewatered. At this point, the gas would flow under natural pressure and the pumping unit may be removed. There is not enough production history to conclude that the wells would not produce some water throughout the project's life. Some type of pump may always be required to lift water, but produced water would decrease significantly from the initial production rates. As further clusters of wells would be completed, further pipelines, central production facility, and delivery pipelines would be constructed. This development sequence would continue within the Project Area until the proposed field development is attained.

#### *2.1.1.1.1 Construction Phase*

This section describes the overall procedures, techniques, and resources that would be employed to construct the facilities comprising the Proposed Action. These facilities include roads, pads for gas wells and disposal wells (for produced water), pipelines, electric utilities, and compressors. Resources needed for construction include labor, materials, and equipment. Dust suppression techniques on all construction areas would be applied in accordance with State of Utah regulations.

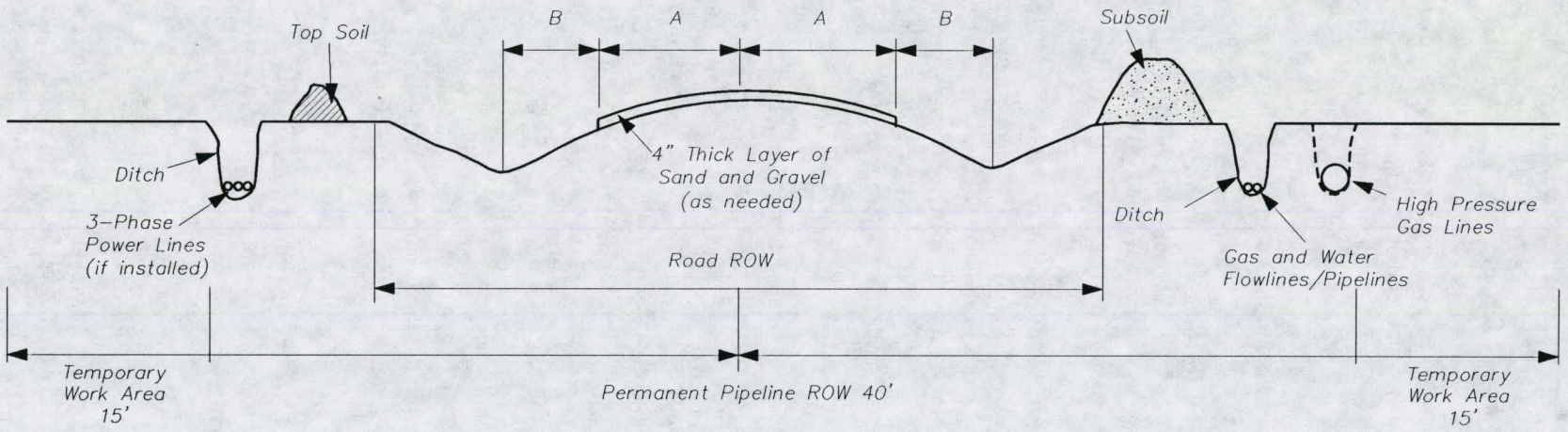
##### **2.1.1.1.1.1 Roads**

A network of roads already exists within the Project Area. These roads would be used as is or upgraded where acceptable for access to project facilities. New roads would be constructed only where necessary. Because the proposed locations of well pads and compressors relative to existing roads vary, lengths of these roads constructed to access these facilities also vary. The overall network of existing, proposed, and potentially-upgraded roads is shown on **Plate 2–1**.

Under the Proposed Action, three classes of roads would be constructed. They are collector roads, local roads, and resource roads. **Plate 2–1** shows the distribution of the 98 miles of proposed roads in the North and South areas, as classified by the BLM's road classification system. On federal lands, all roads would be constructed to BLM or Forest Service standards (**Figure 2–1**). For discussion purposes, all roads proposed are assumed to be BLM roads.

Collector roads are existing or planned roads necessary for support of existing facilities. These roads normally provide access to larger blocks of land and connect with, or are an extension of, an existing public road system. Collector roads receive a high volume of traffic and usually require application of the highest construction and maintenance standards used by the BLM. The design speed is 25 miles per hour (mph). The minimum width for the travel way ranges from 20 feet to 30 feet. Although the actual width would vary with site-specific conditions, the average width for the travel way is expected to be 24 feet.

Local roads are existing or proposed roads that would serve the development of depletable natural resources or temporary facilities. These roads receive lower volumes of traffic than collector roads and usually provide




| | Surfaced Travel Way Width (ft.) | A (ft.) | B (ft.) | Approximate Disturbance Width (ft.) | Total ROW Width (ft.) |
|---|---|---|---|---|---|
| Resource Road | 16 | 8 | 4 | 70 | 40 |
| Local Road | 20 | 10 | 4 | 70 | 40 |
| Collector Road | 24 | 12 | 4 | 70 | 40 |

Not To Scale

**Figure 2-1**
Typical Roadbed
and Pipeline/Utility Trench Cross Section

the internal access network within an oil/gas field. The design speed is 20 mph and width of the travel way usually is 20 feet (a minimum of 20 feet to a maximum of 24 feet).

Resource roads are existing and proposed roads that serve the development of a limited area of a depletable natural resource. These minimal roads usually provide the final segment of access to a well site. The design speed is 15 mph and width of the travel way usually is 16 feet (a minimum of 16 feet to a maximum of 24 feet).

Most roads to well pads (resource roads) would be constructed in two steps. Initially, each road would be roughed in and probably unsurfaced during the construction phase. The need for surfacing would be determined in consultation with the BLM or other landowner based on site-specific conditions. If the well is completed successfully, the road would then be completed to appropriate final specifications. However, if the well is not completed successfully and is plugged, the road would be reclaimed. Roads to other facilities would be constructed to final specifications in a single step.

Access roads constructed on public lands would follow existing two-track roads or trails, where practical. Construction of roads on state or privately-owned lands would follow agreements between the companies and individual landowners. Access roads across public lands would be designed and constructed according to BLM's Manual 9113 standards. The design and staking of all permanent roads on public lands also would be conducted under the direction of a licensed, professional engineer. Construction would be monitored by a qualified professional engineer or qualified inspector, as deemed appropriate by the BLM and Forest Service.

Access roads would be constructed using standard equipment and techniques, such as the crown-and-ditch method (BLM and Forest Service 1989). Heavy equipment would clear vegetation and topsoil materials from the road surface. Both materials would be windrowed for future redistribution during reclamation. All roads would be constructed with appropriate, adequate drainage and erosion control features/structures (e.g., cut and fill slope and drainage ditch stabilization, relief and drainage culverts, water bars, wing ditches, and rip-rap). Where needed, four inches of sand and gravel would be placed on newly-constructed roads to provide a year-round travel way surface.

#### 2.1.1.1.1.2 Wells

The Proposed Action includes the construction of 65 gas wells on federal, state, and private lands in the North Area. Forty-six wells would be constructed on federal lands administered by the BLM. About nine wells would be constructed annually on these federal lands from 1999 through 2003. The other 19 wells would be constructed on state and private lands.

Of the 220 wells proposed for the South Area, 84 wells would be drilled on federal lands administered by the BLM. About 17 wells would be constructed annually on these federal lands from 1999 through 2003. The other 136 wells would be constructed on state and private lands.

##### 2.1.1.1.1.2.1 Well Pad Construction

Construction of a well pad primarily would involve preparing a level area for the equipment that would drill and complete the well. The minimum area required for a well pad varies by company. Overall, the sizes of well pads would range from a minimum of 1.0 acre (200 feet by 225 feet) to a maximum of about 1.4 acres (200 feet by 300 feet). **Figure 2–2** shows the typical layout of a well pad.

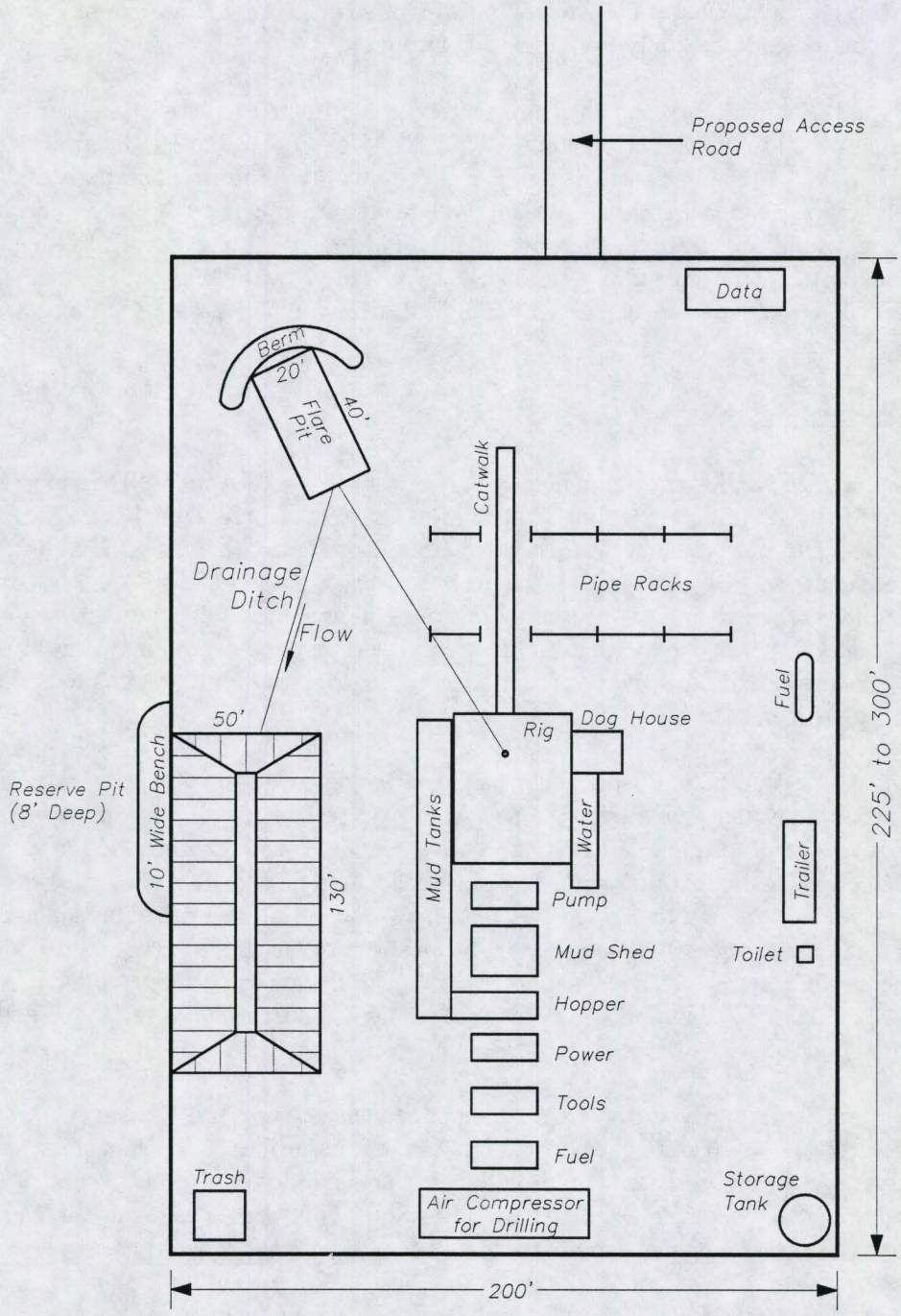



**Figure 2-2**
Typical Well Pad Schematic

Not To Scale

Construction of each well pad would follow a distinct series of steps (BLM and Forest Service 1989). First, vegetation on the pad would be stripped. In general, topsoil also would be stripped from the pad and stockpiled. However, in areas where minimal grading is required or where soils are naturally saline, alkaline, or both, topsoil would be stripped only from the drill cutting pit.

After vegetation and topsoil are stripped, the pad would be graded using standard cut-and-fill techniques of construction using a bulldozer, grader, or both. If the BLM or Forest Service determines site-specific conditions warrant, the pad may be surfaced with sand or gravel to minimize disturbance of soils and to promote efficient drainage. On part of the pad, a pit (with maximum dimensions of 50 feet wide by 130 feet long by 8 feet deep) would be excavated. This pit, which would receive cuttings during drilling, may be lined with an approved plastic liner, for example, High Density Polyethylene (HDPE) with a thickness of at least 12 millimeters. A determination of whether a pit liner is needed would be a site-specific decision made by the Authorizing Officer.

#### 2.1.1.1.1.3 Pipelines

Three types of pipelines would be constructed as part of the Proposed Action. They are gas-gathering pipelines, produced water-gathering pipelines, and high-pressure gas delivery pipelines. The gas-gathering and produced-water gathering pipelines would conduct gas and produced water from the wells to compressor facilities and produced-water disposal facilities, respectively. The high-pressure gas pipelines would connect compressor facilities to the existing and proposed transmission pipelines. Most pipelines would be buried underground. However, some may be laid on the ground where rocky conditions would result in more environmentally damaging and expensive construction methods. Site-specific determinations would be made by the Authorizing Officer.

In general, all three types of pipelines would be installed in rights-of-way along access roads. Gas-gathering pipelines and produced water-gathering pipelines would be placed together in the same trench/ditch paralleling the access roads (**Figure 2–1**). High-pressure pipelines would be installed in a separate ditch (**Figure 2–1**). Gas and produced water-gathering pipelines would be constructed of polyethylene or steel pipe with an outside diameter of 2 to 10 inches. They also would be constructed with manholes to provide access for maintenance and operational purposes. The locations of the manholes would vary depending on the specific pipeline characteristics. Each manhole would be protected by an aboveground barricade that is painted yellow for safety. The high-pressure pipelines would be constructed of steel pipe with an outside diameter of 4 to 10 inches.

Generally, pipeline construction would occur in a planned sequence of operations along or within roads. The path would first be cleared of trees and heavy brush by blading the surface. Where feasible, trees would be avoided. Brush and woody vegetation would be left in-place and driven over as necessary (crushed but potentially capable of redeveloping a vegetative canopy). Soils would be left undisturbed over much of the construction work area, although some compaction may occur.

Construction would be completed using the following steps: pipe stringing, trench excavation, pipe lowering, pipe padding, and trench backfilling. Materials, equipment, and techniques, including quality assurance control checks, would follow the standards for the industry. The pipeline trench would be excavated mechanically with a track excavator to a depth that allows 3.5 feet of material to be placed on top of the pipeline. Trench width would likely range from approximately 18 to 36 inches, depending on the number of pipelines and the diameter of pipe placed in the trench bottom. Earthen materials would be backfilled promptly into the trench following installation.

Before being placed into service, each gathering pipeline would be tested with pressurized fresh water (hydrostatic testing) or air to locate any leaks. After completion of hydrostatic testing, waste water would be directed to the water collection and disposal system (disposal wells) for final disposal. Site regrading would occur where necessary. Reclamation of the portion of the construction ROW not to be retained as part of the adjacent road would be initiated per landowner requirements (i.e., BLM, Forest Service, state, or private) so as to return this temporary disturbance area to productive use and to stabilize soils.

#### 2.1.1.1.1.4 Electric Utilities

Although the Companies would prefer to use gas-fired compressors and pumps, their proposals include the optional use of electric compressors, electric pumps, or both instead of gas-fired equipment. This section describes an electrical option for the Proposed Action, which is based on the Companies' preferences for an electrical system, if they were to construct the Proposed Action with electrical equipment.

Based on projected power demands, it is anticipated that the Companies would require 1 megawatt (MW) per day to transport five million cubic feet of natural gas per day (MMCFD). Based on this power demand, the maximum power requirement would be 33 MW per day. **Figure 2–3** shows the expected average daily power requirements for each year of operations for the Proposed Project.

Under this option, three-phase 12kV distribution lines would connect wells and compressor facilities with the existing transmission and distribution system within the Project Area. Electricity would be routed to wells and compressors aboveground on poles generally located along the access roads or on additional 10-foot-wide rights-of-way across open land. The installation and power would be provided by Utah Power and Light. Power line construction would follow access road surfacing and coincide with the completion of well drilling. The power lines would be designed and constructed according to the Avian Power Line Interaction Committee's (1996) guidelines for the prevention of electrocution of raptors. Electrical junction boxes would be installed as necessary by the public utility. These boxes would be painted with an Agency-approved color to blend with the surrounding environment after each well begins operation.

The power lines would be constructed using tracked and wheeled equipment. A crew with a backhoe or a line-boom truck with an auger attachment would dig the holes where accessible from access roads. The holes would be located as to not disturb existing sensitive vegetation and would be excavated to a depth of 8 to 10 feet. Poles would be transported to the construction site by truck where the structural components would be assembled on the ground and erected by a boom truck.

Pole locations could be moved within the 10-foot wide ROW if topography and/or impacts to cultural, vegetative, or wildlife resources are identified at the site of the structure. In areas of thick vegetation and/or where vegetation may impede the performance of the active line, vegetation would be cleared by hand-held chainsaws or any other equipment needed to complete the job. Where areas of sensitive plant resources are known to occur, the BLM would be consulted before removal of any vegetation.

When the structures are in place, the conductor would be strung. A sock line would be laid along the route by a light vehicle or by hand. Ground crews would place the sock line in pulleys on each structure at the insulator location. The conductor would then be pulled up by pulleys through the insulator with the assistance of a reel truck, or by hand, before moving to the next pole location. At least two miles of conductor could be pulled into place in a single setup.

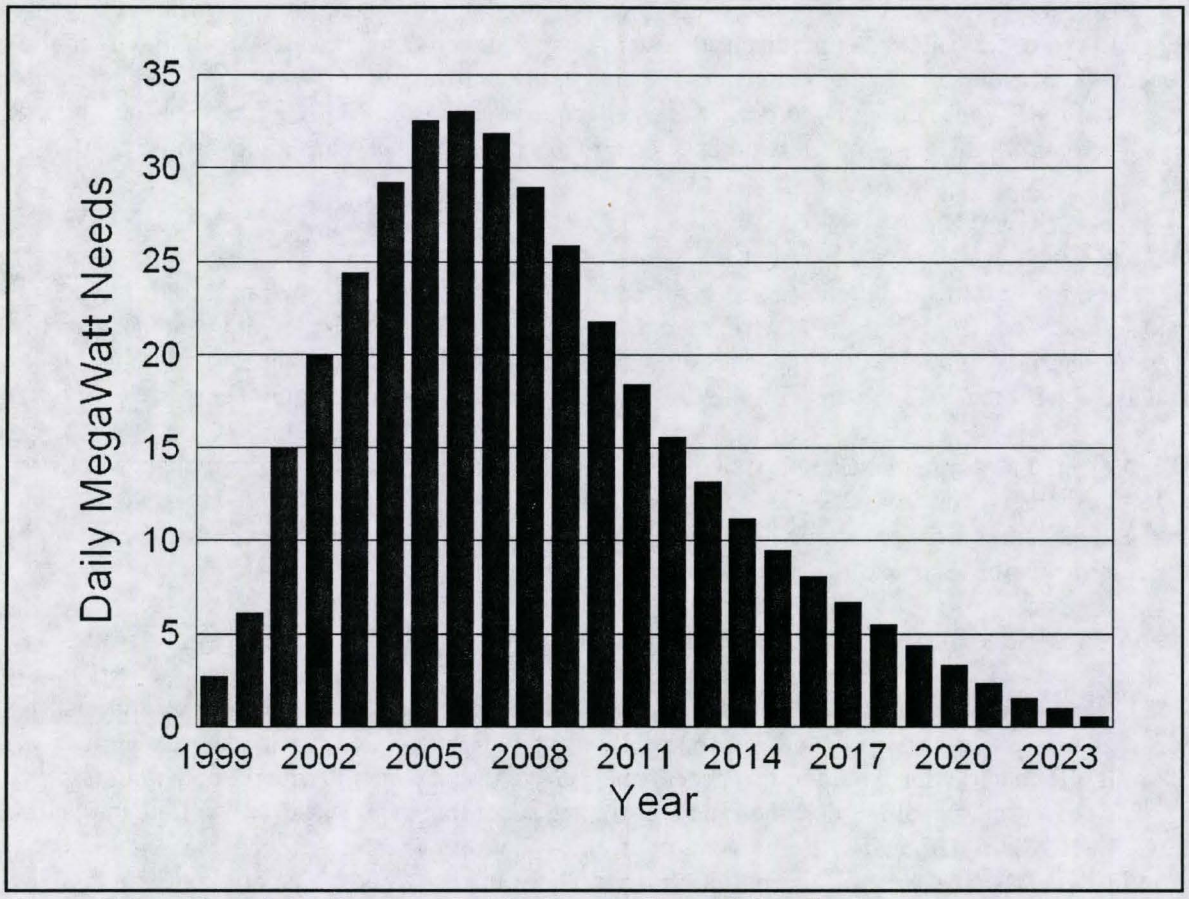



**Figure 2–3 Electricity Forecast for the Ferron Natural Gas Project**

Under this option of the Proposed Action, all electric lines would be installed aboveground on 30-foot tall poles, which would look similar to telephone poles. Poles would be required approximately every 300 feet. Approximately 187 miles of above groundpower lines and 3,302 power line poles would be installed in the Project Area. The distribution of the lines is shown on **Plate 2–2**. **Table 2–2** shows the linear extent of the power lines and the number of poles required for each classification of land ownership.

#### 2.1.1.1.1.5 Produced Water Disposal

##### 2.1.1.1.1.5.1 Water Disposal Wells

Essentially, the actual construction of pads for produced-water disposal wells would follow the same basic procedures described for the pads for gas wells. The pad would be stripped of vegetation and topsoil. Then, it would be graded using standard cut-and-fill techniques of construction and a bulldozer, grader, or both. If the surface-managing agency or owner determines site-specific conditions warrant, the pad may be surfaced with sand or gravel to minimize disturbance of soils and to promote efficient drainage.

**Table 2–2**
**Summary of Above Ground Power Lines for the Proposed Action**

| | Land Ownership | | | |
|---|---|---|---|---|
| **Facility/Area** | **BLM** | **State** | **Private** | **Total** |
| **Miles of Power Line** | | | | |
| North Area | 30 | 10 | 3 | 43 |
| South Area | 59 | 56 | 29 | 144 |
| Total | 89 | 66 | 32 | 187 |
| **Number of Poles** | | | | |
| North Area | 525 | 182 | 55 | 762 |
| South Area | 1,040 | 990 | 510 | 2,540 |
| Total | 1,565 | 1,172 | 565 | 3,302 |

Although the basic construction procedures would be similar, two primary differences would exist between the pads for gas wells and pads for produced-water disposal wells. First, most of the pads for produced-water disposal wells would be located with compressor units on a central production facility (CPF). The typical layout of the disposal well facilities at a CPF is shown in **Figure 2–4.** An access road, a produced water pipeline, and maybe an electrical distribution line would be constructed to the disposal well. Disturbance from the disposal well would total approximately one-half (3.1 acres) of the 6.2-acre CPF. Installed features of the disposal well would include the well, electric- or gas-powered disposal pump, and several 500- to 1,000-barrel tanks for storing water. Lights (250 watts each) would be installed on poles and directed downward to illuminate key areas.

Second, emergency pits would be constructed and connected to each disposal well. If a disposal well has to be shut down for repairs, the companies would use these pits for the short-term storage of produced water that would normally be sent to the disposal well. If the company cannot repair the disposal well before the emergency pit reaches capacity, pumps at the gas wells that are sending produced water to the emergency pit would be shut down until the disposal well is repaired. Once the disposal well is repaired, any water in the emergency pit would be pumped to the well for disposal.

The sizes and number of the emergency pits would vary by company; however, all emergency pits would be lined with synthetic liners to prevent infiltration of produced water. Most pits would range in size from 30 feet by 50 feet by 10 feet (capacity = 2,500 barrels of water) to 115 feet by 115 feet by 8 feet (capacity = 18,850 barrels of water). Disposal wells in the South Area would have an emergency pit associated with each of them on the CPF. However, in the North Area, one large emergency pit that was originally designed as an evaporation pond would service all disposal wells. Specific differences among the Companies' proposals for emergency pits are discussed later in this chapter.

#### 2.1.1.1.1.6 Gas Compression

Currently, four gas-powered compressors are operating within the Project Area. Texaco operates two gas-powered compressor facilities, one in Township 18 South Range 7 East in the NW¼ of Section 24 and one in the NW¼SE¼ of Section 35. Anadarko operates a compressor located in Township 14 South Range 10

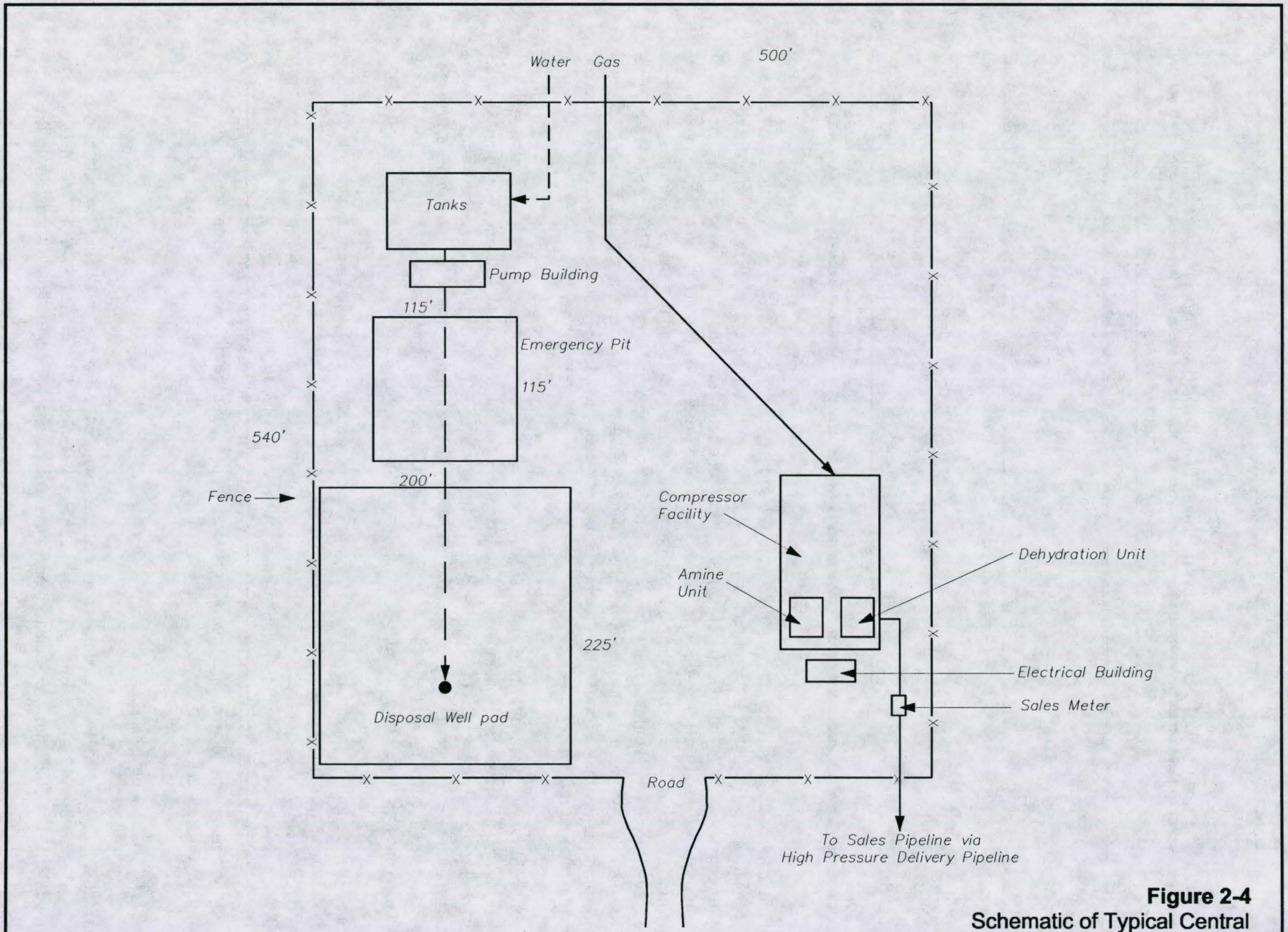



**Figure 2-4**
**Schematic of Typical Central Production Facility**

East, Section 3. Chandler operates a compressor in Township 19 South, Range 7 East in the NE¼ of Section 11. Upon reaching the full development of the Ferron Natural Gas Project, these existing compressors would be decommissioned.

The compressor sites would be constructed similarly to the well pads. An access road would be constructed from the transportation network to the site. Vegetation would be cleared and topsoil would be stripped and stockpiled. An area of about 6.2 acres (500 feet wide by 540 feet long) would be graded using standard cut-and-fill construction techniques and machinery (bulldozer and/or grader). The components for the compressor facility then would be installed. Concurrent with construction of the compressor s, gas pipelines would be built to the site.

The Proposed Action includes a maximum of 10 new compressor stations at the approximate locations shown on **Plate 2–1**. Additionally, one new compressor station would be constructed south of the North Area and Anadarko's existing compressor would be upgraded. The typical layout for the proposed compressor facilities is shown in **Figure 2–4**. Long-term disturbance for the construction and operation of a compressor facility for the life of the project would total approximately 3.1 acres of the 6.2-acre CPF. Clear lamp lights (250 watts each) would be installed to light each compressor facility. Each light would be mounted on a pole or building and directed downward to illuminate key areas within the facility while minimizing the amount of light projected outside the facility.

#### 2.1.1.1.1.7 Workforce Requirements

Most of the active workforce involved in developing the Proposed Action would be involved in construction-related activities. After roads and well pads are constructed, pipelines and utility lines are installed, and wells are drilled and completed, minimal personnel would be required to operate the field. **Table 2-3** shows the estimated employment requirements for the construction, operation, and reclamation of the FNG Project under the Proposed Action.

#### 2.1.1.1.1.8 Construction Resource Requirements

##### 2.1.1.1.1.8.1 Materials and Equipment

Construction of the Ferron Natural Gas Project would require a variety of materials and equipment. The primary materials would be water, sand, and gravel. Additionally, small amounts of chemicals would be required. Equipment needed for construction would include heavy equipment (bulldozers, graders, track hoes, and front-end loaders) and heavy- and light-duty trucks.

Water would be needed for constructing roads, well pads, and compressor stations. It also would be needed for drilling wells. Overall, the requirement for water to construct the Proposed Action is expected to be about 84 acre-feet (**Table 2–4**). This water would be purchased from local sources.

### *2.1.1.1.2 Drilling/Completion Phase*

#### 2.1.1.1.2.1 Roads

As many as 104 miles of existing roads may need to be upgraded to handle the increase in traffic projected under the Proposed Action (**Table 2–1**). About 45 percent of the roads potentially needing upgrading occur

**Table 2–3**
**Estimated Employment Requirements for Ferron Natural Gas Project**

| Work Category | Time Requirements | Number of Facilities | Personnel Required (# per day) | Workdays for Project | Workdays per Year | Average Workers per Day |
|---|---|---|---|---|---|---|
| ***Construction and Installation*** | | | | | | |
| Access Road | 4 days/mile | 98 miles | 4 | 1,568 | 314 | 1 |
| Well Pad | 2 days/site | 285 | 8 | 4,560 | 912 | 4 |
| Pipeline | 10 days/mile | 98 miles | 10 | 9,800 | 1,960 | 8 |
| Electrical Utility Lines[1] | 5 days/mile | 187 miles | 4 | 3,740 | 748 | 3 |
| Drilling and Casing | 4 days/well | 285 | 8 | 9,120 | 1,824 | 8 |
| Well Completion | 4 days/well | 285 | 20 | 22,800 | 4,560 | 19 |
| Well Production | 10 days/well | 285 | 16 | 45,600 | 9,120 | 38 |
| Compressor Facility/station | 90 days/site | 10 | 20 | 18,000 | 3,600 | 15 |
| New Disposal Wells | 40 days/well | 8 | 8 | 2,560 | 512 | 2 |
| Total | | | | 117,748 | 23,550 | 98 |
| ***Operation and Maintenance*** | | | | | | |
| Road/Pad Maintenance | 120 days/year | NA | 3 | 7,200 | 360 | 2 |
| Pumpers | 260 days/year | NA | 36 | 187,200 | 9,360 | 39 |
| Office | 260 days/year | NA | 2 | 10,400 | 520 | 2 |
| Well Workover | 5 days/well | 10/yr | 2 | 2,000 | 100 | 0 |
| Total | | | | 206,800 | 10,340 | 43 |
| ***Reclamation and Abandonment*** | | | | | | |
| Wells (gas and water) | 3 days/well pad | 364 | 4 | 4,368 | NA | |
| Roads | 4 days/mile | 98 | 4 | 1,568 | NA | |
| Compressor Dismantling | 30 days/facility | 14 | 20 | 8,400 | NA | |
| Reclamation | 5 days/facility | 14 | 4 | 280 | NA | |
| Total | | | | 14,616 | | |

Note:
1. Applies to the electrical equipment option only.

on BLM-administered lands. Another 33 percent of the roads occur on state lands and 22 percent occur on privately-owned lands. **Plate 2–3** shows the distribution of the roads potentially needing upgrading.

The rough access road constructed for initial access to the well pad also would be used for the drilling phase. If the well is not successfully completed, the road would be reclaimed using the methods described in the Reclamation Plan (**Appendix A**). If the well is completed successfully, the rough road would be upgraded to the appropriate class (most access roads to well pads would be resource roads).

**Table 2–4**
**Summary of Water Requirements for the Proposed Action**

| Item | Amount (size) | Rate | Total (acre-feet) |
|---|---|---|---|
| Roads and pipelines | 98 miles | 0.36 acre-feet/mile | 35 |
| Well pads | 393 acres[1] | 0.023 acre-feet/acre | 9 |
| Central production facilities | 43.4 acres | 0.29 acre-feet/acre | 13 |
| Compressor stations | 9.3 acres | 0.29 acre-feet/acre | 3 |
| Drilling and completion | | | |
| *Proposed Gas wells* | 285 wells | 0.05 acre-feet/well | 14 |
| *Proposed Disposal wells* | 8 wells | 1.26 acre-feet/well | 10 |
| Total | | | 84 |

Note:
1. Areal extent based on 285 gas wells.
Source: Cox 1998.

Sand and gravel also would be required in the construction of roads, well pads, and compressor facilities. Sand and gravel would be used to surface all newly-constructed roads in the collector and local classes to ensure a surface sufficient for year-round travel. The need for adding gravel to resource roads would be determined by the Authorized Officer or landowner on a case-by-case basis.

**Table 2–5** summarizes the estimated amount of sand and gravel needed if surfacing is required on all new roads, roads potentially requiring upgrading, well pads, and compressor facilities. Approximately four inches of sand and gravel would be applied where needed on roads and well pads. The Companies would purchase sand and gravel from local commercial sources.

**Table 2–5**
**Summary of Sand and Gravel Requirements for the Proposed Action**

| Facility | Amount | Unit | Application Rate (cubic yards per unit) | Total Volume (cubic yards) |
|---|---|---|---|---|
| New roads | 98 | miles | 1,430 | 140,140 |
| Potentially-upgraded roads | 104 | miles | 1,430 | 148,720 |
| New well pads | 285 | pads | 832 | 237,120 |
| New central production facilities | 7 | facilities | 3,225 | 22,575 |
| Compressor, amine, and dehydration stations | 3 | stations | 1,613 | 4,838 |
| Total | | | | 553,393 |

Source: Cox 1998

### 2.1.1.1.2.2 Wells

#### 2.1.1.1.2.2.1 Drilling

Following construction of the access road and well pad, a mobile drilling rig would be transported to and erected on the well pad. Trucks would be used to transport drilling components to the pad. Components of these rigs are designed for portability. Thus, they are easily loaded and unloaded and mostly self-contained on the mobile drill rig. Auxiliary equipment for supplying electricity, compressed air, and/or water also would be trucked in for drilling operations. Drill pipe, drill bits, cement, water, wire rope, and other necessary supplies would be trucked to the well pad and stored temporarily until used. An approximate layout of the well pad during drilling activities is presented in **Figure 2–2**.

The active phase of drilling would begin by setting the four tie-down anchors to guy the derrick tower and digging a pit, called a cellar, where the hole would be drilled. The cellar would provide space for the casing head spools and blow-out preventers that would be installed under the rig. Drilling operations normally include (1) keeping a sharp bit on bottom drilling as efficiently as possible, (2) adding a new joint of pipe as the hole deepens, (3) pulling the drill string out of the hole to put on a new bit and running it back to the bottom, and (4) installing casing and cementing it in the hole. Typically, an 11-inch (diameter) hole would be drilled to a depth of 300 feet; a 7 f -inch hole would then be drilled to a depth 250 feet below the lowest target formation.

The conclusion of well drilling operations would involve placing and cementing the well production casing. Placement of production casing (casing the hole) would entail the insertion of a steel pipe into the drill hole from the bottom of the hole to the surface. Casing would be set in the hole one joint at a time and would be threaded at one end with a collar located at the other end, to connect each joint. Each well would be completed with 8e-inch to 9e-inch surface casing to a depth of 300 feet and 4½-inch to 7-inch production casing to total well depth. Final well depths are anticipated to range from approximately 1,500 to 4,500 feet.

The casing would be partially cemented into place by pumping a slurry of dry cement and water into the casing head, down through the casing string to the bottom, and then up through the spacing between the casing and the well (annulus) to 250 feet above the target interval. A plug and rinse are pumped to the bottom of the well to remove any residual cement from the inside walls of the casing. Sufficient cement would be pumped into the annulus to fill the space where it would be allowed to harden.

A cement bond log would be run on the well to ensure no voids remain in the annulus. Cementing the annulus around the casing pipe restores the original isolation of formations by posing a barrier to the vertical migration of fluids between rock formations within the borehole. It also protects the well by preventing formation pressures from damaging the casing and retards corrosion by minimizing contact between the casing and corrosive formation fluids.

All drilling operations and other well site activities would be conducted in compliance with applicable BLM and UDOGM rules and regulations. As many as six rigs are expected to be used during the drilling period on federal lands and when conditions permit on state and private lands. Each gas well is expected to be drilled within a one- to six-day period, with an average of four days expected.

All wells would be completed in the Ferron Sandstone Member of the Mancos Formation using vertical air drilling techniques, unless special conditions arise requiring drilling mud (such as the presence of substantial water). To date, minimal drilling with mud has been required. With air drilling, compressed air and a slight

amount of surfactant would be used to remove drill cuttings from the hole and control pressure. Excess surfactant and cuttings would be blown into the drilling pit for disposal.

During drilling operations, certain waste waters would be generated, including frac fluids and, potentially, drilling fluids, in addition to the produced water. Where limited quantities of frac fluids (a mixture of water, guar gel, sand, and pH- and bacteria-control chemicals), drilling fluids, or other waste water liquids are generated during drilling, they would be discharged into the reserve pit constructed at the site in accordance with current applicable rules and regulations. After drilling, the water in the pit would be allowed to evaporate. After the pit is completely dry, it would be backfilled.

#### 2.1.1.1.2.2.2 Completion

To prepare each well for the production of gas, a well completion program would be initiated to stimulate production of gas and determine gas and water production characteristics. A mobile completion rig similar to the drill rig would be used to complete a well. The well completion process, which usually lasts from 7 to 14 days, includes perforating the well's steel casing, fracturing the producing formation hydraulically, and installing a series of valves and fittings on the wellhead (called a "Christmas tree").

Perforation of the well casing involves the creation of holes in the casing wall to provide a flow path into the well from the target production interval. Holes are produced by the detonation of a shaped charge placed within the well casing at the desired depth interval. Energy produced by detonating the shaped charge is directed through the well casing wall and hardened cement. The holes through the cement and well casing allow pumped fluids to enter the formations and stimulate the inflow of gas and produced water. Each well would be stimulated using a standard process known as hydraulic fracturing, which stimulates production by increasing the permeability of the producing formation.

In hydraulic fracturing, frac fluid (water and nontoxic additives) is pumped under pressure downward through the casing or tubing and out through the perforations in the casing. The pressurized fluid enters the formation and parts or fractures it. Sandgrains or other proppants (aluminum pellets, glass beads, or similar materials) are carried in suspension by the fluid into the fractures to "prop open" the fractures in the coal. When the pressure is released at the surface, the fracturing fluid returns into the well and the fractures partially close on the proppants, leaving channels for gas and water to flow through into the well. The frac fluid pumped into the casing is recovered and recycled or disposed of with the produced water. Installing the Christmas tree and associated tubing is the final step of the well completion work.

Even though the produced water and gas can flow into the casing after it is perforated, a small diameter pipe, called tubing, is placed in the well to serve as a way for the produced water to be brought to the surface. Typically, tubing is placed below the perforated interval so fluids that collect in the bottom of the well can be pumped up the tubing to the surface. At the surface, the collection of valves (Christmas tree) sits at the top of the well head. The tubing in the well is suspended from the Christmas tree, so as the well production flows up, it enters the Christmas tree. As a result, the production from the well can be controlled by opening and closing valves on the Christmas tree.

All completion activities would be limited to daylight hours, when possible. Minimal venting of gas at well sites would occur during completion or connection of the well to blowlines. Minimal venting also could occur when the well is flowed to surface following hydraulic fracturing. The flowing back of a well is necessary to purge the fluids used in the fracturing process. During the process of flowing back the well, slight amounts of gas are produced. The gas and water are flowed to the drilling pit, to temporary storage

tanks on location, or to the gas and water gathering pipeline systems, if operational. If the volume of water produced during the flowing back of the well is too great for the drilling pit or temporary storage tanks to hold entirely, water in the pit, tanks, or both would be pumped into trucks and transported to the disposal well for disposal.

Any gas entering the tanks with the water is separated and vented to the free atmosphere. In general, venting would only occur during the recovery of the water and is expected to last only a few days. However, Anadarko proposes to vent gas for a maximum of 30 days until the necessary infrastructure is constructed to transport gas and water to CPFs. A complete description of Anadarko's proposed method is found in **Section 2.1.1.2**, Company Breakdown of Proposed Well field Development. Any venting would be in accordance with Utah Administration Code Rule R–649–3–20, BLM's Notice to Lessees 4A (Royalty or Compensation for Oil and Gas Lost) and Onshore Order No. 5 (Measurement of Gas). After the water used in the fracturing is recovered, the well would be tied into the gas and water collection system.

Flaring may be necessary following completion of wells located distant from the existing pipeline infrastructure to determine whether the wells are capable of production in sufficient quantities to justify pipeline installation. Flaring would be done in accordance with all applicable laws, rules, and regulations, including as appropriate, compliance with Utah Administration Code Rule R–649–3–20, BLM's Notice to Lessees–4A and Onshore Order No. 5. These rules address the time frames and maximum amount of gas that can be flared.

Upon completion of the well, all disturbed areas not needed for production facilities would be restored (see **Figure 2–5**). The drill pit would be dried and backfilled. Seeding of these areas would take place in the fall. On federal lands, facilities would be painted with agency-approved BLM colors to blend with surrounding landscape. Overall, the pad for a well during production is expected to be about 60 percent of the size that was needed for drilling and completion.

#### 2.1.1.1.2.2.3 Unsuccessful Wells

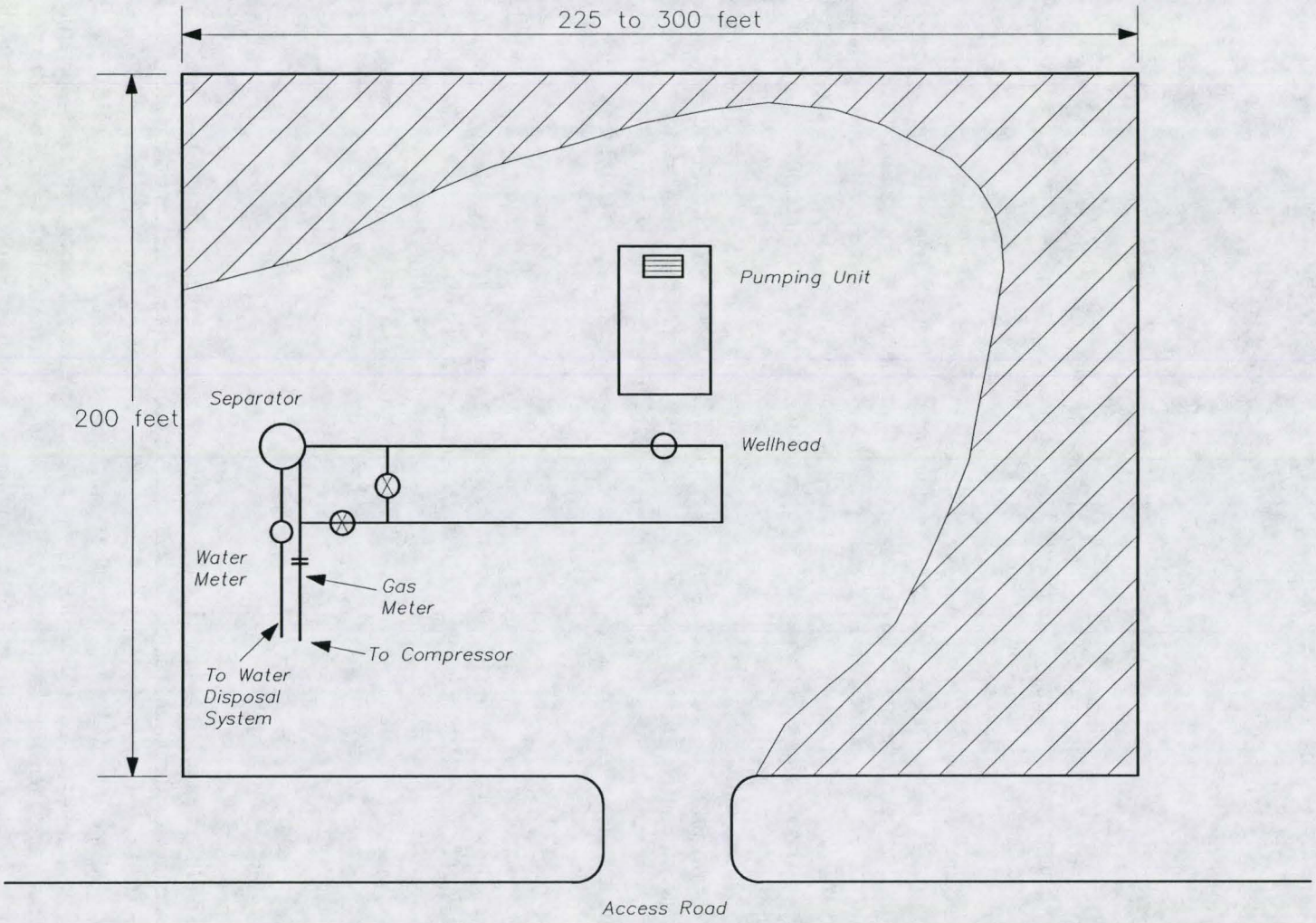
Unsuccessful wells would be reclaimed as described in **Section 2.1.1.1.4**.

### *2.1.1.1.3 Production/Maintenance Phase*

#### **2.1.1.1.3.1 Roads**

Routine maintenance in the Project Area would occur on a year-round basis or as ground and site conditions permit. Summer (late spring to early fall) road maintenance would require gravel additions and/or blading consistent with "traveled road maintenance operations" in the area. Winter (late fall to early spring) maintenance would include blading of snow from access roads and some summer-like maintenance when necessary and permitted by weather conditions. During production and maintenance, the Companies would not routinely employ dust abatement procedures on all roads within the Project Area.

The counties and Companies would primarily be responsible for maintaining the project's roads in the Project Area. Under existing agreements between the BLM and the counties, Carbon and Emery counties maintain segments of BLM roads in the Project Area (**Plate 2–3**). Additionally, the counties would continue to maintain existing county roads. The Companies would maintain all other project roads.




Not To Scale

**Figure 2-5**
**Schematic of a Typical Production Well Pad**

Upon the project's completion, all roads constructed specifically for the project would be removed and reclaimed, unless specifically requested by the landowner. If a landowner decides to keep a road, then the landowner would accept responsibility for maintaining the road upon abandonment by the companies. The counties would continue to maintain existing county roads and any roads covered by maintenance agreements with the BLM.

#### 2.1.1.1.3.2 Wells

##### 2.1.1.1.3.2.1 Production

Installed surface production facilities would include the Christmas tree, a walking beam pumping unit, separator, gas and water metering facilities, and connections to the gas and water collection systems (**Figure 2–5**). All would occupy less than one acre.

The Companies propose to use walking beam pumps rather than progressive cavity pumps. The primary reason for not selecting the progressive cavity pumps is the coal fines present in CBM wells tend to plug up these pumps much more frequently than walking beam pumps. Thus, shut downs and maintenance would occur more frequently if the Companies used progressive cavity pumps. The pumping unit would be powered by a 30- to 100-horsepower electric motor or gas engine and would be used to lift the produced water from the production zone, allowing the gas to flow by reducing the hydrostatic pressure on the coals.

The produced fluid stream contains gas and water. Production of natural gas from coal seams in the Ferron Member was only recently initiated. Therefore, no long-term production history exists to definitively state trends in production performance in this area. However it is assumed that the production rate for each well should increase the first few years, then gradually decline. Based on a zero-time plot analysis used for predicting gas production, the estimated peak gas production for the Proposed Action is 60 billion cubic feet per year.

The produced stream requires separating water in a two-phase separator at the well site that would yield gas and produced water. Following separation the gas is metered and introduced into the gathering system for transport to a compressor facility. Separated, produced water would be transported via the produced water gathering system to approved disposal wells or evaporation ponds. The remaining on-site facilities on the surface are a reciprocating pump (walking beam unit), a vertical separator, and meter house to measure the gas volume. A free standing electric-powered computerized monitoring, control, and telemetry panel may be installed on selected wells.

##### 2.1.1.1.3.2.2 Routine Maintenance

A maintenance person (a "pumper") would visit each well daily to ensure the equipment is functioning properly. Field personnel would routinely calculate balances between wells and collection/transfer points to ensure volumes match within acceptable tolerances. Significant leaks in gas or water pipelines would cause a loss of pressure detectable by the static pressure on the meter run. If such a leak is detected, a well would be shut-in. The shut-in point would be determined for each well based upon individual operating conditions. Field leaks would then be pinpointed using field pressures and the problem would be corrected. Maintenance of the various mechanical components of the gas production would occur at intervals recommended by manufacturers or as needed based on on-site visits.

An off-site computerized monitoring system may be installed if warranted by the number of total producing wells and the cost effectiveness of installing electrical lines to each site. If installed, the automated monitoring system would allow monitoring of operations at each well. The system would monitor various operating conditions (gas and water production rates, pipeline pressure, separator pressure, etc.) to determine if abnormal conditions exist. The well site automation equipment power source would be provided by underground or aboveground electricity cables laid to the well site. The well site operating conditions would be transmitted via radio to a local central facility. If a problem is identified, maintenance personnel would be immediately dispatched to the well site. The radio-controlled system would allow real time signals and solutions in response to well production problems. Control and monitoring of well production by radio telemetry may reduce regular site inspections of each well and would limit vehicular traffic to approximately once a week to each well. However, other factors such as the need for visual inspection of gas and water pipelines may require daily visits for safety and environmental reasons.

#### 2.1.1.1.3.2.3 Workovers

Periodically, a workover on a well would be required. A workover uses a truck-mounted unit similar to a completion rig to ensure that the well is maintained in good condition and is capable of extracting natural gas as efficiently as possible. Workovers are typically needed within the first few months after initial completion to remove coal fines from pumps. Workovers can include repairs to the well bore equipment (casing, tubing, rods, or pumps), the wellhead, or the production formation. These workovers may require venting pressure relief. Routine repairs would occur only during daylight hours and are usually completed within one day. Some limited situation may require several days to complete a workover. Although the frequency of workovers cannot be predicted because the requirements for workovers vary from well to well, each new well would likely require a workover during the first year of production.

### 2.1.1.1.3.3 Pipelines

Routine inspection of gas gathering and produced water pipelines would be done during the daily inspections of facilities. Procedures would be incorporated with the daily inspection of meters at the well sites. If pressure losses are detected, the wells would be shut in until the problem is isolated and rectified.

### 2.1.1.1.3.4 Electric Utilities

Routine inspection and maintenance of electric utilities would be done by Utah Power and Light.

### 2.1.1.1.3.5 Produced Water Disposal

#### 2.1.1.1.3.5.1 Disposal Wells

Based on maximum production characteristics from CBM wells in the region, it is estimated that a well could produce about 350 barrels of water per day (BWPD) during the first year of production and then taper off to 300, 250, 200, and 150 BWPD during the second, third, fourth, and fifth years, respectively. After the fifth year, average water production should gradually taper off to less than 100 BWPD. There is reason to believe that the values could be much lower, but a maximum case analysis was used to ensure adequate capacity for disposal of produced water. Data from five of Anadarko's existing wells in the North Area suggested an average production of 63 BWPD in the first year, 58 BWPD in the second year, and 36 BWPD in the third year. Data from the South Area suggest an average production of 225 BWPD in the first year and 177 BWPD in the first ten months of the second year.

All disposal wells would be located on State or private land. The preliminary locations of the proposed disposal wells are shown on **Plate 2–1**. Disposal of produced water would occur in accordance with a plan approved by the BLM, as provided for in Onshore Oil and Gas Order No. 7, Disposal of Produced, and the Underground Injection Control permit program administered by UDOGM. If the capacity of the water disposal system is exceeded during any phase of the Ferron Natural Gas Project, the Companies would follow the appropriate procedures (UDOGM and Onshore Oil and Gas Order No. 7) to have additional Class II disposal wells approved and drilled and/or construct evaporation ponds.

Since operation began at Texaco's disposal wells (located in southeast ¼, Section 35, Township 18 South, Range 7 East and southwest ¼, Section 24, Township 18 South, Range 7 East), produced water has been deposited into the Navajo Formation. For the period July 1996 through April 1997, produced water was deposited at an average rate of 1,800 BWPD at approximately 750 pounds per square inch (psi). Texaco has recently perforated an additional section of the Navajo Formation and received permission from the UDOGM to inject at pressures as high as 1,750 psi. The wells have demonstrated the capacity to accept water at rates as high as 8,500 BWPD.

The proposed disposal wells would be completed into the Navajo Formation. Based on calculations with rates of disposal into the Navajo Formation and the thickness, porosity, permeability modeling conducted by Texaco and current disposal rates, each proposed well in the South Area should be capable of handling 8,500 BWPD.

The Companies have completed 53 wells in the South Area during the past several years and would drill 220 more, an average of 44 wells per year (across all land ownerships), over the five-year construction time frame. Therefore, by the end of the construction period, the maximum average daily water production rate would be 60,300 BWPD [(44 wells X 350 BWPD/well for the wells in the first year) + (44 X 300 for wells in the second year) + (44 X 250 for wells in the third year) + (44 X 200 for wells in the fourth year) + (44 X 150 for wells in the fifth year) + (47 X 100 for wells in the sixth and succeeding years). The projected disposal rate for Texaco's three proposed wells and Chandler's three wells is 8,500 BWPD for an overall capability of 51,000 BWPD. Texaco's two existing disposal wells would add a further 17,000 BWPD disposal capacity. Therefore, the proposed water disposal capacity of 68,000 BWPD would exceed the projected daily maximum water production rate (60,300 BWPD) by 7,700 BWPD.

Based on Anadarko's experience with rates of disposal into the Navajo Formation, the proposed disposal wells in the North Area should handle 10,000 BWPD. Anadarko's three disposal wells (one existing and two proposed) would be completed into the Navajo and Wingate Formations. Based on a projected disposal rate of 10,000 BWPD, the three disposal wells would have a capacity to dispose of 30,000 BWPD.

Through 1997, the Companies have completed 15 wells in the North Area and would drill 65 more, an average of 13 wells per year, over the five-year construction time frame. Therefore, by the end of the construction period, the maximum average daily water production rate would be 17,750 BWPD [(13 wells X 350 BWPD/well for the wells in the first year) + (13 X 300 for wells in the second year) + (13 X 250 for wells in the third year) + (13 X 200 for wells in the fourth year) + (13 X 150 for wells in the fifth year) + (15 X 100 for wells in the sixth and succeeding years). The projected disposal rate for Anadarko's three wells would be 30,000 BWPD. Therefore, the proposed water disposal capacity of 30,000 BWPD would exceed the projected daily maximum water production rate (17,750 BWPD) by 12,250 BWPD.

As described previously, emergency pits would be constructed and connected to each disposal well. If a disposal well fails and has to be shut down for repairs, the companies would use these pits for the short-term storage of produced water that would normally be sent to the disposal well. If the company cannot repair

its disposal well before the emergency pit reaches capacity, pumps at the gas wells that are sending produced water to the emergency pit would be shut down until the disposal well is repaired. Once the disposal well is repaired, any water in the emergency pit would be pumped to the well for disposal. Emergency pits would not be used for permanent disposal of produced water.

The sizes and number of the emergency pits would vary by company. Most pits would range in size from 30 feet by 50 feet by 10 feet (capacity = 2,500 barrels of water) to 115 feet by 115 feet by 8 feet (capacity = 18,850 barrels of water). Disposal wells in the South Area would have an emergency pit associated with each of them on the CPF. However, in the North Area, one large emergency pit (capacity > 266,000 barrels of water) would service all three disposal wells. Specific differences among the Companies' proposals for emergency pits are discussed later in this chapter.

#### 2.1.1.1.3.6 Compression

Presently, the Companies propose to use natural gas fired compressors at all locations. As development of the Project Area matures, the use of natural gas fired compressors may diminish and selected units may be replaced with electric-powered compressors. Because the likelihood and extent of this replacement are unknown, the impact analysis documented in this EIS assumed all compressors would be fired by natural gas.

The Companies would construct and operate seven new CPFs and three new compressor stations within the Project Area and one new compressor outside the Project Area on private land (**Plate 2–1**). Chandler has proposed three CPFs in the South Area. Two would be rated at 2,200 HP and one at 850 HP. Texaco has proposed three new CPFs in the South Area with all three rated at 4,000 HP. Anadarko has proposed one CPF and three compressor stations within the North Area with two 1,700 HP units at each location. One CPF and all three compressor stations would be within the Project Area and the second CPF would be located south of the North Area on private land. Anadarko's one existing compressor, rated at 1,015 HP, is operating in the North Area (on State land) and would be upgraded to 3,400 HP. This compression capacity would be sufficient to accommodate the volume of natural gas expected from the wells operating in the Project Area.

Amine units and Glycol Dehydration units would also be installed at each compressor site. The function of the amine units is to reduce the quantity of carbon dioxide in the gas stream to the levels that must be attained for transport to the Questar transmission pipeline for commercial sale. Dehydration units would be used to reduce the water in the gas stream to likewise acceptable levels for commercial transportation. Anadarko would install amine units and dehydrators at each of their proposed compressor stations. Both units would accommodate a design flow rate of 15 million cubic feet of natural gas per day (MMcfd). Chandler would install the units at each of their two proposed compressors with the capability to process 10 MMcfd. Texaco would install units with the capability to process 15 MMcfd at each of their three proposed compressor stations. Both amine and dehydration units are discussed in more detail in **Section 4.3**.

#### 2.1.1.1.3.7 Chemical Use

Under the Proposed Action, the Companies would use a variety of chemicals, including solvents, lubricants, paints, and additives. The chemicals the Companies may produce, use, store, transport, or dispose of as a result of the project are identified and discussed in the Hazardous Substances Management Plan, which is included as **Appendix B** of this EIS. The Plan also identifies which substances are considered hazardous or extremely hazardous.

#### 2.1.1.1.3.8 Waste Sources and Controls

A variety of waste, including drilling solids, steel drums, waste oils, spent oil filters, waste parts, cleaning solvents, spent water filters, waste triethylene glycol, and spent glycol filters would be produced during the drilling and production phase. All wastes described in this section would be recycled or disposed of in accordance with applicable current laws and regulations.

Solids or cuttings would be produced during the drilling stage. The cuttings are the bits of rock produced by the drill bit cutting through the drilled interval. The solids would be buried in the drilling pit after fluids, such as water, treatment fluids, and frac fluids, have evaporated or been pumped into trucks and transported to approved disposal facilities.

Emptied steel and plastic drums that had contained materials such as caustic soda, citric acid, lubricating oil, methanol, and drilling additives would require appropriate disposal or recycling. Empty metal or plastic drums would be returned to the supplier of the product. The Companies may rent drums from the suppliers and should be able to return the drums to the suppliers for refills.

Waste lubricating oil generated at the compressor stations and production sites would be disposed of by a contractor. Some fluids would be generated at compressor stations during pipeline cleaning operations, referred to as pigging. This fluid would be stored in a 50 gallon sump tank. The contents of the tank would be removed by a contractor using a vacuum truck and would then be transported to a permitted disposal/ recycling site.

Each compressor station would create an additional oil waste product through the bypass system. This waste would be a combination of about 90 percent water and 10 percent light hydrocarbons. This compressor bypass fluid would be piped to the 50-barrel sump tanks as discussed above.

Solid wastes generated at the compressor stations would include spent gas filters and cleaning rags that would be handled as general trash and sent to the regional landfill. Spent oil filters from the compressor lubrication systems would be removed and disposed of in an approved disposal facility.

Several waste streams would be generated from the triethylene glycol dehydration line at the compressor stations. The dehydration units remove water from the gas stream by contacting the gas with triethylene glycol. The glycol would be regenerated through the application of heat. The water would be "boiled off" and released as steam.

As necessary, triethylene glycol and amine fluids would be replaced due to the excessive accumulation of contaminants. An approved contractor would remove the spent glycol or amine fluids and replace fresh triethylene glycol or amine fluids in the system. On occasion, the Companies may remove the spent glycol or amine fluids and temporarily store the glycol or amine fluids in drums. This glycol and amine fluids would also be removed by an approved contractor.

In addition to the spent glycol, spent sock and charcoal filters would also be used in the dehydration process. These filters would be changed approximately every other month and the spent filters would be placed in general trash for disposal.

Sanitary wastes would be collected in portable toilets located on well pads during drilling and completion. These toilets would be pumped by the contractor regularly. When drilling and completion of the well are finished, the toilets would be removed by the contractor.

Construction materials and trash would be transported to approved disposal areas. General trash would be collected in covered containers and periodically transported to approved disposal areas.

#### *2.1.1.1.4 Decommissioning/Reclamation Phase*

The Proposed Action assumes each well would produce during its approximate 20-year economic lifetime. The reclamation of dry holes would follow the procedures described below with the exception that reclamation would begin as soon as possible after the determination is made that the well would not be an economic producing well. The following briefly describes the procedures that would be addressed to reclaim the disturbance to as near as possible to pre-development conditions.

##### 2.1.1.1.4.1 Roads

Access roads would be reclaimed by plowing and seeding unless the landowner and/or land manager wishes to make use of any roads and accepts responsibility through execution of a release for future road maintenance. Roads not needed for further use would be blocked, recontoured, reclaimed and vegetated consistent with the requirements of the federal land managers (according to Onshore Oil and Gas Order No. 1, Approval of Operations) and SITLA. On private lands, the Companies would execute release of the road to the landowner or reclaim it according to the terms of surface use agreements that may be in effect at that time.

All road disturbance would be reseeded with a seed mixture authorized by the Approval Officer, as described in the Reclamation Plan (**Appendix A**). The seed mixture would be planted in the amounts specified in pounds of pure live seed per acre. All seed would be certified as weed free. Seed would be tested in accordance with state laws and within 12 months prior to purchase. Commercial seed would be either certified or registered seed. Seeding and/or planting would be repeated until satisfactory revegetation is accomplished.

##### 2.1.1.1.4.2 Wells

All surface facilities would be removed. Depleted production holes would be plugged and abandoned in accordance with Onshore Oil and Gas Order No. 2 and UDOGM rules. Once the well is conditioned as a static column, the well would be decommissioned by placing redundant plugs, a slurry of cement and water, at strategic locations in the well bore. These locations would be based upon each well's configuration, but would be placed to prevent the migration of fluids up the well bore or any uncemented paths. A mixture of bentonite and water would be placed between the cement plugs. Well pads would be recontoured, plowed and seeded consistent with the procedures described in the Reclamation Plan (**Appendix A**).

##### 2.1.1.1.4.3 Gas and Water Pipelines

The procedures for decommissioning and reclaiming pipelines depend on whether the pipeline is underground or aboveground. Underground pipelines would be cleaned, disconnected, and then abandoned in place to avoid any extra surface disturbance as noted in the Reclamation Plan (**Appendix A**). Aboveground pipelines would be cleaned, disconnected, and removed. Any surface disturbances associated

with each aboveground pipeline's removal would be recontoured to approximate the original contours, seeded, and mulched using procedures described in the Reclamation Plan (**Appendix A**).

#### 2.1.1.1.4.4 Electric Utilities

Underground electric lines would be disconnected and abandoned in place to avoid any extra surface disturbance. Above ground lines would be disconnected and the power poles would be removed from the sites. Surface disturbance associated with the removal would be reclaimed according to the Reclamation Plan (**Appendix A**).

#### 2.1.1.1.4.5 Produced Water Disposal

##### 2.1.1.1.4.5.1 Disposal Wells

Disposal wells would be abandoned and reclaimed in the same manner as production wells.

#### 2.1.1.1.4.6 Central Production Facility

Underground pipelines leading to the CPF would be cleaned, disconnected, plugged, and abandoned in place. All aboveground facilities and equipment, including the compressor, amine, and dehydration units and buildings, would be disassembled and removed from the site. The CPF would be recontoured as close as possible to original conditions. Reseeding would then be conducted using the methods described in the Reclamation Plan (**Appendix A**).

### *2.1.1.1.5 Safety/Emergency Response*

This section describes the methods that the Companies would employ to ensure a safe operation of the natural gas wells during development and production. It also describes how the Companies would respond to emergency situations.

#### 2.1.1.1.5.1 Geologic Hazards

During drilling operations, abnormally-high pressure (blowouts) could occur. However, more than 100 CBM wells have been drilled in the Price area with only two instances of abnormally-high pressure. All wells drilled would be required to have Blowout Prevention Equipment (BOPE) installed to control any abnormal pressures encountered. Blowouts are considered highly unlikely because of the BOPE, shallow well depths, normal formation pressures, and past experience in the Ferron Sandstone Member.

$H_2S$ has not been encountered to date during drilling in any of the more than 100 CBM wells drilled in the Price area. However, $H_2S$ has been detected in produced water from some of the CBM wells in small amounts (80 to 90 ppm below the minimum level of 100 ppm at which it is regulated under Onshore Order No. 6). Solution $H_2S$ was also recently encountered in the drilling of a disposal well to a depth of approximately 6,000 feet into the Navajo Formation. As a result, the Companies would prepare an $H_2S$ contingency plan in accordance with UDOGM's requirements.

#### 2.1.1.1.5.2 Fires and Explosions

The potential for gas flowline or pipeline leaks or ruptures would exist. Most ruptures are the result of heavy equipment accidentally striking the pipeline while operating in close proximity. Such ruptures could result in an explosion and/or fire if a spark or open flame would ignite the escaping gas. Pipeline design and materials would be conducted in accordance with applicable standards to minimize the potential of a leak or rupture. Frequent signing along the pipelines would reduce the risk of accidental ruptures from excavating equipment. Additionally, the Companies would monitor the pipeline flow by either remote sensors or daily inspections of the flow meters. This would reduce the probability of ruptures by prompt detection of leaks.

Well fires are very rare, but could occur under certain conditions. For the reasons listed in the previous sections, the probability of a blowout is very low. However, if a fire would occur, the Companies would contract one of the several companies specializing in controlling well fires as part of their Emergency Plan.

#### 2.1.1.1.5.3 Public Safety

The Companies would take measures to protect the public from hazards at well facilities. All CPFs would be fenced. Pumping units would have guard railing to prevent people and large animals from being injured by moving parts according to the Occupational Safety and Health Administration (OSHA) regulations and the Authorized Officer. Warning signs would be placed around all facilities.

#### 2.1.1.1.5.4 Employee Safety

The Companies would develop Emergency Plans that would cover all potential emergencies to include fires, employee injuries, chemical releases, and $H_2S$ releases, among others. The Plans would include phone numbers for all medical and emergency services, and the people to contact in event of emergency situations. The Plans would be posted at all local Company offices and field facilities. All employees and subcontractors would be trained on matters concerning the Emergency Plan when they would be hired, and refresher courses would be presented annually.

In addition, the Companies would not allow firearms to be brought into the area by on-duty employees and contractors. They also would train employees and provide written notification to contractors not to harass local wildlife.

### 2.1.1.2 Company Breakdown of Proposed Well field Development

This section describes the features of the Proposed Action that would be specific to each Company involved in the Proposed Action. The general methods of well field development, production, and reclamation are generally the same for all three companies. The major differences would be the amount of development and the type of facilities to be constructed.

#### *2.1.1.2.1 Anadarko*

Anadarko would develop wells in the North Area only. Anadarko's Proposed Action is to develop 65 new natural gas wells during the first five years of the project. Anadarko is proposing well pads with an areal extent of 200 feet by 300 feet or 1.37 acres. They are also proposing to build five new gas compressors and two new disposal wells. Anadarko has no plans to install a remote monitoring system. As a result, Anadarko would inspect all wells and facilities on a daily basis.

As mentioned previously, Anadarko plans to use a single large pit for storing produced water when one or more disposal wells may not be operating. All of Anadarko's disposal wells would be connected to this emergency pit so produced water could be routed to it if needed. This pit in T14S R10E Section 3, which was originally constructed as an evaporation pond, encompasses about 3.7 acres (400 feet wide by 400 feet long by 10 feet deep). The pit's overall capacity exceeds 266,000 barrels of water.

As with the other companies, if Anadarko cannot repair its disposal well or wells before the emergency pit reaches capacity, pumps at the gas wells that are sending produced water to the emergency pit would be shut down until the disposal well is repaired. Once the disposal well is repaired, any water in the emergency pit would be pumped to the well for disposal.

For development wells in an area with existing infrastructure, the following is Anadarko's typical testing scenario. After wells are fractured and stimulated, water would be pumped/flowed to the reserve pit for approximately 30 days. During the first two weeks of this period, typically only water would be produced. Over the next two weeks, as the fluid level in the wellbore is reduced, the production of gas slowly would increase from ten thousand cubic feet per day (Mcfd) up to 100 Mcfd on average. In most cases, a gathering system would be installed within this 30 day period and the gas would no longer be vented. Water may continue to be pumped to a pit until a water gathering system is installed and/or volumes are reduced. If the volume of water present in the pit approaches the reserve pit's capacity, Anadarko would pump the water into a truck for transport to and disposal in a disposal well.

For remote wells (step out or exploratory) where infrastructure is not in place, a longer testing period is required to determine the well's economic potential. The same process as described above would occur, but typically would require up to 90 days to evaluate the capacity of the well. Venting and flaring beyond 30 days would require approval per NTL 4–A and UDOGM Permit to flare gas. The longer period of time would be required to determine if the gas recovery rates will justify the expenditures needed for the project to be viable.

The above information is an average for a typical completion. However, the average time may vary depending on well performance and other factors such as weather, equipment availability, etc.

#### 2.1.1.2.2 Texaco

Texaco would develop wells in the South Area only. Texaco's Proposed Action is to develop 137 new natural gas wells during the first five years of the project. Texaco is proposing to build wells with pads that would be 225 feet by 200 feet or 1.03 acres in size. Texaco would also install four compressors and four disposal wells. Texaco is planning to install a remote monitoring system for its well field. As a result, they may inspect all wells and facilities on an approximate weekly basis. However, daily visits to wells and facilities may be required to maintain an efficient and safe operation.

#### 2.1.1.2.3 Chandler

Chandler would develop wells in the South Area only. Chandler's Proposed Action is to develop 87 new natural gas wells during the first five years of the project. Chandler is proposing 300 feet by 160 feet (1.1 acres) well pads, three compressors, and four disposal wells. Like Anadarko, Chandler has no plans to install a remote monitoring system. As a result, Chandler proposes to inspect all wells and facilities on a daily basis.

Additionally, Chandler has applied to unitize a portion of the South Area under regulations contained in 43 CFR 3180 — Onshore Oil and Gas Unit Agreements. Unitization provides for the exploration, development, and operation of a geologically defined area by a single operator so that drilling and production may proceed in the most efficient and economical manner. A unit agreement is an agreement approved by the Authorized Officer of the BLM, submitted by an operator on behalf of the owners of oil and gas interests over a potential oil or gas reservoir who wish to unite with each other to facilitate the orderly and timely development of the oil and gas resources within the unit area. **Figure 2–6** shows the location of Chandler's proposed unit.

Approval of the unit agreement does not, in itself, authorize any on-the-ground activities. All such activities are permitted on a case-by-case basis through this EIS and the Application for Permit to Drill (APD) and Sundry Notice processes (see 43 CFR Part 3160 and the Oil and Gas Onshore Orders). Unitization serves the public interest in that it promotes the exploration of unproven acreage and permits the BLM to exercise more effective control over drilling activity in a large area.

## 2.1.2 Transmission Pipeline

Questar proposes to build a transmission pipeline in the Project Area. This pipeline would extend a pipeline that was considered in the Price Coalbed Methane Project (now referred to as Jurisdictional Lateral #102 [JL102]) approximately 27 miles. The new 20-inch diameter pipeline would start in Section 26, Township 16 South, Range 9 East, about 5 miles northeast of Huntington and extend southwest terminating in Section 15, Township 20 South, Range 7 East. It would follow Questar's existing pipeline (JL44) for the entire route. The proposed pipeline location is shown on **Plate 2–1**. The pipeline would require a 50-foot permanent ROW width and a 30-foot wide temporary use area (**Figure 2–7**). All construction activities would occur inside the limits of the ROW and temporary use areas. The life of the pipeline is projected to be 50 years. The projected life may vary as it depends on natural gas demand. The pipeline would be abandoned in place after the termination of its viable life.

Questar's internal pipeline construction standards would apply. All facilities would be constructed in accordance with the Department of Transportation regulations described in 49 CFR Part 192. The pipeline would be designed, constructed, and operated in compliance with the Occupational Safety and Health Act. The pipeline would consist of 20-inch outside diameter (OD) steel pipe with a 0.25-inch wall thickness and manufactured from American Petroleum Institute 5L–X52 steel. The pipe would have an external anti-corrosion coating of 12 to 14 millimeters applied at a coating facility under controlled conditions.

### 2.1.2.1 Construction Phase

The pipeline would be constructed in a single spread consisting of equipment and crews handling various phases of construction activities along the route. Construction of the pipeline would generally follow standard pipeline construction methods. Prior to construction, the centerline and the exterior ROW boundaries would be staked and left marked for the duration of construction. The pipeline would be buried with a minimum cover of 40 inches, except where bedrock is encountered at a lesser depth. Where bedrock is found, the pipe would be buried with a minimum cover of 24 inches.

Installation of the pipeline would be modified somewhat at crossings of streams, such as Huntington and Cottonwood creeks, and dry washes. The basic methods (trenching) used would remain unchanged. However, the depth of the pipeline would be increased. At both live streams and dry washes, the pipeline would be buried eight feet below the bed of the stream or wash. Additionally, material excavated from the beds of live streams would be stored on the streambanks and used as backfill. Construction of the crossings

would be timed to minimize the time the trench is open, minimize concurrence with high flows, and minimize effects on aquatic species.

#### 2.1.2.1.1 ROW Clearing and Excavation

On lands supporting shrub-type vegetation cover (e.g. sagebrush, salt bush), the ROW would be cleared by "scalping" off the tops of brush plants with a motor grader or a bulldozer. Vegetation cover types such as grasses or other low growth vegetation would not be cleared except in areas directly over the trench or where grading would be required. Brush and rocks cleared from the ROW would be windrowed or piled on one side of the ROW for later use in reclamation. The ROW would then be leveled. In areas where rugged topography with steep side slopes cannot be avoided, a level working pad would be cut from the hillside with a bulldozer (see **Figure 2–8)**.

After the ROW would be cleared, ditching would be conducted with a wheel ditcher, saw trencher or backhoe. Topsoil material would be salvaged along areas specified by either the land managing agency or the landowner where it can be saved.

During construction of access roadways, Questar would comply with all crossing requirements of the state or county where the road is located. Roadways would be bored or open cut, depending on the determination of the jurisdictional agency. Typically, dirt or gravel surfaced roads would be open cut and the pipeline crossing completed within one day. Crossings at heavily traveled roads would likely be made by horizontal boring at a minimum depth of 5.5 feet beneath the road surface.

In areas where surface or subsurface rock is unrippable, blasting for grade or ditch excavation would be necessary. A blasting plan would be submitted for approval prior to blasting activities.

In applicable areas, care would be taken to prevent damage to underground structures (cables, conduits, pipelines) or to springs, water wells or other water resources. Blasting mats or soil cover would be used on all blasts to prevent the scattering of loose rock. Landowners or tenants in close proximity to the blasting would be notified in advance. Before blasting, the affected area would be checked to ensure that all people are out of the blasting danger area. Where blasting would occur adjacent to roads, flagmen would be stationed to control traffic and protect people. Blasting would not occur within ¼ mile of live springs, water wells or reservoirs without prior approval from the authorized agency.

#### 2.1.2.1.2 Pipe Insertion and Testing

After ditching is complete, the pipe sections would be strung along the trench, bent to fit the contour of the trench, aligned, welded together, inspected, coated, and placed on temporary supports along the edge of the trench. The pipe assembly would then be lowered in to the trench by side-boom tractors and backfilled. After backfilling, the pipeline will be either hydrostatically tested or gas tested to verify the integrity of the pipeline. If water is used, test segments will be determined by topography and water availability. Questar probably would purchase water for hydrostatic testing from local water users. After testing a segment, the water may be pumped into the next test segment. However, all water used for hydrostatic testing would ultimately be disposed of in accordance with applicable regulations.

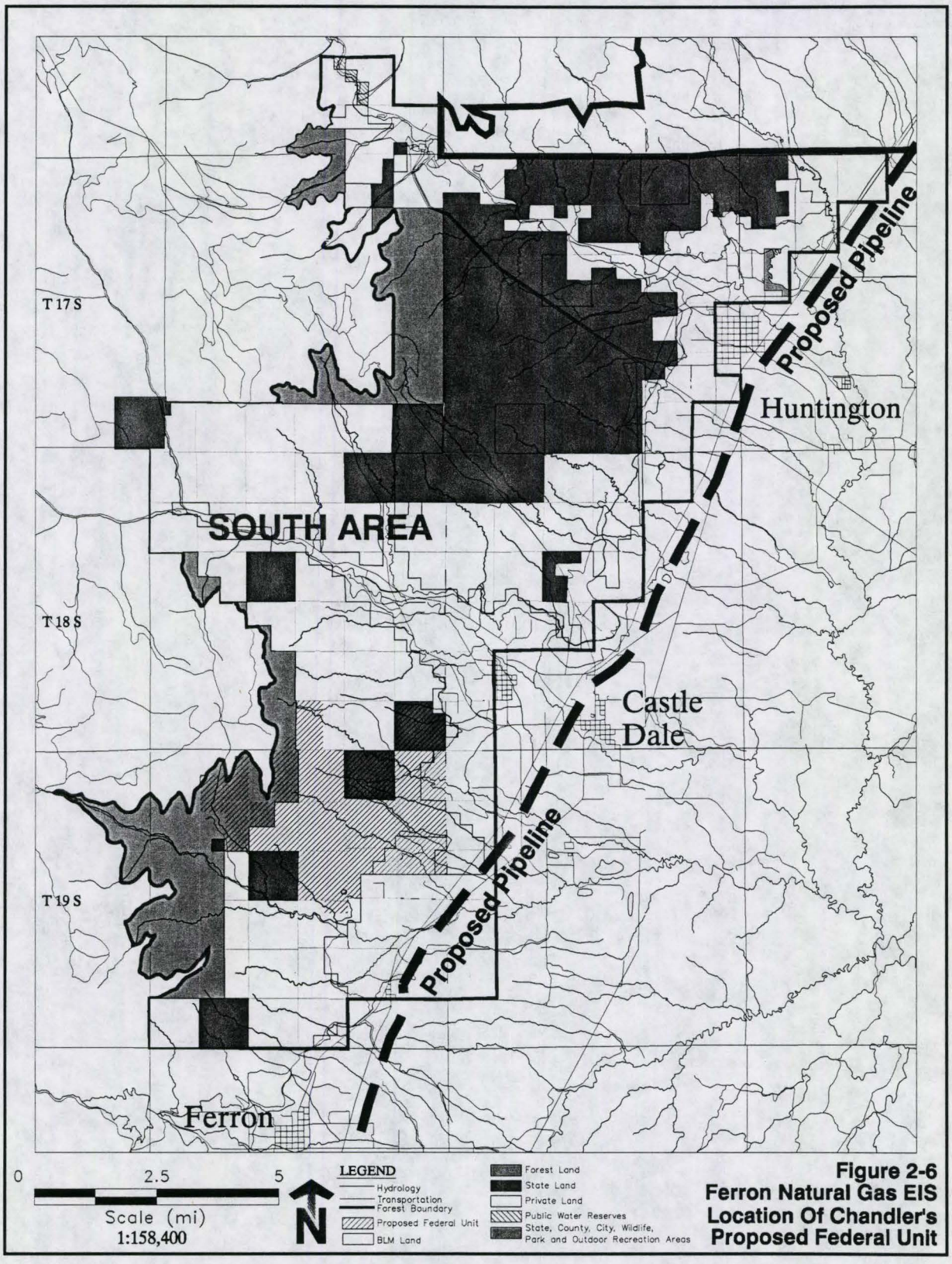



**Figure 2-6**
**Ferron Natural Gas EIS**
**Location Of Chandler's Proposed Federal Unit**

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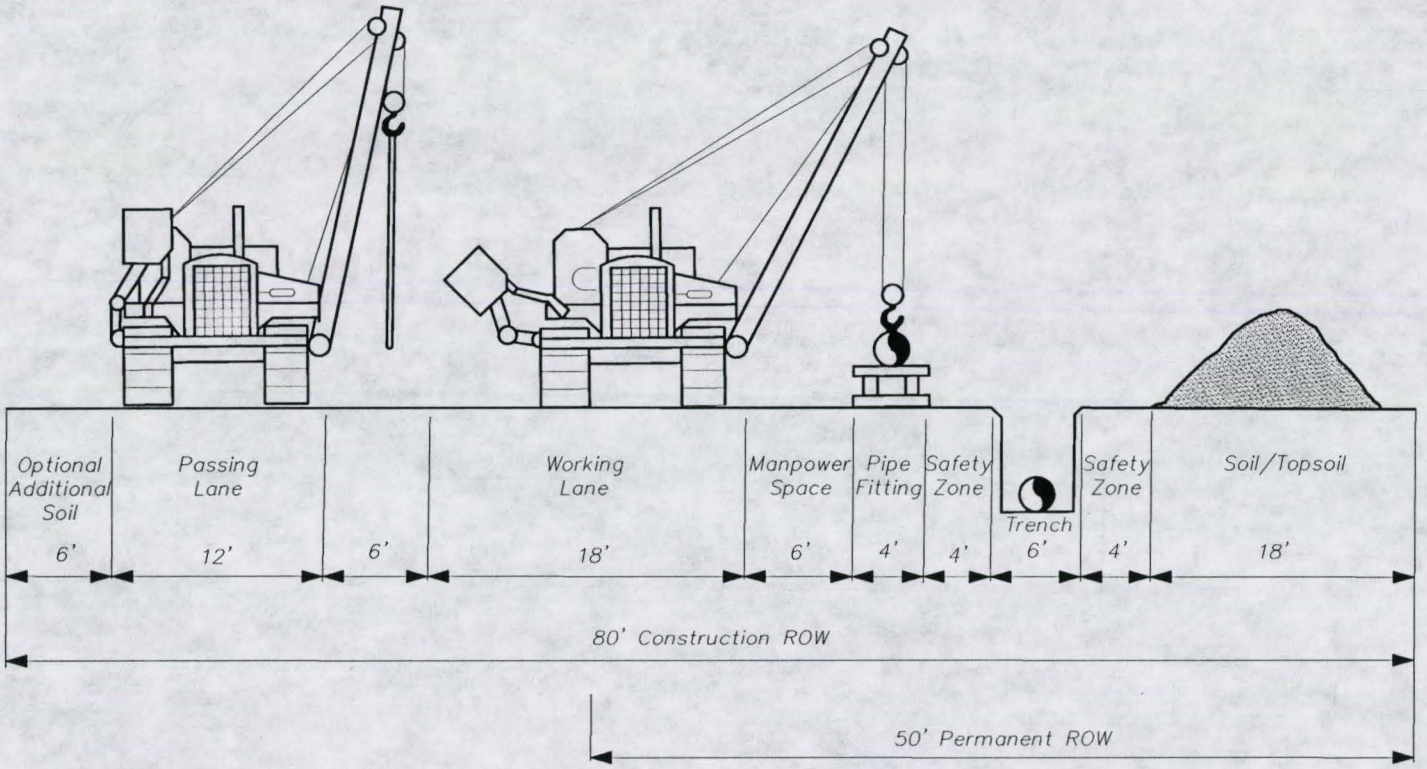
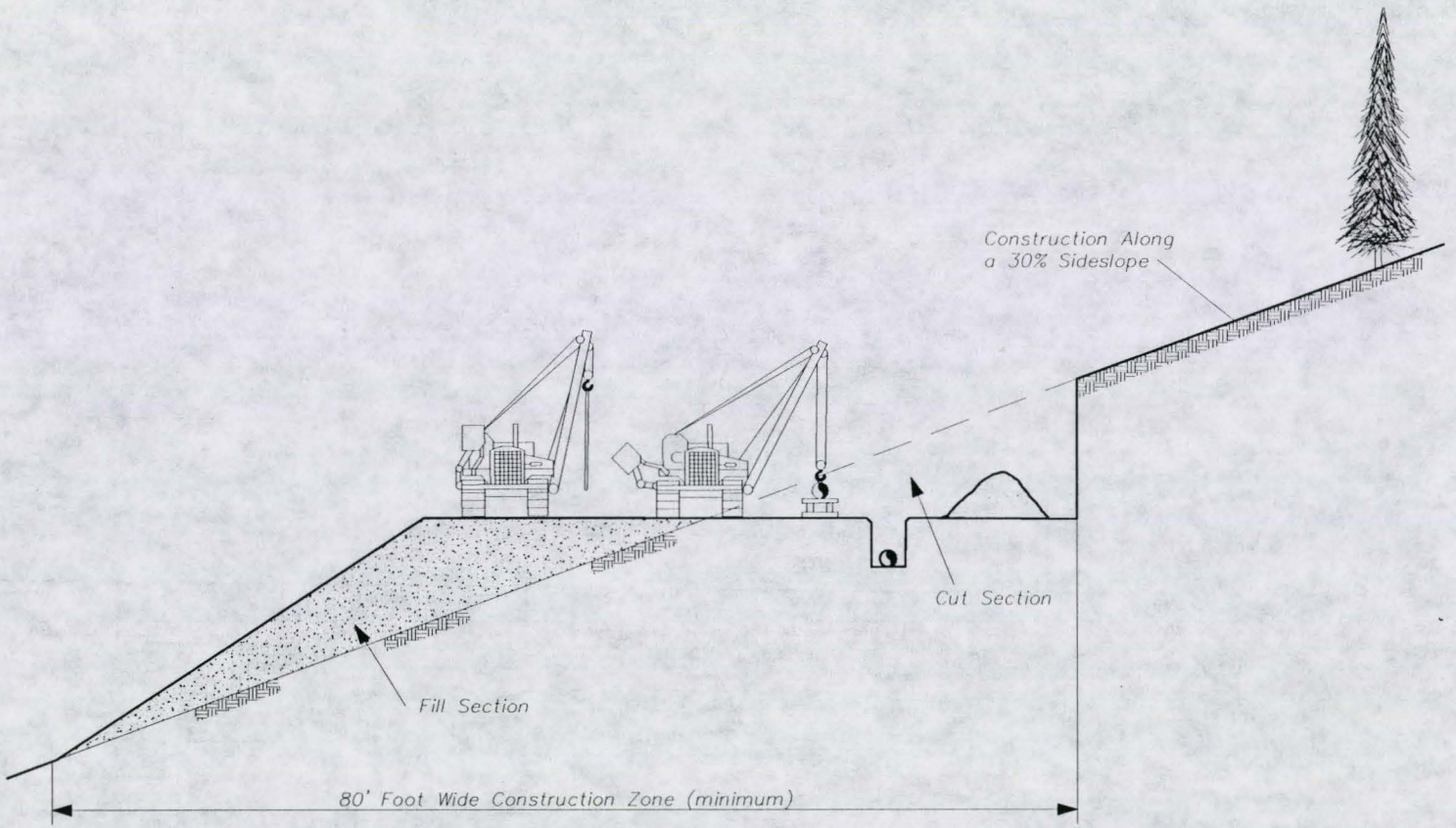



**Figure 2-7**
Transmission Pipeline ROW
Typical Cross-Section

Not To Scale




Not To Scale

**Figure 2-8**
Transmission Pipeline ROW
Typical Slope Construction

#### 2.1.2.1.3 Work Force

The work force is anticipated to include 75 people. The pipeline construction crews would include equipment operators, welders and laborers. Questar anticipates that approximately 25 percent of the total work force would be made up of people from Carbon and Emery counties. The remaining work force would be from various parts of the country.

#### 2.1.2.1.4 Cleanup and Reclamation

Following the backfilling operation, cleanup and reclamation of the ROW would be accomplished. The backfilling would be completed using the spoil previously excavated from the ditch. The topsoil would then be redistributed back over the ROW. The ditch would be compacted as much as possible over the pipe during backfilling. The disturbed surface would be graded and restored, as near as practicable, to the original contour of the land. Restoration would include moving fill material back into the sidehill cuts that were made during construction.

Water diversions would be constructed as needed to control surface water and erosion. To accomplish this, waterbars would be constructed on a contour across disturbed areas. All such structures would be built to simulate the imaginary contour lines on the slope, and to drain away from the disturbed area and continue across the ROW so that water is carried onto adjacent vegetation. Waterbars would be constructed at the following general spacing intervals:

| Grade (percent) | Spacing (feet) |
|---|---|
| 5–15 | 300 |
| 16–30 | 200 |
| >30 | 100 |

Vegetation and rocks would not be permanently windrowed along the edge of the ROW. Brush and other woody material cleared from the ROW would be randomly scattered over the ROW and temporary use areas. Rocks cleared from the ROW would be buried either on the ROW, used to construct rimrock, strategically placed as barricades across the ROW to deter use as a road, or randomly scattered across the ROW as directed by the applicable land manager. The density of surface rocks would be comparable with adjacent disturbed land.

Restoration of washes would entail removing all debris from the stream bed and restoring the banks as nearly as possible to the original contour. Surplus soil would be spread on the ROW adjacent to the crossing.

Disturbed areas would be reseeded with a seed mix prescribed by the permitting agency. There would be no noxious weeds in the mixture. Seed would be tested in accordance with applicable regulations. Commercial seed would be certified and used within 12 months of testing to assure seed viability. The seed mixture container would be tagged in accordance with state laws.

Compacted soil conditions would be relieved before seeding. Seed would be applied by a range type drill or like service. The seed would be drilled in rows up to a maximum of 4 to 10 inches apart and at a depth of not less than ½ inch or more than one inch. If broadcast or hydro seeding methods would be used, seeding rates would be doubled. Seeding would be repeated in two growing seasons if a satisfactory stand is not established as determined by the BLM. Approved mulch application would be used in sensitive areas if

required to control erosion. The type and application of mulching materials would be determined by the site inspection and consultation with the BLM.

### 2.1.2.2 Operation Phase

After the transmission pipeline is tested and commissioned, the Companies would connect the high-pressure gas pipelines (4 to 10 inches OD) from their CPFs Questar's transmission pipeline. Questar would require that the gas would arrive at the metering building at a pressure sufficient to transport the gas. The connections would be housed in a small metering building. Equipment would be installed in the building to measure the volume, quality, temperature and pressure of the gas arriving from the central processing facilities. These fully automated measurements would be continuously transmitted via microwave signal to Questar's field office in Price and to the Questar's headquarters in Salt Lake City. Thus, the telemetered readings would permit Questar to continuously monitor the pressure of the gas stream. Any deviations from operational standards that may include potential leaks in the system would be detected in a timely fashion. At that point, Questar would be able to quickly isolate any problems and quickly take corrective actions.

### 2.1.2.3 Decommissioning/Reclamation Phase

The life of the pipeline is projected to be 50 years, depending on the demand for natural gas. The pipeline would be abandoned at the end of its viable life. Reclamation, described in the Construction Phase section, would begin as soon as possible after the pipeline is commissioned. The pipeline would be purged, cleaned, sealed and secured as described in the Reclamation Plan (**Appendix A**). The line would be abandoned in place, but all aboveground facilities would be removed. All disturbed areas would be rehabilitated, to the extent possible, to their pre-construction condition. Abandonment would result in the reversion of the ROW back to private landowners or the managing agency.

## 2.2 ALTERNATIVE 2 — PROPOSED ACTION WITH ADDITIONAL ENVIRONMENTAL PROTECTION MEASURES

This alternative was developed in response to issues raised during the public and agency scoping process. This alternative would incorporate the same construction and operational components as the Proposed Action with additional environmental protection measures applied to those actions taking place on federal lands. None of the environmental protection measures described in this alternative would disallow lawful access to develop a lease, but they may require relocation of well pads, roads, or ancillary facilities within the lease, restrict development during certain periods of the year, or require special construction and operational methods to reduce potential environmental impacts. The additional measures included in this alternative are listed below.

**Water Resources**

- Avoid surface disturbance within 330 feet of the centerline or within a designated 100-year floodplain of perennial streams.
- Avoid surface disturbance within 660 feet of springs, whether flowing or not.
- Avoid blasting or geophysical drilling within 0.25 mile of a spring or water well.

**Soils**

- Avoid construction on frozen or saturated soils. The Authorized Officer (BLM or FS) will determine what is wet, muddy, or frozen based on weather and field conditions at the time. This does not apply to maintenance of existing roads and wells.

- Exclude road and pad construction on slopes in excess of 25 percent. Pipeline construction on slopes in excess of 25 percent would be determined on a site-specific basis.

- On critical soils, avoid construction on slopes greater than 6 percent. Where construction cannot be avoided, operations and facilities will be located to reduce erosion and improve the opportunity for revegetation.

- New roads will be constructed to avoid critical soil areas, where possible. Where roads must be allowed, new roads will be constructed in accordance with agency-specified design standards to minimize watershed damage.

- On critical soils, avoid road grades greater than 10 percent. The Authorized Officer (BLM or FS) may allow grades in excess of 10 percent with a maximum length of 1,000 feet. No road grades in excess of 15 percent will be allowed.

- On critical soils, pipelines will avoid slopes in excess of 15 percent.

**Vegetation**

- In accordance with a weed control plan developed for this project (**Appendix C**), treat and control noxious weed infestations within 100 feet of disturbed areas associated with well sites and facilities and roads or rights-of-way constructed or improved by the Companies, to the extent the infestation is caused by the Companies.

**Wetlands/Riparian**

- Avoid construction, development, and rights-of-way within 220 feet of the boundary of riparian areas. Where these areas must be disturbed, minimize impacts and perform post-disturbance reclamation.

**Reclamation**

- All project roads designated for reclamation (or partial reclamation) and all well sites, facility sites, and pipelines shall be reclaimed (recontoured and reseeded) in the fall season or at a period specified by the Authorized Officer.

- Disturbed areas will be restored to approximately the original contour.

- Reclamation on sites with critical soils will be graded using slopes of 5 percent or less where feasible and grading the site so as to collect water for revegetation. Site-specific evaluation by the surface managing agency may allow for modification to this standard.

**Wildlife**

- Selected roads in big game winter range habitats shall be gated and signed. The gates shall be locked during the critical period for wildlife (December 1 to April 15). The gate locations shall be determined by the Authorized Officer for the BLM in consultation with Emery or Carbon counties. A cooperative agreement will be developed to detail maintenance responsibilities, design of gates, and contingency methods for excessive vandalism to the gates. The BLM shall provide the verbiage for the signs, which shall explain the reasons for the seasonal closure and agencies participating in the closure shall be identified.

- In elk and mule deer winter range (crucial and high priority), exploration, drilling, and other development shall occur only during the period of April 16 to November 30. This shall not apply to maintenance and operation of producing wells. Exceptions to this limitation in any year shall be requested in writing to the Authorized Officer of the BLM or Forest Service.

- In elk and mule deer crucial winter range, all non-emergency workover operations, as defined in this EIS, shall occur only during the period April 16 to November 30. The proponent shall provide notice for all emergency work requiring use of heavy equipment during the winter period (December 1 to April 15). The notice shall be provided within five days of the work.

- Minimize the number of actual visits by personnel needed to monitor well operations.

- Reclamation on big game crucial winter range will include hand planting of seedling browse plants and use of seedling protectors.

- In order to provide winter range protection for mule deer and elk, avoidance areas would be created in big game wildlife corridors on Federal lands. The big game corridors (shown on **Plates 3–5** and **3–6**) include drainages and critical areas within winter range habitat. Under existing regulations (43 CFR 3101.1–2) and lease rights, BLM would relocate wells, roads, or facilities within the boundary of the proposed 160-acre legal subdivision of a lease to minimize surface disturbance and/or surface occupancy within the designated big game corridors. It is recognized that in some instances, wells, roads, and facilities would be located within the big game corridors. Evaluation of the need to relocate any facility would be conducted during the site-specific, on-site evaluation of a proposed well at the time an APD is submitted. BLM shall not identify relocation of facilities that would result in a well being situated off the lease or outside the 160-acre legal subdivision. BLM would not recommend relocating wells, roads, or facilities outside the corridors in those circumstances where useable roads already exist. With corroboration by BLM geologists, BLM would not recommend relocation of wells that would prevent the proponent from hitting a specific geologic target with regard to presence and alignment of known fault lines. Wells, roads, or facilities would not be relocated to a position that would be more environmentally damaging or exceed provisions of this EIS or appropriate land use plan. The Companies may choose to alter the location of wells adjacent to the big game corridor to achieve desired drainage of gas and water resources.

- To offset direct impacts to mule deer and elk, when disturbance exceeds 10 acres in elk or mule deer winter range (crucial and high priority), an equivalent acreage of adjacent habitat will be enhanced to accommodate increased use by the animals. The habitat enhancement will be completed commensurate with the surface disturbing activity. All costs associated with project planning through completion shall be the obligation of the lessee. To satisfy this mitigation provision of the governing land use plans, the companies and BLM have agreed to establish a Wildlife Habitat Mitigation Fund that includes provisions for monetary contributions of $1,301.26 (1998 dollars) per well on Federal surface/subsurface ownership

in big game crucial and high priority winter range. This mitigation fund would be used to complete habitat enhancement projects to directly benefit wildlife by being used within the herd unit affected. Administration of this fund, including objectives for habitat enhancement, would be formalized in an agreement developed between the proponents, BLM and the UDWR.

- Individual companies will attend yearly meetings with BLM to coordinate and organize APD processing for yearly drilling plans of the companies to assure that expected reworking of newly completed wells occurs before the winter closure period.

**Special-Status Species**

- Avoid temporary surface disturbance and occupancy (i.e., seismic lines and pipeline, power line, and project construction) within one-half mile of active raptor nests during the critical nesting period (February 1 to August 15). Site-specific evaluation in coordination with the USFWS and UDWR may allow for modifications. This mitigation does not apply to maintenance and operation of existing wells and access roads constructed prior to occupancy of the nest.

- Permanent surface disturbance and occupancy shall be prohibited within 0.5 mile of raptor nests that have been documented as occupied within the 3-year period proceeding construction. Site-specific evaluations in coordination with USFWS and UDWR may allow for modifications to this requirement.

- Permanent surface disturbance and occupancy shall be prohibited within 1.0 mile of peregrine falcon eyries. Section 7, Endangered Species Act consultation with USFWS shall be required for modifications to this requirement.

- Perform raptor surveys to determine the status of known nests and to verify the presence of additional nests for all federal leases within the Project Area. Surveys shall be conducted by consultants qualified to conduct such surveys and approved by the BLM's Authorized Officer. All surveys shall be conducted by helicopter during May of each year, prior to the proposed drilling and prior to APD approval. The surveys shall be done in the same year as the proposed drilling so the current nest activity status data are available. Costs for the survey and preparation of a report of the findings of the survey shall be borne by the lease holder. This survey could be conducted in cooperation with the annual raptor surveys conducted by other companies (coal and power) so that the companies may share costs.

- All APDs, Sundry Notices, and rights-of-way submitted for proposed wells and other surface-disturbing activities within Winkler cactus habitat shall be submitted before April 1 of any given year. This would allow the clearances for T & E plants at the optimum time. Any applications for surface-disturbing activities received after April 1 shall be held until the next year. On extremely dry years, the cactus does not surface or bloom and clearances shall be delayed until conditions are better, possibly until the next year.

- Avoid surface disturbance in special-status plant habitats. Site-specific evaluations or Section 7 Endangered Species Act consultation with the USFWS may allow for modifications to this requirement.

**Livestock Management**

- Any replacements , improvements, or additions of rangeland facilities shall meet BLM or Forest Service standards as applicable. [BLM Handbook H–1741–1 (fencing), BLM Manual Section 9100 (roads, reservoirs, dams, pipelines, cattle guards, gates, etc.), BLM Manual Section 9200 (Integrated and Chemical

Pest Management and Control), Forest Service Manual 2242.03, and BLM Price Field Office and Manti-La Sal National Forest policies.]

**Recreation**

- In the North Area, all existing recreational trails identified in the 1998 Carbon County Trails Plan that are disturbed by the Companies would be reclaimed to pre-development conditions upon abandonment of individual roads and locations. Reclamation of company-constructed roads throughout the Project Area would be determined by the Authorized Officer on a case-by-case basis in consultation with the County.

- The Companies and the BLM will complete an agreement to study the development of trails to offset recreational impacts in the Project Area.

**Visual Resources**

- Where topography permits, well sites would be positioned to prevent "sky lining".

- Existing vegetation and topographic features would be used to screen wells, facilities, and roads from the viewshed of Key Observation Points.

- To eliminate broadside views of pumping units, design well locations so the pumping units are situated "in line" with Key Observation Points.

- When installing chain link fences, use non-reflective materials to reduce visibility from a distance.

- Avoid straight line-of-sight bulldozing. Design roads through wooded areas shall to take a curvilinear path.

### 2.2.1 Primary Elements Comprising this Alternative

The primary elements comprising this alternative are very similar to those comprising Alternative 1 — Proposed Action. Also, the construction, operation, and decommissioning/reclamation phases would occur as described for Alternative 1. However, implementation of the environmental protection measures identified above would result in two primary differences from the facilities comprising Alternative 1. First, implementation of these measures would eliminate 14 wells from development in the South Area. To avoid conflicts with nests of raptors, Anadarko, Chandler, and Texaco would forgo development of four, eight, and four wells, respectively. Thus, the total number of new wells constructed under this alternative would be 335 (**Table 2–6**), instead of the 353 that would be developed under Alternative 1.

Second, the locations of many wells and roads proposed under Alternative 1 were moved for this alternative (**Plate 2–4**). These relocations were made in response to the environmental protection measure requiring avoidance of steep slopes (greater than 25 percent). As a result of these relocations, the overall total lengths of roads the Companies would construct would be slightly higher under this alternative, compared to Alternative 1 (**Table 2–6**).

The last element of Alternative 2 is an option for the use of electrical equipment instead of gas-fired compressors and pumps. Under Alternative 2, this option includes the installation of a network of underground and aboveground power lines. For analysis purposes, this network was estimated based on an

**Table 2–6**
**Alternative 2 Ferron Natural Gas Project Facilities**

| Facility | Company | | | Total[1] |
|---|---|---|---|---|
| | Anadarko | Chandler | Texaco | |
| **Number of Existing and New Wells** | | | | |
| *Existing on* | | | | |
| Federal lands | 7 | 5 | 18 | 30 |
| State lands | 8 | 4 | 6 | 18 |
| Private lands | 0 | 1 | 19 | 20 |
| Total | 15 | 10 | 43 | 68 |
| *Proposed on* | | | | |
| Federal lands | 42 | 36 | 34 | 112 |
| State lands | 9 | 27 | 64 | 100 |
| Private lands | 10 | 12 | 33 | 55 |
| Total | 61 | 75 | 131 | 267 |
| Total number of natural gas wells | 76 | 85 | 174 | 335 |
| **Lengths of Roads (miles)** | | | | |
| *Potentially upgraded[2] on* | | | | |
| Federal lands | 24.4 | 11.4 | 11.4 | 47.2 |
| State lands | 5.0 | 14.6 | 14.6 | 34.1 |
| Private lands | 1.8 | 10.4 | 10.4 | 22.7 |
| Total[1] | 31.2 | 36.4 | 36.4 | 104.0 |
| *Proposed new on* | | | | |
| Federal lands | 7.5 | 15.0 | 13.6 | 36.1 |
| State lands | 2.3 | 11.3 | 21.4 | 35.0 |
| Private lands | 2.5 | 3.3 | 6.7 | 12.5 |
| Total | 12.3 | 29.6 | 41.7 | 83.6 |
| Total lengths of upgraded or new roads | 43.5 | 66.0 | 78.1 | 187.6 |
| **Number of Disposal Wells** | 3 | 3 | 5 | 11 |
| **Compressors** | | | | |
| Existing Central Production Facilities[3] | 1 | 1 | 2 | 4 |
| Proposed Central Production Facilities[4] | 1 | 3 | 3 | 7 |
| Proposed Compressor Stations[4] | 3 | 0 | 0 | 3 |
| Total Horsepower | 20,400 | 5,250 | 12,000 | 37,650 |

Notes:
1. Totals may not match precisely with values obtained by adding unit numbers due to rounding conventions.
2. Both Texaco and Chandler would use the upgraded roads in the South Area. Therefore, the total lengths of upgraded roads in the South Area were split evenly between Chandler and Texaco.
3. Chandler and Texaco would decommission their existing CPFs once the proposed CPFs are on line. However, they would continue to use the disposal wells associated with the existing CPFs.
4. One amine unit and one dehydration unit would be installed at each facility or station.

analysis of soil characteristics from the soil survey used in this EIS. Areas where the depth to bedrock is more than 18 inches and no cobbly rock soils were selected as locations where power lines could be buried. In areas where depth to bedrock is less than 18 inches and cobbly soil conditions are present, it was determined that the environmental effects of excessive blasting would outweigh any benefits of burying electric lines.

The aboveground power lines would be constructed using tracked and wheeled equipment. A crew with a backhoe or a line-boom truck with an auger attachment would dig the holes where accessible from the ROW for access roads. The holes would be located as to not disturb existing sensitive vegetation and would be excavated to a depth of 8 to 10 feet. Poles would be transported to the construction site by truck where the structural components would be assembled on the ground and erected by a boom truck. In areas where vegetation, topography, or the presence of sensitive resources inhibits the use of conventional power line construction, the BLM may require the use of helicopters to set structural components and string the conductor.

Pole locations could be moved within the 10-foot wide ROW if topography and/or impacts to cultural, vegetative, or wildlife resources are identified at the site of the structure. In areas of thick vegetation and/or where vegetation may impede the performance of the active line, vegetation would be cleared by hand-held chainsaws or any other equipment needed to complete the job. Where areas of sensitive plant resources are known to occur, the BLM would be consulted before removal of any vegetation.

When the structures are in place, the conductor would be strung. A sock line would be laid along the route by a light vehicle or by hand. Ground crews would place the sock line in pulleys on each structure at the insulator location. The conductor would then be pulled up by pulleys through the insulator with the assistance of a reel truck, or by hand, before moving to the next pole location. At least two miles of conductor could be pulled into place in a single setup.

Underground power lines would be buried along access roads. These power lines would be installed in a ditch excavated within the access roads' 40-foot ROW on the side opposite the gas and produced water gathering pipelines (**Figure 2–1**). The power lines would be installed using the same general construction techniques used to install the pipelines.

Under Alternative 2's electrical equipment option, 97 miles of power lines would be installed aboveground on 1,704 poles (30 feet tall) spaced at approximately 300-foot intervals and 73 miles would be buried. The distribution of the lines is shown on **Plate 2–5**. **Table 2–7** shows the linear extent of the aboveground power lines, the number of poles required for each classification of land ownership, and the distribution of buried lines on each land ownership classification.

## 2.2.2 Workforce and Construction Resource Requirements

The requirements for constructing the facilities comprising this alternative would be very similar to those identified for Alternative 1. However, due to the 18 fewer wells the Companies would install under this alternative, requirements for a workforce and requirements for construction materials would be slightly less. Most of the active workforce involved in developing the Proposed Action would be involved in construction-related activities. After roads and well pads are constructed, pipelines and utility lines are installed, and wells are drilled and completed, minimal personnel would be required to operate the field. **Table 2–8** shows the estimated employment requirements for the construction, operation, and reclamation of the Ferron Natural Gas Project under Alternative 2.

Construction of Alternative 2 would require a variety of materials and equipment. The primary materials would be water, sand, and gravel. Additionally, small amounts of chemicals would be required. Equipment needed for construction would include heavy equipment (bulldozers, graders, track hoes, and front-end loaders) and heavy- and light-duty trucks.

**Table 2–7**
**Summary of Above Ground and Buried Power Lines for Alternative 2**

| | Land Ownership | | | |
|---|---|---|---|---|
| Facility/Area | BLM | State | Private | Total |
| Aboveground Power Lines | | | | |
| Miles of Power Lines | | | | |
| North Area | 6 | 3 | 2 | 11 |
| South Area | 23 | 47 | 16 | 86 |
| Total | 29 | 50 | 18 | 97 |
| Number of Poles | | | | |
| North Area | 113 | 48 | 28 | 189 |
| South Area | 412 | 821 | 282 | 1,515 |
| Total | 525 | 869 | 310 | 1,704 |
| Buried Power Lines | | | | |
| Miles of Power Lines | | | | |
| North Area | 20 | 7 | 2 | 29 |
| South Area | 26 | 8 | 10 | 44 |
| Total | 46 | 15 | 12 | 73 |

Water would be needed for constructing roads, well pads, and compressor stations. It also would be needed for drilling wells. Overall, the requirement for water to construct Alternative 2 is expected to be about 77 acre-feet (**Table 2–9**). This water would be purchased from local sources.

Sand and gravel would be required in the upgrading of at least parts of existing roads and the construction of new roads, well pads, and compressor facilities. Sand and gravel would be used to surface all newly-constructed roads in the collector and local classes to ensure a surface sufficient for year-round travel. The need for adding gravel to resource roads would be determined by the Authorized Officer or landowner on a case-by-case basis.

**Table 2–10** summarizes the estimated amount of sand and gravel needed if surfacing is required on all new roads, roads potentially requiring upgrading, well pads, and compressor facilities. Approximately four inches of sand and gravel would be applied where needed on roads and well pads. The Companies would purchase sand and gravel from local commercial sources.

All other construction, operation, and decommissioning/reclamation activities identified for the Proposed Action would occur under this alternative. The production of water and gas would be essentially the same as described for the Proposed Action. Additionally, Questar would construct, operate, and maintain the transmission pipeline as described under the Proposed Action.

## 2.3 ALTERNATIVE 3 — NO ACTION ALTERNATIVE

The No Action Alternative is required by NEPA for comparison to other alternatives analyzed in the EIS. For this project, the No Action Alternative would not authorize additional natural gas development on

**Table 2–8**
**Estimated Employment Requirements for Alternative 2**

| Work Category | Time Requirements | Number of Facilities | Personnel Required (# per day) | Workdays for Project | Workdays per Year | Average # of Workers per Day |
|---|---|---|---|---|---|---|
| ***Construction and Installation*** | | | | | | |
| Access Road | 4 days/mile | 84 miles | 4 | 1,344 | 269 | 1 |
| Well Pad | 2 days/site | 267 | 8 | 4,272 | 854 | 4 |
| Pipeline | 10 days/mile | 84 miles | 10 | 8,400 | 1,680 | 7 |
| Electrical Utility Lines[1] | 5 days/mile | 170 miles | 4 | 3,400 | 680 | 3 |
| Drilling and Casing | 4 days/well | 267 | 8 | 8,544 | 1,709 | 7 |
| Well Completion | 4 days/well | 267 | 20 | 21,360 | 4,272 | 18 |
| Well Production | 10 days/well | 267 | 16 | 42,720 | 8,544 | 36 |
| Compressor facilities | 90 days/site | 10 | 20 | 18,000 | 3,600 | 15 |
| New Disposal Wells | 40 days/well | 8 | 8 | 2,560 | 512 | 2 |
| Total | | | | 110,600 | 22,120 | 92 |
| ***Operation and Maintenance*** | | | | | | |
| Road/Pad Maintenance | 120 days/year | NA | 3 | 7,200 | 360 | 2 |
| Pumpers | 260 days/year | NA | 36 | 187,200 | 9,360 | 39 |
| Office | 260 days/year | NA | 2 | 10,400 | 520 | 2 |
| Well Workover | 5 days/well | 10/yr | 2 | 2,000 | 100 | 0 |
| Total | | | | 206,800 | 10,340 | 43 |
| ***Reclamation and Abandonment*** | | | | | | |
| Wells (gas and water) | 3 days/well pad | 344 | 4 | 4,128 | NA | |
| Roads | 4 days/mile | 84 | 4 | 1,344 | NA | |
| Compressor Dismantling | 30 days/facility | 14 | 20 | 8,400 | NA | |
| Reclamation | 5 days/facility | 14 | 4 | 280 | NA | |
| Total | | | | 14,152 | | |

Note:
1. Applies to the electrical equipment option only.

Federal leases within the Project Area. Drilling could continue on State and private leases and access and pipelines across Federal lands to reach such proposed State and fee wells would be granted as required by BLM policy. The Environmental Protections Measures outlined in Alternative 2 would apply to rights-of-way granted for access to State and private leases.

The Department of Interior's authority to implement a "No Action" alternative that precludes development by denying the process is, however, limited. An oil and gas lease grants the lessee the "right and privilege to drill for, mine, extract, remove and dispose of all oil and gas deposits" in the leased lands," subject to the terms and conditions incorporated in the lease (Form 3110–2). Because the Secretary of Interior has the authority and responsibility to protect the environment within Federal oil and gas leases, restrictions are imposed on the lease terms.

**Table 2–9**
**Summary of Water Requirements for the Alternative 2**

| Item | Amount (size) | Rate | Total (acre-feet) |
|---|---|---|---|
| Roads and pipelines | 84 miles | 0.36 acre-feet/mile | 30 |
| Well pads | 368 acres[1] | 0.023 acre-feet/acre | 8 |
| Central production facilities | 43.4 acres | 0.29 acre-feet/acre | 13 |
| Compressor facilities | 9.3 acres | 0.29 acre-feet/acre | 3 |
| Drilling and completion | | | |
| *Gas wells* | 267 wells | 0.05 acre-feet/well | 13 |
| *Disposal wells* | 8 wells | 1.26 acre-feet/well | 10 |
| Total | | | 77 |

Notes:
1. Areal extent based on 267 gas wells.
Source: Cox 1998.

On land leased without a No Surface Occupancy or similarly restrictive lease stipulation, the Department of Interior cannot deny a permit to drill. Once the land is leased, the Department no longer has the authority to preclude surface-disturbing activity, even if the environmental impact of such activity is significant. The Department can only impose mitigation measures upon a lessee who pursues surface-disturbing activities. By issuing a lease, the Department has made an irrevocable commitment to allow some surface disturbances (Tenth Circuit Court of Appeals in Sierra Club vs. Peterson [717 F. 2d 1409, 1983]).

Leases within the Project Area contain various stipulations concerning surface disturbance, surface occupancy, limited surface area, and timing restrictions. In addition, the lease stipulations provide for the imposition of such reasonable conditions, not inconsistent with the purposes for which the lease was issued, as the (BLM and/or Forest Service) may require to protect the surface of the leased lands and the environment. None of the stipulations, however, would empower the Secretary of Interior to deny all

**Table 2–10**
**Summary of Sand and Gravel Requirements for Alternative 2**

| Facility | Amount | Unit | Application Rate (cubic yards per unit) | Total Volume (cubic yards) |
|---|---|---|---|---|
| New Roads | 84 | miles | 1,430 | 120,120 |
| Potentially-upgraded roads | 104 | miles | 1,430 | 148,720 |
| New well pads | 267 | pads | 832 | 222,144 |
| Central production facilities | 7 | facilities | 3,225 | 22,575 |
| Compressor, amine, and dehydration stations | 3 | stations | 1,613 | 4,838 |
| Total | | | | 518,397 |

Source: Cox 1998

development activity because of environmental concerns. Provisions in leases that expressly provide authority to deny or restrict development in whole or in part depend upon conformance with certain non-discretionary statutes, such as the Endangered Species Act (43 Code of Federal Regulations 3101.1–2).

## 2.3.1 Primary Elements Comprising this Alternative

The primary elements comprising this alternative are very similar to those comprising the other two alternatives. The Companies would construct gas wells, new roads, pipelines, and CPFs. Also, the construction, operation, and decommissioning/reclamation phases would occur as described for Alternative 1. However, the Companies would construct a smaller number of facilities under this alternative than they would under alternatives 1 or 2.

With implementation of this alternative, the Companies would construct fewer wells and a smaller infrastructure to support them (**Table 2–11**). The Companies would construct a total of 155 new natural gas wells, all of which would be on state and privately-owned lands (**Plate 2–6**). Fewer miles of existing roads would be upgraded and about 44 miles of new roads would be constructed. Finally, fewer CPFs would be required to handle the natural gas and produced water.

## 2.3.2 Water Production

Through 1997, the Companies have completed 53 wells in the South Area and would drill 136 more, an average of 27 wells per year, over the five-year construction time frame. Therefore, by the end of the construction period, the maximum average daily water production rate would be about 39,050 BWPD [(27 wells X 350 BWPD/well for the wells in the first year) + (27 X 300 for wells in the second year) + (27 X 250 for wells in the third year) + (27 X 200 for wells in the fourth year) + (27 X 150 for wells in the fifth year) + (53 X 100 for wells in the sixth and succeeding years). The projected disposal rate for Texaco's three proposed wells and Chandler's two wells is 8,500 BWPD, which would provide an overall capability of 42,500 BWPD. Texaco's existing disposal well would add a further 8,500 BWPD disposal capacity. Therefore, the proposed water disposal capacity of 51,000 BWPD would exceed the projected daily maximum water production rate (39,050 BWPD).

The Companies have completed 15 wells in the North Area during the past two years and would drill 19 more, an average of 4 wells per year, over the five-year construction time frame. Therefore, by the end of the construction period, the maximum average daily water production rate would be 6,250 BWPD [(4 wells X 350 BWPD/well for the wells in the first year) + (4 X 300 for wells in the second year) + (4 X 250 for wells in the third year) + (4 X 200 for wells in the fourth year) + (4 X 150 for wells in the fifth year) + (15 X 100 for wells in the sixth and succeeding years). The projected disposal rate for Anadarko's single existing well would be 10,000 BWPD. Therefore, the proposed water disposal capacity of 10,000 BWPD would exceed the projected daily maximum water production rate (6,250 BWPD) by 3,750 BWPD.

## 2.3.3 Workforce and Construction Resource Requirements

The requirements for constructing the facilities comprising this alternative would be smaller than those identified for alternative 1 or 2. Most of the active workforce involved in developing the project would be involved in construction-related activities. After roads and well pads are constructed, pipelines and utility

**Table 2–11**
**Alternative 3 Ferron Natural Gas Project Facilities**

| Facility | Company | | | Total[1] |
|---|---|---|---|---|
| | Anadarko | Chandler | Texaco | |
| **Number of Existing and New Wells** | | | | |
| *Existing on* | | | | |
| Federal lands | 7 | 5 | 18 | 30 |
| State lands | 8 | 4 | 6 | 18 |
| Private lands | 0 | 1 | 19 | 20 |
| Total | 15 | 10 | 43 | 68 |
| *Proposed on* | | | | |
| Federal lands | 0 | 0 | 0 | 0 |
| State lands | 9 | 27 | 64 | 100 |
| Private lands | 10 | 12 | 33 | 55 |
| Total | 19 | 39 | 97 | 155 |
| Total number of natural gas wells | 34 | 49 | 140 | 223 |
| **Lengths of Roads (miles)** | | | | |
| *Potentially upgraded[2] on* | | | | |
| Federal lands | 11.2 | 7.3 | 7.3 | 25.8 |
| State lands | 2.4 | 14.2 | 14.2 | 30.9 |
| Private lands | 1.8 | 8.4 | 8.4 | 18.5 |
| Total[1] | 15.4 | 29.9 | 29.9 | 75.2 |
| *Proposed new on* | | | | |
| Federal lands | 0.1 | 0.0 | 0.2 | 0.3 |
| State lands | 2.4 | 9.5 | 22.3 | 34.2 |
| Private lands | 1.8 | 2.5 | 5.4 | 9.7 |
| Total | 4.3 | 12.0 | 27.9 | 44.2 |
| Total lengths of upgraded or new roads | 19.7 | 41.9 | 57.8 | 119.4 |
| **Number of Disposal Wells** | 1 | 2 | 4 | 7 |
| **Compressors** | | | | |
| Existing Central Production Facilities | 1 | 1 | 2 | 4 |
| Proposed Central Production Facilities[3] | 0 | 2 | 2 | 4 |
| Proposed Compressor Stations | 0 | 0 | 0 | 0 |
| Total Horsepower | 6,800 | 4,050 | 13,000 | 23,850 |

Notes:
1. Totals may not match precisely with values obtained by adding unit numbers due to rounding conventions.
2. Both Texaco and Chandler would use the upgraded roads in the South Area. Therefore, the total lengths of upgraded roads in the South Area were split evenly between Chandler and Texaco.
3. One amine unit and one dehydration unit would be installed at each facility.

lines are installed, and wells are drilled and completed, minimal personnel would be required to operate the field. **Table 2–12** shows the estimated employment requirements for the construction, operation, and reclamation of the Ferron Natural Gas Project under Alternative 3.

Construction of Alternative 3 would require a variety of materials and equipment. The primary materials would be water, sand, and gravel. Additionally, small amounts of chemicals would be required. Equipment

**Table 2–12**
**Estimated Employment Requirements for Alternative 3**

| Work Category | Time Requirements | Number of Facilities | Personnel Required (# per day) | Workdays for Project | Workdays per Year | Average # of Workers per Day |
|---|---|---|---|---|---|---|
| ***Construction and Installation*** | | | | | | |
| Access Road | 4 days/mile | 44 miles | 4 | 704 | 141 | 1 |
| Well Pad | 2 days/site | 155 | 8 | 2,480 | 496 | 2 |
| Pipeline | 10 days/mile | 44 miles | 10 | 4,400 | 880 | 4 |
| Drilling and Casing | 4 days/well | 155 | 8 | 4,960 | 992 | 4 |
| Well Completion | 4 days/well | 155 | 20 | 12,400 | 2,480 | 10 |
| Well Production | 10 days/well | 155 | 16 | 24,800 | 4,960 | 21 |
| Compressor facility | 90 days/site | 4 | 20 | 7,200 | 1,440 | 6 |
| Disposal Well | 40 days/well | 5 | 8 | 1,600 | 320 | 1 |
| Total | | | | 58,544 | 11,709 | 49 |
| ***Operation and Maintenance*** | | | | | | |
| Road/Pad Maintenance | 120 days/year | NA | 3 | 7,200 | 360 | 2 |
| Pumpers | 260 days/year | NA | 36 | 187,200 | 9,360 | 39 |
| Office | 260 days/year | NA | 2 | 10,400 | 520 | 2 |
| Well Workover | 5 days/well | 10/yr | 2 | 2,000 | 100 | 0 |
| Total | | | | 206,800 | 10,340 | 43 |
| ***Reclamation and Abandonment*** | | | | | | |
| Wells (gas and water) | 3 days/well pad | 230 | 4 | 2,760 | NA | |
| Roads | 4 days/mile | 44 | 4 | 704 | NA | |
| Compressor Dismantling | 30 days/facility | 8 | 20 | 4,800 | NA | |
| Reclamation | 5 days/facility | 8 | 4 | 160 | NA | |
| Total | | | | 8,424 | | |

needed for construction would include heavy equipment (bulldozers, graders, track hoes, and front-end loaders) and heavy- and light-duty trucks.

Water would be needed for constructing roads, well pads, and compressor stations. It also would be needed for drilling wells. Overall, the requirement for water to construct Alternative 3 is expected to be about 42 acre-feet (**Table 2–13**). This water would be purchased from local sources.

Sand and gravel would be required in the upgrading of at least parts of existing roads and the construction of new roads, well pads, and compressor facilities. Sand and gravel would be used to surface all newly-constructed roads in the collector and local classes to ensure a surface sufficient for year-round travel. The need for adding gravel to resource roads would be determined by the Authorized Officer or landowner on a case-by-case basis.

**Table 2–14** summarizes the estimated amount of sand and gravel needed if surfacing is required on all new roads, roads potentially requiring upgrading, well pads, and compressor facilities. Approximately four inches

**Table 2–13**
**Summary of Water Requirements for Alternative 3**

| Item | Amount (size) | Rate | Total (acre-feet) |
|---|---|---|---|
| Roads and pipelines | 44 miles | 0.36 acre-feet/mile | 16 |
| Well pads | 214 acres[1] | 0.023 acre-feet/acre | 5 |
| Central production facilities | 24.8 acres | 0.29 acre-feet/acre | 7 |
| Drilling and completion | | | |
| *Gas wells* | 155 wells | 0.05 acre-feet/well | 8 |
| *Disposal wells* | 5 wells | 1.26 acre-feet/well | 6 |
| Total | | | 42 |

Notes:
1. Areal extent based on 155 gas wells.
Source: Cox 1998

of sand and gravel would be applied where needed on roads and well pads. The Companies would purchase sand and gravel from local commercial sources.

All other construction, operation, and decommissioning/reclamation activities identified for the Proposed Action would occur under this alternative. The production of water and gas would be essentially the same as described for the Proposed Action. Additionally, Questar would construct, operate, and maintain the transmission pipeline as described under the Proposed Action.

## 2.4 ALTERNATIVES CONSIDERED — BUT NOT EVALUATED IN DETAIL

Several additional project alternatives were considered as a result of issues raised during scoping. When they were considered, each potential alternative was evaluated and some were eliminated from detailed analysis in the EIS for various reasons. A description of these considered alternatives follows along with a brief description of the rationale for their exclusion.

**Table 2–14**
**Summary of Sand and Gravel Requirements for Alternative 3**

| Facility | Amount | Unit | Application Rate (cubic yards per unit) | Total Volume (cubic yards) |
|---|---|---|---|---|
| New Roads | 44 | miles | 1,430 | 62,920 |
| Potentially-upgraded roads | 75 | miles | 1,430 | 107,250 |
| New well pads | 155 | pads | 832 | 128,960 |
| New central production facilities | 4 | facilities | 3,225 | 12,900 |
| Total | | | | 312,030 |

Source: Cox 1998

### 2.4.1 Alternative Well Densities

An alternative that incorporated the development of wells on an 80-acre well density pattern instead of the proposed 160-acre pattern was considered. The primary reason for its consideration was to ensure that the maximum well development scenario for the Ferron study area was evaluated in this EIS. It was dropped from consideration because the Companies have no current plans to pursue an 80-acre well density pattern because current geological information supports the proposed 160-acre development pattern. In addition, at Anadarko's request, the Utah Board of Oil Gas and Mining has issued a spacing order for portions of Anadarko's development in and around the North Area. This order is for a 160-acre well density pattern.

The geologic information and the spacing order do not preclude the development of an 80-acre pattern in the future if updated geologic data, economic conditions, or new technology would encourage this density. However, the development of an 80-acre pattern could not be permitted under this NEPA analysis. Additional environmental analysis under NEPA would be required to evaluate such a proposal at that time.

### 2.4.2 Proposed Action with Certain Areas Excluded from Development

This alternative was suggested so certain identified sensitive areas (such as wildlife security areas) would be eliminated from potential natural gas development. This alternative was dropped from further consideration in the EIS because it could prohibit development of valid leases. None of the leases acquired by the Companies have a lease-wide No Surface Occupancy stipulation. Therefore, this alternative could not be legally implemented.

### 2.4.3 Specific Buffers Around Residences

An alternative considering ½ and 1 mile buffer zones between well sites and residences was suggested during scoping to reduce potential impacts to local residents. It was not analyzed as a separate alternative in this EIS because buffer zones this size could preclude development on valid leases held by the Companies. Additionally, most leases near residences are located on non-Federal land and, therefore, are not within the jurisdiction of BLM.

### 2.4.4 Deeper Disposal Wells

An alternative was suggested that would require disposal wells to be developed into deeper formations than proposed. Analysis in Chapter 4 addressed impacts into the Navajo and four deeper formations. Therefore, a separate alternative was not necessary.

### 2.4.5 Alternate Produced Water Disposal Methods

Disposing water into the subsurface is the preferred method of produced water disposal by the UDOGM and BLM. All the disposal wells proposed for the Ferron Natural Gas Project would be located on State of Utah or private land and would be under the jurisdiction of UDOGM. BLM regulations in Onshore Oil and Gas Order No. 7 state that disposal of water from Federal leases into permitted injection wells on State or private lands would be approved by BLM.

Several different methods of produced water disposal were considered and have been investigated for the proposed project. The methods were evaluated on the basis of economics, applicability and reliability.

Disposal of produced water in surface impoundments was suggested as an alternative to subsurface disposal. This method is dependent on evaporation rates and results in inconsistent year-round disposal capability. Other issues arise with the eventual disposal of salt concentrations and residuals, and pit abandonment and subsequent reclamation. Due to the large volumes of water that could be expected from the Proposed Action, numerous surface disposal pits would be necessary. Even with several surface pits, it is anticipated that other forms of disposal would be necessary to accommodate water volumes. Evaporation ponds were not considered as a long-term option for disposal.

An alternative was also considered for using produced water for beneficial uses such as to control fugitive dust on roads and disturbed areas, for livestock water, or other uses. This was suggested in order to eliminate the need for water disposal while possibly providing a local benefit. Produced water would have to be treated before it would be suitable for other uses because it contains high level of suspended coal fines, total dissolved solids, calcium, magnesium, sodium, potassium, chloride, sulfate, and bicarbonate (see **Section 3.2.2.2**). Five alternative technologies for the treatment of produced water were evaluated to provide a comparison with the current practice of deep injection. They included distillation, freeze desalination, reverse osmosis, electro-dialysis, and ion exchange.

Distillation can be conducted through different processes (long-tube-vertical multiple effect distillation, multi-stage flash-evaporation, and forced-circulation vapor compression processes). All these processes treat water by evaporating it and then condensing the resultant vapor in a manner to recover and reuse as much of its heat content as possible. Distillation yields a relatively pure water stream, but evaporation has a large energy requirement (Cox and Stevens 1993). Costs are among the highest of the treatment technologies (Cox and Stevens 1993).

Freeze desalination involves freezing saline water to form a slurry of ice crystals and brine, from which the ice crystals are separated, rinsed, and melted. This process has not been applied in commercial projects and needs more research and development before it becomes acceptable (Cox and Stevens 1993). In addition, no cost estimates were found.

Reverse osmosis is the most widely applied desalination process for municipal and industrial plants in the U.S. and has been used in several petroleum industry settings (Cox and Stevens 1993). Reverse osmosis is a membrane process where water under pressure passes through a semi-permeable membrane but the contaminants do not. By repeating this cycle several times, a concentrated waste stream and a relatively pure water stream are obtained. The process is greatly degraded by the presence of fine suspended solids (coal fines) (Office of Technology Assessment [OTA] 1980) that are present in produced water from coal beds in the area. Costs for this process in the San Juan Basin were estimated to range from $0.30 to $0.70 per barrel of produced water (Cox and Stevens 1993).

Reverse osmosis has recently been tested as a water disposal method in the Castlegate Field, an abandoned coal bed methane project northwest of Price, Utah. This project was developed to produce gas from the coal beds of the Blackhawk Formation with produced water disposed into formations above the Blackhawk. Reverse osmosis was investigated as a disposal option primarily due to problems encountered with subsurface disposal of produced water. While treatment was successful, long term expenses were considered uneconomical compared to subsurface disposal for the high volumes of produced water encountered, and the field was eventually abandoned.

Electro-dialysis is similar to reverse osmosis in that semi-permeable membranes are used. However, in electro-dialysis the ions are forced across the membranes by an electrical potential. Electro-dialysis has not been used in petroleum applications, but has been used in such a wide variety of applications that only minor changes are likely to be needed to adapt it to CBM operations (Cox and Stevens 1993). Removal rates for electro-dialysis were reported as 10 to 40 percent in 1980 (OTA 1980) and as 80 to 85 percent in 1993 (Cox and Stevens 1993). Costs for electro-dialysis are estimated around $0.30 per barrel (Cox and Stevens 1993).

Ion-exchange removes dissolved solids from water by exchanging waterborne ions for other, more soluble ions as the water passes through chemical "resins" (Cox and Stevens 1993). Ionexchangers are useful for removing hardness (calcium and magnesium ions), but are inefficient for removing carbonate, bicarbonate, or chloride ions (Cox and Stevens 1993). Ion-exchange is not effective on highly saline waters. This process is also ineffective in removing organic compounds and suspended particulates (OTA 1980). Ion exchangers typically have limited capacity and therefore do not serve as the primary removal process (OTA 1980).

**Table 2–15** presents a relative comparison of the technologies in removing dissolved solids (OTA 1980). Adaptability in the table refers to the ability to respond to changing water quality. For comparison purposes, subsurface disposal was also included in the table.

**Table 2–15**
**Relative Ranking of Treatment/Disposal Technologies for Dissolved Solids**

| | Parameter | | | |
|---|---|---|---|---|
| **Technology** | **Removal Rate (percent)** | **Reliability** | **Adaptability** | **Relative Cost** |
| Distillation | 99 | Medium | Low | Very high |
| Reverse osmosis | 60–95 | Medium | Medium | Medium |
| Electro-dialysis | 10–85 | Medium | Medium | Very high |
| Ion-exchange | High | High | Low | High |
| Sub-surface disposal | High | High | High | Low |

Source: Cox and Stevens 1993 and OTA 1980.

Treatment of produced water is not analyzed in this EIS. Water treatment options have not been tested to determine if they would be viable for use in the project area. Most of the options would also be uneconomical. Reverse osmosis to treat produced water could be possible, but the high volumes of water and the presence of suspended coal fines negate this treatment method as a feasible option. Produced water would be a waste product of the proposed gas production. Treatment of produced water is not a regulatory requirement. While there is a possibility for making water available for treatment, to date, no proposals have been submitted to treat waste water from existing projects in the area. Any proposal to treat produced water from Federal leases would undergo separate NEPA analysis.

### 2.4.6 Directional Drilling

Directional drilling can only be considered a viable alternative if the method meets the proponent's needs. To date, none of the Companies has proposed any directional wells. Several technical and economic aspects challenge the feasibility of directional drilling.

First, CBM wells are produced by pumping water from the coal seams to the surface; a process known as "dewatering." The water is brought to the surface using pumping units and rod actuated subsurface pumps. Wells must be nearly vertical to accommodate this production equipment. Therefore, the deviation from vertical in the wellbore must be very gentle. In the Project Area, not enough vertical distance exists, from the surface to the target formation, to drill a directional well that would access an adjacent spacing unit while still being able to accommodate a pump.

Secondly, coal exists locally in multiple seams; therefore, in order to access all of the coal, at least one lateral leg would have to be drilled into each coal seam. The technology of conventional horizontal drilling does not permit this many laterals in such a limited vertical section. Multiple laterals can be drilled using ultra-short radius horizontal drilling, but technology does not exist to drill the laterals far enough away from the wellbore to influence an adjacent spacing unit.

In addition to the above technical impediments, directional and horizontal wells are much more expensive to drill. They require larger rigs, larger drill pas, larger reserve pits, they take much longer to drill, must be drilled with mud rather than air, and they require specialized tools, surveys and expertise.

### 2.4.7 Staged Development

This suggested alternative involves two separate concepts. The first considers phasing the development of a lease to allow only enough sites to be developed to hold the lease. Further development of that lease would be precluded until production of these wells has reached its economic end. This was not analyzed in the EIS because timely development of leases would be restricted and it would be technically infeasible because dewatering of the coal seam is only effective with a large number of wells working concurrently. The second concept involves phased development in an area wide context. That is, a certain number of wells would be developed in one area and operated until production ends before proceeding to another area. This was eliminated because it would restrict timely development of leases and could violate valid lease rights.

### 2.4.8 Alternative Transmission Pipeline Routes

Alternative routes for Questar's proposed transmission pipeline were initially considered. However, they were readily discounted as viable alternatives because they would not follow an existing pipeline and right-of-way like Questar's proposed route does. Therefore, alternative routes would require more disturbance of previously undisturbed land than would occur under the proposed route.

## 2.5 SUMMARY ALTERNATIVES AND IMPACTS

The following tables summarize the alternatives considered in detail and the likely environmental consequences of each alternative. **Table 2–16** contains the summary of alternatives. This table contrasts the three alternatives in terms of their physical characteristics.

The matrix presented in **Table 2–17** provides a comparative summary of the impacts to the various environmental resources that would be realized by implementing each of the three alternatives for the Ferron Natural Gas Project.

**Table 2–16**
**Comparison of Alternatives Considered in Detail**

| Parameter | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| **Facilities** | | | |
| *Number of Natural Gas Wells* | | | |
| Existing on | | | |
| Federal lands | 30 | 30 | 30 |
| State lands | 18 | 18 | 18 |
| Private lands | 20 | 20 | 20 |
| Total | 68 | 68 | 68 |
| Proposed new on | | | |
| Federal lands | 130 | 112 | 0 |
| State lands | 100 | 100 | 100 |
| Private lands | 55 | 55 | 55 |
| Total | 285 | 267 | 155 |
| Total number of wells | 353 | 335 | 223 |
| *Roads (miles)* | | | |
| Potentially upgraded on | | | |
| Federal lands | 47 | 47 | 26 |
| State lands | 34 | 34 | 31 |
| Private lands | 23 | 23 | 18 |
| Total | 104 | 104 | 75 |
| Proposed new on | | | |
| Federal lands | 48 | 36 | <1 |
| State lands | 36 | 35 | 34 |
| Private lands | 14 | 13 | 10 |
| Total | 98 | 84 | 44 |
| Total for all roads | 202 | 188 | 119 |
| *Number of proposed water disposal wells* | 11 | 11 | 7 |
| *Proposed Compressors* | | | |
| Number of existing CPFs | 4 | 4 | 4 |
| Number of proposed CPFs | 7 | 7 | 4 |
| Number of proposed compressor stations | 3 | 3 | 0 |
| Total horsepower | 37,650 | 37,650 | 23,850 |

**Table 2–16 (continued)**
**Comparison of Alternatives Considered in Detail**

| Parameter | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| **Short-term Disturbance (acres)** | | | |
| *Proposed Wells on* | | | |
| Federal lands | 179 | 154 | 0 |
| State lands | 138 | 138 | 138 |
| Private lands | 76 | 76 | 76 |
| Total | 393 | 368 | 214 |
| *Proposed Roads on* | | | |
| Federal lands | 458 | 341 | 3 |
| State lands | 339 | 331 | 323 |
| Private lands | 129 | 118 | 91 |
| Total | 926 | 790 | 418 |
| *Proposed CPFs* | 43 | 43 | 25 |
| *Proposed Compressor Stations* | 9 | 9 | 0 |
| *Total for all facilities* | 1,371 | 1,210 | 657 |
| **Long-term Disturbance (acres)** | | | |
| *Proposed Wells on* | | | |
| Federal lands | 107 | 93 | 0 |
| State lands | 83 | 83 | 83 |
| Private lands | 45 | 45 | 45 |
| Total | 236 | 221 | 128 |
| *Proposed Roads on* | | | |
| Federal lands | 235 | 175 | 2 |
| State lands | 174 | 170 | 166 |
| Private lands | 66 | 61 | 47 |
| Total | 475 | 405 | 214 |
| *Proposed CPFs* | 43 | 43 | 25 |
| *Proposed Compressor Stations* | 9 | 9 | 0 |
| *Total for all facilities* | 763 | 678 | 367 |
| **Workforce Requirements** | | | |
| *Construction and Installation (number of workdays for the project)* | 117,768 | 110,600 | 58,544 |
| *Operation and Maintenance (number of workdays for the project)* | 206,800 | 206,800 | 206,800 |
| *Reclamation and Abandonment (number of workdays for the project)* | 14,616 | 14,152 | 8,424 |
| **Water Requirements (acre-feet)** | 84 | 77 | 42 |
| **Sand and Gravel Requirements (cubic yards)** | 553,393 | 518,397 | 312,030 |

## Table 2–17
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| **GEOLOGY AND MINERALS** | | | |
| Removal of natural gas resources | 680 bcf Project total | 645 bcf Project total | 430 bcf Project total |
| Conflict with exiting coal leases or KCRA | No conflict with active coal leases; one potential conflict with KCRA on State land. | No conflict with active coal leases; one potential conflict with KCRA on State land. | No conflict with active coal leases; no conflict with KCRA. |
| **WATER RESOURCES** | | | |
| Effects to groundwater | Disposal of produced water would transfer saline groundwater from the Ferron Sandstone to the Navajo Aquifer. Shallow alluvial aquifers could be affected by spills and construction activities. Blasting near springs and water wells could affect flows. | Similar to Alternative 1. Produced water would be transferred from the Ferron Sandstone to the Navajo Aquifer. Environmental protection measures would limit construction near streams and in floodplains to reduce effects on shallow aquifers. Protection measures for avoidance of construction and blasting near springs would protect springs and seeps and reduce impacts. | Same effects as the Proposed Action, but at a proportionally lower rate as 130 fewer wells would be drilled. |
| Effects to surface water | Increased sedimentation and salinity due to surface disturbances. Sedimentation and salinity would be more pronounced from construction near water courses and from pipelines and roads that cross streams and ephemeral drainages. Sediment delivery would be 4.5 tons/acre/yr. Salinity delivery would be 0.319 tons/acre/yr. These rates would occur on 763 acres of long-term disturbance. Increased risk of spills of chemicals, drilling fluids, fuels and produced water from wells and facilities near streams and drainage. | Similar impact to Alternative 1, but protection measures would safeguard springs and reduce spill impacts. Sediment delivery would be reduced to 4.0 tons/acre/yr. Salinity delivery would be 0.239 tons/acre/yr. These rates would occur on 678 acres of long-term disturbance. | Same effects as the proposed action but at a proportionally lower rate. Sediment delivery would be 4.4 tons/acre/year. Salinity delivery would be 0.306 tons/acre/yr. These rates would occur on 367 acres of long-term disturbance. Increased risk of spills of chemicals, drilling fluids, fuels and produced water from wells and facilities near streams and drainage. |
| **AIR QUALITY** | | | |
| Construction dust effects | Construction dust would be controlled per Utah Air Conservation Rules by watering, chemical application, wind breaks, vegetative or synthetic covering. Companies are not proposing dust control on roads during operations. Dust levels from operational vehicles may be locally high. | Construction dust would be controlled per Utah Air Conservation Rules by watering, chemical application, wind breaks, vegetative or synthetic covering. BLM would require dust suppression techniques to be applied on roads near residences and high traffic volume. | Construction dust would be controlled per Utah Air Conservation Rules by watering, chemical application, wind breaks, vegetative or synthetic covering. Dust levels from operational vehicles may be locally high if dust suppression is not applied to roads near residences and high traffic volume. |

## Table 2–17 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| Operational compressor effects | Ambient air levels of $NO_2$ would be moderate on elevated terrain within one mile of compressors. Maximum levels would be below NAAQS in all cases. Maximum levels of $NO_2$ would exceed Class II PSD increment near compressors at elevated terrain nearby. No other standards would be exceeded. If recommended mitigation are implemented, no $NO_2$ Class II incremental increase would be exceeded. With the electric power option, no $NO_x$ or CO emissions would occur. | Ambient air levels of $NO_2$ would be moderate on elevated terrain within one mile of compressors. Maximum levels would be below NAAQS in all cases. Maximum levels of $NO_2$ would exceed Class II PSD increment near compressors at elevated terrain nearby. No other standards would be exceeded. If recommended mitigation are implemented, no $NO_2$ Class II incremental increase would be exceeded. With the electric power option, no $NO_x$ or CO emissions would occur. | Ambient air levels of $NO_2$ would be moderate on elevated terrain within one mile of compressors. Ambient air levels of $NO_2$ may exceed PSD Class II increment if compressors are constructed near elevated terrain. |
| Effects to regional haze. | Regional visibility may be reduced by 10 percent 4 days per year at Capitol Reef National Park. If recommended mitigation measures are implemented, visibility at Capitol Reef would not be reduced by more than 10 percent on any days. With the electric power option, the Proposed Action would not affect regional visibility. | Regional visibility may be reduced by 10 percent 4 days per year at Capitol Reef National Park. If recommended mitigation measures are implemented, visibility at Capitol Reef would not be reduced by more than 10 percent on any days. With the electric power option, this alternative would not affect regional visibility. | Regional visibility would not be reduced by more than 10 percent at any of the nearby National Parks. |
| **SOILS** | | | |
| Erosional effects from facilities located on critical soils with slopes greater than 6 percent | 178 wells and portions of the access roads would be on critical soils with slopes in excess of 6 percent. Water and wind erosion would increase, especially with disturbances on critical soils. Soil loss from 763 acres of long-term disturbances would be 11.2 tons/acre/year. | Environmental protection measures would reduce impacts to soils by avoiding critical soils on slopes where possible. 160 wells and portions of the access roads would be on critical soils with slopes greater than 6 percent. Water and wind erosion would increase. Increased soil loss from 678 acres of long-term disturbance would be 9.9 tons/acre/year. Overall soil loss is projected to be about 88 percent of loss associated with the Proposed Action. | Effects similar to Alternative 1, but proportionally less. 39 wells would be constructed on critical soils with slopes in excess of 6 percent. Soil loss increase from 367 acres of long-term disturbance would be 6.6 tons/acre/year. Overall soil loss would be 59 percent less than the Proposed Action. |
| Facility location of slopes greater than 25 percent | 44 wells and portions of their access roads would be located on slopes greater than 25 percent. Water and wind erosion would increase and reclamation success would be difficult on these well pads and roads. | No wells or roads would be located on slopes greater than 25 percent. Wells and access roads would be relocated to exclude construction on slopes greater than 25 percent. | Effects similar to Alternative 1, but proportionately less. No roads would be constructed on slopes greater than 25 percent on BLM lands. |

## Table 2–17 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| Effects on soil properties | Soil compaction, loss of soil productivity and soil profile and a breakdown in soil structure from facility and road construction, and surface disturbances. | Same as Proposed Action, but slightly less, as 18 fewer wells would be drilled. | Same as the Proposed Action but, proportionally less because 155 new wells would be drilled instead of 285. |
| **VEGETATION** | | | |
| Loss of vegetation | 1,633 acres of vegetation (1.5 percent of the Project Area) would be removed for construction. After partial reclamation, long-term vegetation loss would be 763 acres (0.7 percent of the project Area). 46 percent of disturbance would be on BLM land. 97 percent of vegetation would be pinyon-juniper, sagebrush/grassland, and salt desert shrub. | 1,472 acres of vegetation (1.3 percent of the Project Area) would be removed for construction. After partial reclamation, long-term vegetation loss would be 679 acres (0.6 percent of the project Area). 41 percent of disturbance would be on BLM land. 98 percent of vegetation would be pinyon-juniper, sagebrush/grassland, and salt desert shrub. | 916 acres of vegetation (0.8 percent of the Project Area) would be removed for construction. All vegetation removal would be on State and private land. After partial reclamation, long-term vegetation loss would be 367 acres (0.3 percent of the project Area). 96 percent of vegetation would be pinyon-juniper, sagebrush/grassland, and salt desert shrub. |
| Invasion of noxious weeds | Disturbance would increase potential for spread of noxious weeds. Implementation of the Weed/Vegetation Management Plan would reduce potential for establishment of noxious weeds. | Disturbance would increase potential for spread of noxious weeds. Implementation of the Weed/Vegetation Management Plan would reduce potential for establishment of noxious weeds. | Disturbance would marginally increase potential for spread of noxious weeds. Noxious weeds would be controlled by Companies in accordance with State and County laws. |
| **RIPARIAN AREAS** | | | |
| Riparian communities loss | Construction would remove 10.3 acres of riparian communities in South Area. One-half would be on BLM land. Effects would be long-term after the project ends because of the long time required for regrowth of riparian overstory. | Construction would remove 9.3 acres of riparian communities in South Area. About 18 percent would be on BLM land. Effects would be long-term after the project ends because of the long time required for regrowth of riparian overstory. | Construction would remove 6.9 acres of riparian communities in South Area. Almost all would be on private land. Effects would be long-term after the project ends because of the long time required for regrowth of riparian overstory. |
| **WILDLIFE** | | | |
| Effects on aquatic species | 12 wells would be located in floodplains adjacent to perennial streams. Increased sedimentation could occur during heavy precipitation. | Because of other environmental restraints, 6 wells would not be constructed adjacent to perennial streams. Sedimentation potential would be reduced by 50 percent. | Potential impacts would be similar to other alternatives because State and private lands contain most of the wells that would be constructed along perennial streams. |

## Table 2–17 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| Effects on mule deer winter range | 65 new wells would be constructed in North Area. Development would directly disturb 229 acres (1.2 percent of North Area winter range). Indirect disturbance to habitat would affect 4,235 acres (22.9 percent of winter range within the North Area) within 200 meters of facilities during operations. Deer normally using winter range may vacate these areas of indirect disturbance.<br>177 new wells in South Area would be constructed on winter range. Development would directly disturb 890 acres (1.5 percent of South Area winter range). Indirect disturbance to habitat would affect 13,505 acres (24 percent of winter range within the South Area) within 200 meters of facilities during operations. Deer normally using winter range may vacate these areas of indirect disturbance. | No construction would occur when animals are using winter range. 61 new wells in North Area would be constructed on winter range. Development would directly disturb 201 acres. Indirect disturbance to habitat would affect 3,534 acres within 200 meters of facilities during operations.<br>163 new wells in South Area would be constructed on winter range. Development would directly disturb 740 acres (1.3 percent of South Area winter range). Indirect disturbance to habitat would affect 11,082 acres (19 percent of winter range within the South Area) within 200 meters of facilities during operations. Deer normally using winter range may vacate these areas of indirect disturbance. Mitigation would involve direct payments for loss of winter range to enhance adjacent winter range habitat. | 19 new wells on private and State land would be constructed in North Area on winter range. Development would directly disturb 67 acres (0.4 percent of North Area winter range). Indirect disturbance to habitat would affect 521 acres (2.8 percent of winter range within the North Area) within 200 meters of facilities during operations. Deer normally using winter range may vacate these areas of indirect disturbance.<br>105 new wells on State and private land in South Area would be constructed on winter range. Development would directly disturb 428 acres (0.7 percent of South Area winter range). Indirect disturbance to habitat would affect 6,844 acres (12 percent of winter range within the South Area) within 200 meters of facilities during operations. Deer normally using winter range may vacate these areas of indirect disturbance. |
| Effects on elk winter range | No elk winter range occurs in the North Area. 50 wells would be constructed in winter range in the South Area directly disturbing 207 acres (0.8 percent of the winter range). Construction would occur when animals are using winter range and would drive animals away from construction during winter range times. Indirect disturbance to habitat would affect 11,969 acres (49 percent of winter range within the South Area) within 800 meters of facilities during operations. Elk normally using winter range may vacate these areas of indirect disturbance. | No construction would be allowed during time elk use winter range. 49 wells would be constructed within winter range directly disturbing 128 acres 0.5 percent of winter range within the South Area). Indirect disturbance would affect 11,011 acres (45 percent of winter range within the South Area) within 800 meters of facilities during operations. Elk normally using winter range may vacate these areas of indirect disturbance. Mitigation would involve direct payments by Companies for loss of winter range to enhance adjacent winter range habitat. | 46 wells would be constructed within winter range directly disturbing 179 acres (0.7 percent of winter range within the South Area). Indirect disturbance would affect 10,096 acres (41 percent of winter range within the South Area) within 800 meters of facilities during operations. Elk normally using winter range may vacate these areas of indirect disturbance. |

## Table 2–17 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| Effects on raptors | No construction would occur within ½ mile of raptor nests during the breeding season, February 1 through August 15. Construction during breeding season would not occur within ½ mile of 140 known and active nests. This restriction would affect 59 proposed wells. Operational activities within ½ mile of active nests could lead to nest abandonment, increased disturbance from Companies and public using roads, and temporary reduction in prey populations. With the electric power option, additional disturbance would be minor and the power lines would be constructed according to the APLIC's guidelines, so the potential for electrocuting raptors would be minimized. | Same as Alternative 1 for timing restrictions. Environmental protection measure would preclude permanent surface occupancy within ½ mile of an active raptor nest precluding the construction of 12 wells in the South Area. With the electric power option, additional disturbance would be minor and the power lines would be constructed according to the APLIC's guidelines, so the potential for electrocuting raptors would be minimized. | No seasonal or construction restrictions within ½ mile of raptor nests. 22 wells could be constructed within ½ mile of known raptor nest. |
| **SPECIAL STATUS SPECIES** | | | |
| Effects to Special-status species | 5 wells and 1,800 feet of access roads would be constructed in or near Winkler cactus populations. 6 wells and 6,120 feet of access road would be constructed in or near known populations of Creutzfeldt-flower. Pre-construction surveys would identify exact location and facilities would be re-located to avoid these species. 12 wells and access roads are proposed for construction within the one-mile buffer around peregrine falcon aerie. Impact should be minimal because of widespread hunting habitat on adjacent Forest Service lands. With the electric power option, disturbance associated with construction of the power lines would be minor because the power lines could be moved to avoid known populations. Power lines would be constructed according to the APLIC's guidelines, so the potential for electrocuting special-status raptors would be minimized. | Same as Alternative 1 except one-mile buffer would be imposed around peregrine falcon aerie. 8 fewer wells and access roads would be constructed on federal lands because of the no surface occupancy within one mile of a peregrine falcon aerie. With the electric power option, disturbance associated with construction of the power lines would be minor because the power lines could be moved to avoid known populations. Power lines would be constructed according to the APLIC's guidelines, so the potential for electrocuting special-status raptors would be minimized. | Four wells would be constructed on State lands within the one-mile of a peregrine falcon aerie buffer. Populations of special status plants, if present, may be uprooted by development. |

## Table 2–17 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| **CULTURAL RESOURCES** | | | |
| Effects to Cultural resources | Construction activities could affect 77 sites in addition to the 10 known significant sources in the Project Area. Some of these sites could be destroyed before they are discovered. Four sites eligible for the NRHP could be inadvertently destroyed. If found, construction would cease, authorities would be notified, and mitigation of site would be carried out according to the Ferron Natural Gas Project Cultural Resource Treatment Plan. Pre-construction surveys would allow the opportunity to find and evaluate previously unknown cultural resources. With the electric power option, an additional six sites could be affected directly or indirectly. Also, one additional site may be affected by inadvertent destruction. | Construction activities could affect 69 sites in addition to the 10 known significant sources in the Project Area. Some of these sites could be destroyed before they are discovered. Four sites eligible for the NRHP could be inadvertently destroyed. If found, construction would cease, authorities would be notified, and mitigation of site would be carried out according to the Ferron Natural Gas Project Cultural Resource Treatment Plan. Pre-construction surveys would allow the opportunity to find and evaluate previously unknown cultural resources. With the electric power option, an additional six sites could be affected directly or indirectly. Also, one additional site may be affected by inadvertent destruction. | Construction activities could affect 40 sites in addition to the 10 known significant sources in the Project Area. Some of these sites could be destroyed before they are discovered. Two sites eligible for the NRHP could be inadvertently destroyed. If found, construction would cease, authorities would be notified, and mitigation of site would be carried out according to the Ferron Natural Gas Project Cultural Resource Treatment Plan. Pre-construction surveys would allow the opportunity to find and evaluate previously unknown cultural resources. With the electric power option, an additional six sites could be affected directly or indirectly. Also, one additional site may be affected by inadvertent destruction. |
| **LAND USE** | | | |
| Effects to land use | Total long-term disturbance would be 763 acres, or 0.7 percent of the Project Area. About 50 percent of disturbance would be on BLM land. Most of disturbance would be on rangeland. 53 wells would be constructed within one mile of residences. Dust levels and noise at these residences would be temporarily elevated during construction activities at these residences. | Total long-term disturbance would be 678 acres, or 0.6 percent of the Project Area. 41 percent of disturbance would be on BLM land. Most of disturbance would be on rangeland. 53 wells would be constructed within one mile of residences. Dust levels and noise at these residences would be temporarily elevated during construction activities at these residences. | All wells and most access roads would be constructed on State and private lands. 26 wells would be constructed within one mile of residences. Dust levels and noise at these residences would be temporarily elevated during construction activities at these residences. |
| Effects to transportation | Construction related traffic would average 110 trips per day, an increase of 1 to 5 percent over present levels, from Price area to Project Area. Operational traffic would average less than one percent of present levels. Slight increase of traffic accident potential (2 to 5 percent) during construction activities where project traffic would enter paved highways. | 18 fewer wells would be drilled. Effects would be similar, but slightly less, to Alternative 1. | Construction traffic would be similar to the Proposed Action for the three years required for construction. Operational traffic would be considerably less than the Proposed Action because only 82 wells would be operated. |

## Table 2–17 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| **LIVESTOCK MANAGEMENT** | | | |
| Effects to livestock management | During construction, grazing would be reduced by almost 70 AUMs, (49 AUMs BLM) a decrease of less than 1 percent. Grazing would be reduced by 46 AUMs (33 AUMs BLM) during the operational phase. Increased traffic and access may lead to harassment and minor loss of livestock. | Effects on grazing would be similar to the Proposed Action. Environmental protection measure dictates range improvements must meet BLM standards and reduce the potential for traffic-related conflicts. Increased traffic and access may lead to harassment and minor loss of livestock. | Grazing on State and privately-owned land would be reduced by about 13 AUMs. |
| **RECREATION** | | | |
| Effects to recreation opportunities | Construction activities would alter the recreational experience for users through a loss of solitude and the natural setting. After construction, the loss of solitude would be less because of greatly reduced traffic. Installation and operation of facilities would still affect the natural setting of the Project Area for the life of the project. BLM recreation management objectives would not be met in Semi-primitive Motorized areas. | Construction activities would alter the recreational experience for users through a loss of solitude and the natural setting. After construction, the loss of solitude would be less because of greatly reduced traffic. Installation and operation of facilities would still affect the natural setting of the Project Area for the life of the project. BLM recreation management objectives would not be met in Semi-primitive Motorized areas. | No impacts to recreation on BLM lands would occur. Loss of solitude and natural setting could occur on State lands. |
| **VISUAL RESOURCES** | | | |
| Effects to visual resources | 114 wells, associated access roads, and 5 CPFs would be constructed on VRM Class III areas and the Class III management objectives may not be met. With the electric power option, about 187 miles of aboveground power lines and 1,532 power poles would be constructed in VRM Class III areas and may not meet management objectives. | 114 wells, associated access roads, and 5 CPFs would be constructed on VRM Class III areas and the Class III management objectives may not be met. With the electric power option, about 32 miles of aboveground power lines and 552 power poles would be constructed in VRM Class III areas and may not meet management objectives. | BLM Class II and III objectives designated for non-federal lands may not be met on State and private lands. |

## Table 2–17 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| **NOISE** | | | |
| Noise effects | Construction noise would be above 55 dBA within 1,500 feet of activities. 5 residences would experience noise above 55 dBA from construction on BLM land. 14 residences would experience noise above 55 dBA from construction on private land. Noise from drilling would be above 55 dBA at distances out to 2,000 feet. Noise would be short-term (1 to 4 days) but would occur 24 hours per day at the 14 residences. Operational noise from pumping units would be below 55 dBA at distances beyond 200 feet from these units. Therefore, after construction activities, noise levels would not be significant. | Noise effects would be similar to the Proposed Action. The location of the 18 fewer wells would be far away from residences. | Noise levels would be above 55 dBA for the 14 residences within 2,000 feet of wells constructed on State and private land. |
| **SOCIOECONOMICS** | | | |
| Effects to employment | 98 people would be employed for construction activities. 40 percent would be locally hired and 60 percent would be specialists from outside the area. Employment would be seasonal during the 8-month construction period. Construction period would be 5 years. Secondary activities (services, supply) would create about 25 jobs annually during construction phase. 43 people would be permanently employed during the operational phase of the Project. | With 18 fewer wells, 94 people would be employed for construction activities. 40 percent would be locally hired and 60 percent would be specialists from outside the area. Employment would be seasonal during the 8-month construction period. Construction period would be 5 years. Secondary activities (services, supply) would create about 25 jobs annually during construction phase. 43 people would be permanently employed during the operational phase of the Project. | Since 155 new wells would be constructed, employment level would occur only for three years. |
| Effects to wages | Combined annual payroll of the three Companies would average about $900,000 during initial construction phase. This amount would be less than one percent of Carbon and Emery counties. The combined payroll during the operational phase would average about $1,150,000. | Combined annual payroll of the three Companies would average about $867,000 during initial construction phase. This amount would be less than one percent of Carbon and Emery counties. The combined payroll during the operational phase would average about $999,000. | Combined annual payroll would be reduced to $621,000 because a maximum of 155 wells would be constructed. |
| Effects on housing and community services | Small influx of transient employees (59 people) would not have significant effect. Workers would tend to live in spread out communities in and near the Project Area. | Influx of transient employees (56 people) would not have significant effect. Workers would tend to live in spread out communities in and near the Project Area. | Small flux of transient employees would only occur for the three-year construction period. |

## Table 2–17 (continued)
## Ferron Natural Gas EIS Summary of Impacts

| Type of Potential Impact | Alternative 1 — Proposed Action | Alternative 2 — Proposed Action with Environmental Protection Measures | Alternative 3 — No Action |
|---|---|---|---|
| Royalties generated | Federal royalties would be $53 million over life of project. $27 million would be paid to State of Utah of which $6.8 million would be distributed directly to Carbon and Emery Counties. With the electric power option, employment would increase an additional three percent. | Federal royalties would be $50 million over life of project. $23 million would be paid to State of Utah of which $6.6 million would be distributed to Carbon and Emery Counties. With the electric power option, employment would increase an additional three percent. | There would be no federal royalties. Therefore, none would be distributed to Carbon and Emery counties. All wells would be constructed on State and private land. |
| **HEALTH AND SAFETY** | | | |
| Risk associated with construction and operations | Risks to employees, subcontractors and public would be similar to those associated with heavy construction and industry. | Risks wold be similar to Proposed Action but slightly less because 18 fewer wells would be constructed and operated. | Risks less than Proposed Action because only 154 wells would be constructed and operated. |
| **RECLAMATION** | | | |
| Reclamation potential | 1,633 acres disturbed. 77 percent of disturbance would involve soils unsuitable for reclamation. Reclamation in these areas would require multiple growing seasons and reseeding to generate vegetative cover similar to cover that currently exists. | 1,473 acres disturbed. About 75 percent of disturbance would involve soils unsuitable for reclamation. Reclamation in these areas would require multiple growing seasons and reseeding to generate vegetative cover similar to cover that currently exists. | 917 acres disturbed on State and private lands. 68 percent of disturbance would involve soils unsuitable for reclamation. Reclamation in these areas would require multiple growing seasons and reseeding to generate vegetative cover similar to cover that currently exists. |

# CHAPTER 3

# AFFECTED ENVIRONMENT

# CHAPTER 3
# AFFECTED ENVIRONMENT

The Affected Environment Chapter describes the existing condition of the environment within and adjacent to the Ferron Natural Gas Project Area. The information presented for each resource focuses on the issues identified during scoping.

As discussed in Chapters 1 and 2, the Ferron Natural Gas Project Area consists of the North Area, the South Area, and the proposed transmission pipeline corridor (**Plate 2–1**). When a resource discussion applies to the entire area, the term Project Area is used. Discussions unique to certain areas refer to either the North Area, the South Area, or the pipeline corridor.

## 3.1 GEOLOGY AND MINERALS

### 3.1.1 Physiography and Topography

The North Area is situated at the northern edge of the San Rafael Swell, a broad, asymmetrical, northeast-trending upwarp within the Colorado Plateau physiographic province (Weiss et al. 1990). This physiographic subprovince is known as the Mancos Shale lowland (Stokes 1986). The landscape of these lowlands is characterized by southerly sloping, gravel-covered pediments, rugged badlands and narrow, flat-bottomed alluvial valleys. The pediments are comprised of fluvial sediments of quaternary origin that rest on shale and siltstone of the Blue Gate Member of the Mancos Shale (Weiss et al. 1990).

The Book Cliffs, steep escarpments capped by resistant sandstones, are located immediately north of the North Area. The Price River valley is west and south of the North Area whereas Coal Creek, a tributary of the Price River, is located to the east.

The surface of the North Area generally slopes to the south from the Book Cliffs to the Price River valley. Slopes are on the order of 5 to 10 percent on the pediment surfaces and 10 to 75 percent on pediment side slopes adjacent to drainages. Elevations range from 5,770 feet in Deadman Creek (SE¼, Section 11, Township (T) 14 South (S), Range (R) 10 East (E) to 7,300 feet at the north edge of the NE¼, Section 24, T13S, R10E, resulting in total relief within the North Area of more than 1,500 feet.

The South Area also is located within the Colorado Plateau physiographic province. It extends from the Castle Valley on the east to the Wasatch Plateau on the west. The Castle Valley is part of the Mancos Shale lowland (Stokes 1986). It is a topographic low between the Wasatch Plateau to the west and the San Rafael Swell to the east (Witkind 1988). The surface of the Castle Valley is characterized by southeast sloping pediments, which consist of quaternary fluvial sediments resting on shale and siltstone of the Bluegate Member of the Mancos Shale (Witkind 1988 and Witkind et al. 1987).

The Wasatch Plateau is high table land comprised of essentially horizontal sandstone beds (Speiker 1931). The eastern margin of the plateau, an abrupt wall of barren cliffs, forms the western boundary of the South Area. To the east of the South Area lies the western flank of the San Rafael Swell. The pattern of landforms within the South Area continues to the north and south of the area.

The surface of the South Area generally slopes to the southeast from the Wasatch Plateau to the Castle Valley. Slopes range from approximately 2 to 10 percent on the pediment surfaces and stream valleys and from about 10 to 100 percent on the pediment and mesa side slopes. Elevations range from 5,670 feet in Rock Creek on the east edge of the NE¼, Section 19, T19S, R8E to 9,090 feet at the center of the western edge of Section 36, T17S, R6E. Therefore, total relief within the South Area is more than 3,400 feet.

## 3.1.2 Stratigraphy

Stratigraphic and geohydrologic units present within the Project Area are illustrated on **Figure 3–1**. Stratigraphic units exposed at the surface, or relevant to this project are described below. Rock units are described in order from youngest to oldest with the abbreviation for each formation following in parentheses. Formation thicknesses are based on stratigraphic charts 64 (Huntington-Ferron-Emery) and 65 (Helper-Price-Wellington) in the Geologic History of Utah (Hintze 1988).

Alluvium (Qal) (Holocene) is found in the valley bottoms of the major streams (including Cottonwood and Huntington creeks) that cross the South Area. It consists of thin to thick bedded, unconsolidated clay, silt, sand, granules, pebbles and a few cobbles deposited in stream valleys in recent time. Alluvium within the South Area is commonly less than 50 feet thick (Witkind et al. 1987).

Slope Wash (Qsw) (Holocene) forms broad, gently-sloping areas in the Castle Valley. It also includes small unmapped valley fill deposits within the North Area. Slope wash consists of thin to thick bedded, unconsolidated to weakly cemented (locally) clay, silt, sand, and pebbles. Slope wash can reach thicknesses of up to 25 feet in the South Area (Witkind 1988). Slope wash deposits in the North Area are smaller and thinner than those in the South Area.

Alluvial Fan Deposits (Qf) (Holocene) are found at the base of the eastern Wasatch Plateau escarpments. These are unconsolidated to semi-consolidated deposits that consist of moderately well sorted silt, sand, pebbles, and cobbles (Witkind 1988). Within the South Area, alluvial fan deposits are up to 50 feet thick (Witkind et al. 1987).

Pediment Mantle (QTpm) (Holocene to Miocene) is found on the pediment surfaces scattered throughout the North and South areas. It consists of unconsolidated to well-cemented, massive to crudely bedded fluvial sediments (Weiss et al. 1990). The poorly bedded mixture of silt, sand, pebbles, cobbles, and boulders is derived from the adjacent uplands. The surfaces of these deposits are relatively smooth and slope gently away from the Book Cliffs and the Wasatch Plateau. Thicknesses range from 10 to 150 feet.

The Mesaverde Group (Upper Cretaceous), an assemblage of upper Cretaceous rock units, forms cliffs at the western edge of the South Area and immediately north of the North Area. It includes, in descending order, the Price River Formation (Kpr), Castlegate Sandstone (Kc), Blackhawk Formation (Kbh), and Star Point Sandstone (Ksp) (Witkind et al. 1987). It is not present in the North Area.

The Price River Formation is comprised of irregularly bedded sandstone, conglomerate, and conglomeratic sandstone. It ranges in thickness from 600 to 1,000 feet (Hintze 1988) in the South Area.

The Castlegate Sandstone is thin bedded to massive with some conglomerate beds. Its thickness ranges from about 150 to 500 feet in the South Area (Hintze 1988).

| MINERALS | GEOHYDROLOGIC UNIT[1,2] | DESCRIPTION | THICKNESS, FT[3] | AGE | STRATIGRAPHIC UNIT[2] | |
|---|---|---|---|---|---|---|
| | | Variegated shales with subordinate sandstone, conglomerate and freshwater limestone, thickens to north, slope former. | 500–2,500 | CRETACEOUS | | LOWER NORTH HORN (CRETACEOUS) |
| | MESAVERDE AQUIFER | Gray to white gritty sandstone inter-bedded with subordinate shale and conglomerate, ledge and slope former. | 600–1,000 | | MESAVERDE GROUP | PRICE RIVER FORMATION |
| | | White to gray, coarse-grained often conglomeratic sandstone, cliff former, weathers to shades of brown. | 150–500 | | | CASTLEGATE SANDSTONE |
| COAL CBM | | Yellow to gray, fine to medium-grained sandstone, interbedded with subordinate gray and carbonaceous shale, several thick coal seams. | 700–1,000 | | | BLACK HAWK FORMATION |
| | | Yellow-gray, massive cliff-forming sandstone, often in several tongues seperated by Mosuk Shale, thickens westward. | 100–1,000 | | | STAR POINT SANDSTONE |
| | MANCOS CONFINING UNIT | Yellow to blue-gray sandy shale, slope former, thick in north and central plateau area, thins southward. | 300–1,300 | | MANCOS SHALE | UPPER BLUE GATE MEMBER |
| COAL? | | Yellow-gray friable sandstone tongue or tongues, cliff former, may contain coal. | 50–800 | | | EMERY SANDSTONE MEMBER |
| | | Pale blue-gray, nodular and irregularly bedded marine mudstone and siltstone with several arenaceous beds, weathers into low rolling hills and badlands, thickens northerly. | 1600–3500+ | | | BLUE GATE MEMBER |
| | | Friable sandstone tongue or tongues, cliff former. Located within Blue Gate. | 70–130 | | | GARLEY CANYON SANDSTONE MEMBER |
| OIL, COAL, CNG, CBM | | Alternating yellow-gray sandstone, sandy shale and gray shale with important coal beds of Emery coal field, resistant cliff former. | 180–300 | | | FERRON SANDSTONE MEMBER |
| OIL | | Blue-gray to black sandy marine slope forming mudstone. | 200–650 | | | TUNUNK SHALE MEMBER |
| OIL, CNG | DAKOTA AQUIFER | Variable assemblages of yellow-gray sandstone, conglomerate, shale, and coal. Beds lenticular and discontinuous. | 0–60 | | DAKOTA GROUP | DAKOTA SANDSTONE |
| | | | | | | CEDAR MOUNTAIN FORMATION |
| | | Varicolored shale underlain by the Buckhorn Conglomerate. | 100–800 | | | BUCKHORN CONGLOMERATE |
| URANIUM, GYPSUM | MORRISON CONFINING UNIT | Variegated-color claystone and mudstone, with a few thin limestone and sandstone lenses. | ±570 | JURASSIC | MORRISON FORMATION | BRUSHY BASIN MEMBER |
| | ? | | | | | SALT WASH |
| | MORRISON AQUIFER | Light-gray, thin bedded friable quartzose sandstone with occasional interbeds of conglomerate and mudstone. | ±510 | | SAN RAFAEL GROUP | SUMMERVILLE FORMATION |
| | | | | | | CURTIS FORMATION |
| | CURTIS-STUMP CONFINIING UNIT | Reddish-brown shaley siltstone with thin, continuous bedding. | 120–420 | | | ENTRADA SANDSTONE |
| | | Light-gray to greenish-gray, glauconitic quartzose sandstone with thin beds of conglomerate. | 140–280 | | | CARMEL FORMATION |
| | ENTRADA PREUSS AQUIFER | Orangish-brown to light-brown, medium to thick bedded sandstone. | 150–950 | | GLEN CANYON GROUP | NAVAJO SANDSTONE |
| GYPSUM | CARMEL-TWIN CREEK CONFINING UNIT | Reddish-brown shaley siltstone underlain by light-gray, crystalline limestone. | 300–1300 | | | KAYENTA FORMATION |
| $CO_2$ | NAVAJO-NUGGET AQUIFER | Light brown to light gray, massive crossbedded, quartzose sandstone. | 150–320 | TRIASSIC | | WINGATE SANDSTONE |
| | | Lavender to reddish-brown, crossbedded, quartzose sandstone, well-cemented. | 120–250 | | CHINLE FORMATION | CHURCH ROCK MEMBER |
| | | Reddish-brown to brown, quartzose sandstone, well-cemented by calcium. | 300–400 | | | MOSS BACK MEMBER AND TEMPLE MOUNTAIN MEMBER |
| | CHINLE-MOENKOPI CONFINING UNIT | Reddish-brown to dark brown sandstone and shaley siltstone. | 200–300 | | | UPPER PART |
| | | Light-gray, crossbedded sandstone with interbeds of conglomeritic sandstone, conglomerate and mudstone. | 20–140 | | | |
| $CO_2$, OIL, URANIUM | | Altered, greenish-gray, very fine grained, petroliferous sandstone and shaley siltstone. | 420–700 | | MOENKOPI FORMATION | |
| | | Yellowish-gray to light brown, crystalline limestone. | 50–60 | | | SINBAD LIMESTONE |
| | | Greenish-gray to yellowish brown interbedded quartzose sandstones, shaley siltstones and mudstones. | 250–300 | | | LOWER PART |

**Note: Adapted from BLM, 1997c**

1 FROM FREETHEY AND CORDY, 1991.
2 EXCLUDES QUATERNARY AND TERTIARY DEPOSITS.
3 HINTZE, 1988

647strat.dwg

**Figure 3-1**
**Stratigraphic Geohydrologic Column**

The Blackhawk Formation consists of bedded quartzose sandstones with shaley siltstone, shale, carbonaceous shale, and coal interbeds (BLM 1997c). It ranges in thickness from 700 to 1,000 feet (Hintze 1988) in the South Area.

The Star Point Sandstone is a fine- to medium-grained gradational unit between the Blackhawk Formation and the underlying Mancos Shale. In the South Area, its thickness ranges from 100 to 1,000 feet (Hintze 1988).

The Mancos Shale (Upper Cretaceous) is exposed at the surface over much of the North and South areas. It consists of six members (in descending order): Upper Blue Gate, Emery Sandstone, Blue Gate, Garley Canyon Sandstone, Ferron Sandstone, and Tununk Shale (BLM 1997c, Weiss et al. 1990, Witkind 1988, and Witkind et al. 1987).

The Upper Bluegate (or Masuk) Member (Kmub) is a slope-forming, thin- to medium-bedded shale and shaley siltstone with a few thin interbedded sandstone beds. It ranges in thickness from 300 to 1,300 feet (Hintze 1988).

The Emery Sandstone Member (Kme) consists of upper and lower sandstone units separated by a middle shale unit. The sandstone units are cliff-forming and consist of thin-to medium bedded, very fine grained quartzose sandstone. The middle shale unit consists of thin- and even-bedded shale and shaley siltstone with a few interbedded thin sandstone beds. The Emery Sandstone ranges in thickness from 50 to 800 feet (Hintze 1988) with thickness increasing from east to west.

The Blue Gate Member (Kmbg) (or Lower Blue Gate Member) is a slope-forming, thin- to medium-bedded shale and shaley siltstone with sparse interlayered thin sandstone beds. Thickness ranges from 1,600 to more than 3,500 feet (Hintze 1988).

The Garley Canyon Member (Kmgc) consists of two thin, cliff-forming sandstone beds separated by shale. It occurs within the Blue Gate Member and ranges in thickness from 70 to 150 feet within the North Area (Hintze 1988).

The Ferron Sandstone Member (Kmf) consists of an upper and lower sandstone unit separated by a middle shale unit. Total thickness ranges from 200 to 250 feet on the eastern side of the South Area to 300 feet on the western side (as documented by Texaco). Within the North Area, thickness of the Ferron is about 180 to 200 feet (Bunnell and Hollberg 1991). There are up to 13 coal beds within this member, although most areas average 5 coal layers (Tabet 1995). The individual coal beds average 4 to 9 feet thick with total coal thicknesses of up to 40 feet. The coals and sandstone intervals are the primary production target for the project.

The Tununk Member (Kmt) forms the base of the Mancos Shale. It consists of thin- to medium-bedded shale and shaley siltstone. It ranges in thickness from 200 to 650 feet. Neither the Tununk Member nor older formations below it are exposed at the surface within the Project Area.

The Dakota Group (Cretaceous), Morrison Formation (Jurassic), Summerville Formation (Jurassic), Curtis Formation (Jurassic), Entrada Sandstone (Jurassic), and Carmel Formation (Jurassic) lie below the Mancos Shale. Their combined thickness ranges from about 1,900 to 4,900 feet. These formations lie between the production zone and the Navajo Sandstone, the target formation for project disposal wells. The Carmel Formation, located directly above the Navajo, contains anhydrite which is important for containment of disposal water injected into the Navajo.

The Navajo Sandstone (Jurassic and Triassic) is a thick-bedded to massive, fine-grained quartzose sandstone with a few thin lenticular limestone beds in the upper part. It ranges in thickness from 150 to 300 feet (Hintze 1988).

### 3.1.3 Structure

Several structural features occur in the vicinity of the Project Area. The San Rafael Swell is a large, elongate, asymmetric anticline that plunges to the northeast. The axis of this anticline is located east of the Project Area. Strata dip as steeply as 80 degrees on the east flank of this anticline while strata on the west flank dip only 5 to 15 degrees (Stokes 1986). The Uinta Basin is an east-west trending, asymmetric syncline which lies northeast of the Project Area (BLM 1997c). The Book Cliffs, an erosional escarpment located immediately north of the North Area, separate the Uinta Basin from the Mancos Shale lowlands. The Wasatch Plateau is an erosional remnant capped by essentially horizontal sedimentary rocks (Stokes 1986). It is located west of the Project Area.

The structure of the North Area is dominated by the regional northward dip of strata from the San Rafael Swell toward the Uinta Basin (Nethercott 1985 and Russon 1992). This northward dip averages 5 degrees in the North Area. There is no indication of faulting in this area.

The South Area lies on the western flank of the San Rafael Swell, resulting in a slight dip of strata to the west (Witkind 1988). This trend is interrupted slightly by two local features, the Huntington Anticline and the Castle Dale Dome, which lie west of Huntington and east of Castle Dale, respectively. These features are located outside the Project Area.

Several faults exist in the South Area. Most are concentrated in the northwest corner where a series of north-south trending, high-angle normal faults are found (Witkind et al. 1987). Within this area, known as the Pleasant Valley fault zone (Doelling 1972), displacements of up to 450 feet have been identified. Within the Pleasant Valley fault zone, 12 major faults exist along with shear zones containing numerous smaller faults (Speiker 1931).

### 3.1.4 Geologic Hazards

The Project Area lies within seismic risk zone 2 (on a scale of 0 to 3, with 3 being the highest risk) (Algermissen 1969). Seismic risk zones are based on the number and intensity of earthquakes per 100-year period. Moderate damage from earthquakes corresponding to an intensity of 7 (on the Modified Mercalli Intensity Scale, which measures intensities from 1 to 12) is the maximum impact that can be expected within the Project Area. A search of the National Earthquake Information Center database was conducted to identify seismic events that have occurred within a 250-km (155-mile) radius of the geographic center of the Project Area. During the period January 1, 1973 through October 31, 1997, 31 earthquakes of magnitude 4.0 to 5.7 occurred within the 250-km radius. The largest had a magnitude of 5.7 and was centered 140 miles to the east near Rio Blanco, Colorado. A 5.5 magnitude event occurred in 1988 and was centered only 19 miles southeast of the geographic center of (but outside of) the Project Area.

Seismic events have occurred in the area associated with long wall coal mining. These events tend to be small in magnitude, ranging from approximately 2 to 3.5 (Walter et al. 1996).

Mass movements including rockfall, landslides, and slumps are common along the Book Cliffs and Wasatch Plateau escarpments. These events occur at the foot of these escarpments in the northern margin of the North

Area and the western margin of the South Area. Slope stability also is of concern within Mancos Shale lowlands, which are found in the majority of the Project Area. The Mancos is easily eroded where exposed to weathering. It is subject to swelling when wet and prone to slope failure where overlain by younger dense rocks.

A soil gas survey was conducted to determine the presence and concentration of methane along a portion of the Ferron Sandstone Member of the Mancos Shale outcrop (Aubry et al. 1998). The outcrop surveyed is adjacent to the FNG Project South Area. Procedures and equipment used ensure repeatability allowing for future trend analysis. In the FNG Project Area, there are no known gas seeps. There is a substantial caprock (± 2,000 feet of impermeable Mancos Shale) between the surface and the gas-producing zone. Ferron coalbeds pinch out several miles west of the outcrop in this area, and are not exposed at the surface. The survey indicates methane, carbon monoxide, and hydrogen sulfide are not escaping along the Ferron outcrop (Aubry et al. 1998).

$H_2S$ has not been encountered to date during drilling in any of the more than 100 CBM wells drilled in the Price area. However, $H_2S$ has been detected in produced water from some of the CBM wells in small amounts (80 to 90 ppm below the minimum level of 100 ppm at which it is regulated under Onshore Order No. 6). Solution $H_2S$ was also recently encountered in the drilling of a disposal well to a depth of approximately 6,000 feet into the Navajo Formation.

## 3.1.5 Mineral Resources

### 3.1.5.1 Oil

Although oil production has not occurred within the Project Area, oil shows have been observed in the Dakota Group and the Kaibab Limestone as well as the Ferron and Tununk members of the Mancos Shale. There are four oil fields near the Project Area, including the Flat Canyon, Joe's Valley, Grassy Trails, and Indian Creek fields. These fields all involve structural traps. Although future exploration could occur within the Project Area, production is not considered likely due to a lack of favorable structures.

### 3.1.5.2 Conventional Natural Gas

Conventional natural gas reserves include resources that may be produced at the surface from a well bore as a consequence of natural pressure within the subsurface reservoir; and the maintenance of reservoir pressure by means of water or gas injection (U.S. Geological Survey [USGS], BLM, and Forest Service 1990). Conventional natural gas has been observed during drilling in both the North and South areas in the Ferron Sandstone and in the South Area in the Dakota Group. There is some conventional production from the Ferron, along with CBM, in at least one of Texaco's CBM wells. In addition, Chandler's existing wells are producing conventional gas from the Ferron (Aubry 1998). Conventional natural gas is produced west of the Project Area in the Clear Creek and Flat Canyon fields and to the south in the Ferron field. The Clear Creek field produces from the Ferron Sandstone. The Flat Canyon field (include both the East Mountain and the Indian Creek fields) produces from the Ferron Sandstone and from the Dakota Group. The Ferron field produces gas from the Ferron Sandstone.

Carbon dioxide production was established at the Farnham Dome field, to the east of the Project Area. Although more than 2 billion cubic feet of carbon dioxide have been produced from that field, there is no current production. In the Gordon Creek field to the west, shows of carbon dioxide have been reported in the Coconino Sandstone, the Sinbad Member of the Moenkopi Formation, and the Kaibab Limestone. Based

upon discussions with operators, carbon dioxide is presently being produced from River Gas, Anadarko, and Texaco wells within and near the Project Area. Operators have indicated that all wells produce in the range of 2 to 20 percent carbon dioxide with an average of 10 percent (McKee 1998).

There is a potential for undiscovered conventional natural gas throughout the Project Area. Stratigraphic traps within or adjacent to the deltaic zones of the Ferron Sandstone have the highest potential for conventional natural gas reserves. There is potential to develop the existing Gordon Creek field, although it does not appear economically feasible at this time. Currently, River Gas is producing adjacent to the Miller Creek field and plans to develop it soon.

### 3.1.5.3 Coalbed Methane

Coals in the Mesaverde Group and the Ferron Sandstone Member of the Mancos Shale contain coalbed methane (CBM) reserves. These coals are classified as high-volatile B bituminous in the northern part of the Emery Coal Field (Doelling et al. 1979). Within the Project Area, CBM from the coals of the Ferron Sandstone would be extracted by the proposed Ferron Natural Gas Project. CBM is currently produced from 53 wells in the South Area and 15 in the North Area. These wells are predominantly located on private and state lands. As of March 1998, there were 140 wells in the area located between the North and South areas.

CBM is created along with water, carbon dioxide and nitrogen, as organic matter changes into coal (coalification). Some of the water and gasses become trapped as the coal seam is compacted. A coal seam is a dual porosity medium that consists of a solid matrix containing micropores and a natural fracture system known as cleats. Gas-saturated water occupies the cleats, while the bulk of the gas remains adsorbed to the walls of the matrix micropores. CBM reservoirs can contain from three to seven times more methane than a conventional natural gas reservoir because of large internal surface areas. Generally, higher ranked coals contain more trapped methane (BLM 1997c).

Adsorbed methane is produced from the coal by reducing the hydrostatic pressures (pressure exerted by water at any given point in a body of water at rest) within the formation. The reduced pressures allow gas to desorb from the coal micropores into the cleat system and flow toward low pressure areas.

Hydrostatic pressures are reduced by removing formation water. As water is produced, gas begins to desorb from the coal. In most wells, gas is produced immediately along with large quantities of water. Gas production gradually increases, and water production peaks then declines (within 3 to 4 years). As less water is produced, more gas desorbs and is produced at the well bore. Finally, gas production declines as water production remains low or ceases in the last stages of a well's production.

Portions of the Project Area are located within the Ferron Coalbed Gas Fairway, which extends from north of Price to south of Emery (Tabet 1995). The Ferron Fairway is 6 to 10 miles wide and at least 80 miles long. Ultimate recoverable reserves for the Ferron coalbed gas fairway are estimated at between 4 and 9 trillion cubic feet (Tabet et al. 1995). Total Ferron coal thickness in the Project Area is estimated to range from 0 to more than 40 feet.

### 3.1.5.4 Coal

Coal is not currently mined within the Project Area, although some coals of the Ferron Sandstone may be considered minable. Four principal coal fields are located in the vicinity of the Project Area: the Book Cliffs, the Wasatch Plateau, the Emery, and the Northern Emery. Coal beds in the Book Cliffs field occur in the

Blackhawk Formation. The Wasatch Plateau coal field is located west of the South Area on the Wasatch Plateau. Coal beds in this field also occur in the Blackhawk Formation. Coal in the Southern Emery coal field, located south of the South Area, is found in the Ferron Sandstone Member of the Mancos Shale. The Northern Emery field is located within and adjacent to the South Area. Coal reserves in the Ferron Sandstone in the Northern Emery coal field have been estimated at two billion tons based on burial depths of less than 3,000 feet (Doelling 1972 and Bunnell and Hollberg 1991). However, the Ferron coal has not been mined any closer than 15 miles south of the South Area.

There are 11 active coal mines, four inactive coal mines, two coal mines under development, and 12 in reclamation status in the Carbon-Emery counties area. In addition, numerous abandoned coal mines (pre-Surface Mining Control and Reclamation Act of 1977) are located in this area.

As shown on **Plate 3–1**, the South Area has three operational coal mines. Two mines operated by PacifiCorp and one by Co-Op Mining Company. The two active PacifiCorp coal mines are the Trail Mountain Mine and the Deer Creek Mine. These mines provide the fuel for the power needs of the Hunter and Huntington electric generation plants. The Deer Creek Mine is located on State Highway 31 adjacent to the Huntington power plant. The coal is transferred from the Deer Creek mine to the power plant by conveyor beltline located in the Deer Creek drainage. The Trail Mountain Mine is located on Forest Development Road 50040, in Cottonwood Canyon. Coal is transhipped by conveyor from the Trail Mountain Mine through the Cottonwood Mine (an inactive mine) to the Cottonwood Mine loadout. This coal is then trucked to the Hunter Plant. The Cottonwood Mine and Des-Bee-Dove Mine complex has been requested to be permanently abonadoned. The Co-Op Bear Canyon Mine is an active mine adjacent to the South Area. The Co-Op mine is located off State Highway 31. Trucks from the Co-Op mine haul coal to a rail loadout west of Wellington, Utah, for rail transport to designated markets.

As shown on **Plate 3–1**, the North Area has one adjacent operational coal mine. Cyprus Plateau's Willow Creek Mine, located on State Highway 191, is the only active mine in the vicinity of the North Area. The coal is transferred from the mine by conveyor beltline to a rail loadout on Highway 6.

### 3.1.5.5 Sand, Gravel, and Stone Resources

Commercially-exploitable deposits of sand and gravel are found within the South Area (USGS 1969). Significant deposits are found within the lower valleys of the larger streams, such as Huntington and Cottonwood creeks. There has been only limited development of these resources because of a lack of local demand.

Sandstone and other bedrock within the North and South areas is not currently exploited as a source of commercial materials.

Sand and gravel also occur extensively as residual deposits on tops of hills and benches. Emery County has two active pits in the South Area, which are under free use permits. There is one pit at the Sherman Wash north of Huntington Lake and the other is on Johnson Beach. The Sherman Wash pit also produces rock used as riprap.

# 3.2 WATER RESOURCES

## 3.2.1 Regional Overview

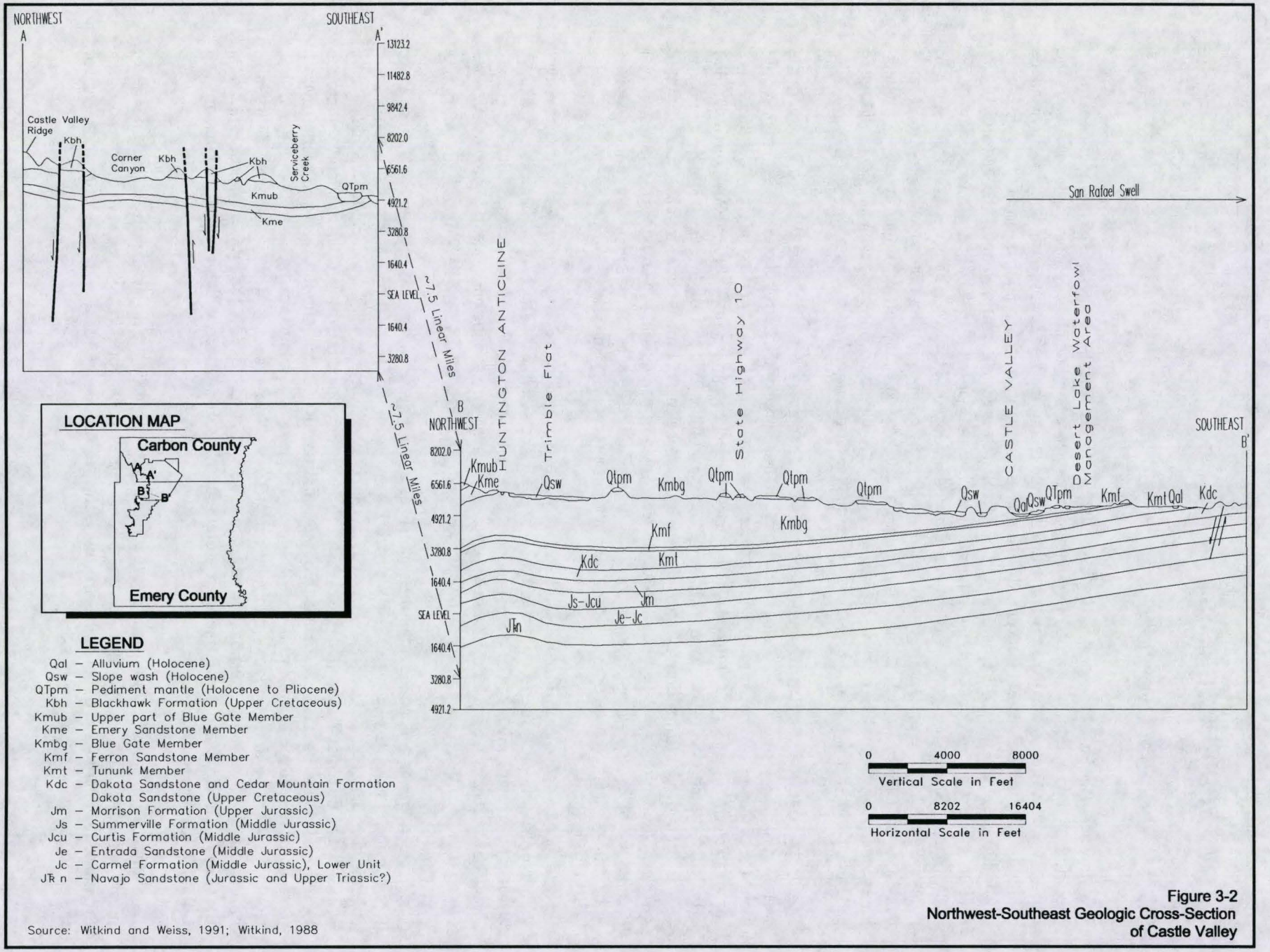
Groundwater in the Project Area occurring in geohydrologic units has been categorized into a series of major aquifers separated by confining units. Beginning at the surface and extending downward, these units are the Quaternary Alluvium (actually a group of discontinuous aquifers), the Mesaverde aquifer, the Mancos confining unit, the Dakota aquifer, the Morrison confining unit, the Morrison aquifer, the Curtis-Stump confining unit, the Entrada-Preuss aquifer, the Carmel-Twin Creek confining unit, the Navajo-Nugget aquifer, and the Chinle-Moenkopi confining unit (Freethey and Cordy 1991). The Ferron Sandstone member of the Mancos Shale, from which CBM and associated produced water would be extracted, is an aquifer in the Project Area. In general, units designated as aquifers are composed of sandstone, while confining units consist principally of shale, siltstone, limestone, and claystone (although confining units may include interbedded sandstone). The relationship between geohydrologic and stratigraphic units is shown in **Figure 3–1**, along with their associated regional stratigraphic descriptions and thicknesses.

Regional groundwater flow in the shallower bedrock aquifers is generally from the Wasatch Plateau in the west toward aquifer outcrops and subcrops in the east. Recharge of the Ferron Sandstone occurs primarily along the fault zones of the Wasatch Plateau where precipitation is highest and extensional faulting allows for greater vertical recharge (**Figure 3–2**). Recharge to deeper aquifers in the Project Area, including the Navajo Sandstone, occurs, at least in part, along outcrops on the west side of the San Rafael Swell (Weiss 1987). Groundwater flows through interconnected pore spaces in the formations as well as through fracture systems. Discharge occurs where aquifers are dissected by deep canyons and where aquifers subcrop against the alluvium of the larger creeks. Other than in the highly-faulted areas of the Wasatch Plateau, there appears to be little vertical recharge or discharge between aquifers (Freethey and Cordy 1991).

Only four of the above geohydrologic units are likely to be affected by the proposed project. The Quaternary Alluvium has the potential to be impacted by near-surface activities. The Ferron Sandstone would be affected by the withdrawal of CBM and produced water. The Entrada-Preuss and Navajo-Nugget aquifers would be affected by the injection of water produced from the Ferron Sandstone. The following discussions of groundwater flow, water quality, and water use focus primarily on these four units.

The Project Area is contained within the watersheds of the Price River and San Rafael River. The Price River in the North Area separates the Wasatch Plateau from the Book Cliffs. Various dry washes and ephemeral creeks of the Price River watershed flow through the North Area. These include Deadman Creek, Meads Wash, Cardinal Wash, and Hayes Wash. These channels generally flow south or southwest into the Price River. In the South Area, tributaries of the San Rafael River generally flow east and southeast from portions of Wasatch Plateau into Castle Valley. The perennial tributaries include Huntington Creek, Cottonwood Creek, Rock Canyon Creek, and Ferron Creek. Most channels draining the area are dry most of the year, and flow only in response to storm events. Water resources in the Project Area are shown on **Plate 3–2**. The Price and San Rafael Rivers drain into the Green River, which eventually drains into the Colorado River.

As drainages along the western portion of the South Area approach the higher elevations and amounts of precipitation typical of the Wasatch Plateau, they are more likely to be perennial, or have flow year-round. Similar to the distribution of perennial streams, identified springs are found near the western boundary of the South Area and shown on **Plate 3–2**.




Source: Witkind and Weiss, 1991; Witkind, 1988

**Figure 3-2**
**Northwest-Southeast Geologic Cross-Section of Castle Valley**

Surface water quality is directly influenced by higher amounts of precipitation associated with the mountains of the Wasatch Plateau and the composition of the rocks in the area. Regionally, the lowest total dissolved solids (TDS) concentrations occur at higher elevations and increase significantly as the streams flow away from the mountains across the saline soils of the Mancos Shale Lowlands.

## 3.2.2 Groundwater

### 3.2.2.1 Groundwater Flow

#### *3.2.2.1.1 Quaternary Alluvium*

Quaternary Alluvium along major streams typically forms the shallowest accessible aquifers in the Project Area. Principal alluvial aquifers include those deposits associated with the main stems and tributaries to the Price River, San Rafael River, Huntington Creek, Cottonwood Creek, Rock Canyon Creek, and Ferron Creek. Alluvial aquifers are generally recharged by streams during periods of high flow and discharge to the same stream during periods of low flow. They also are recharged by precipitation.

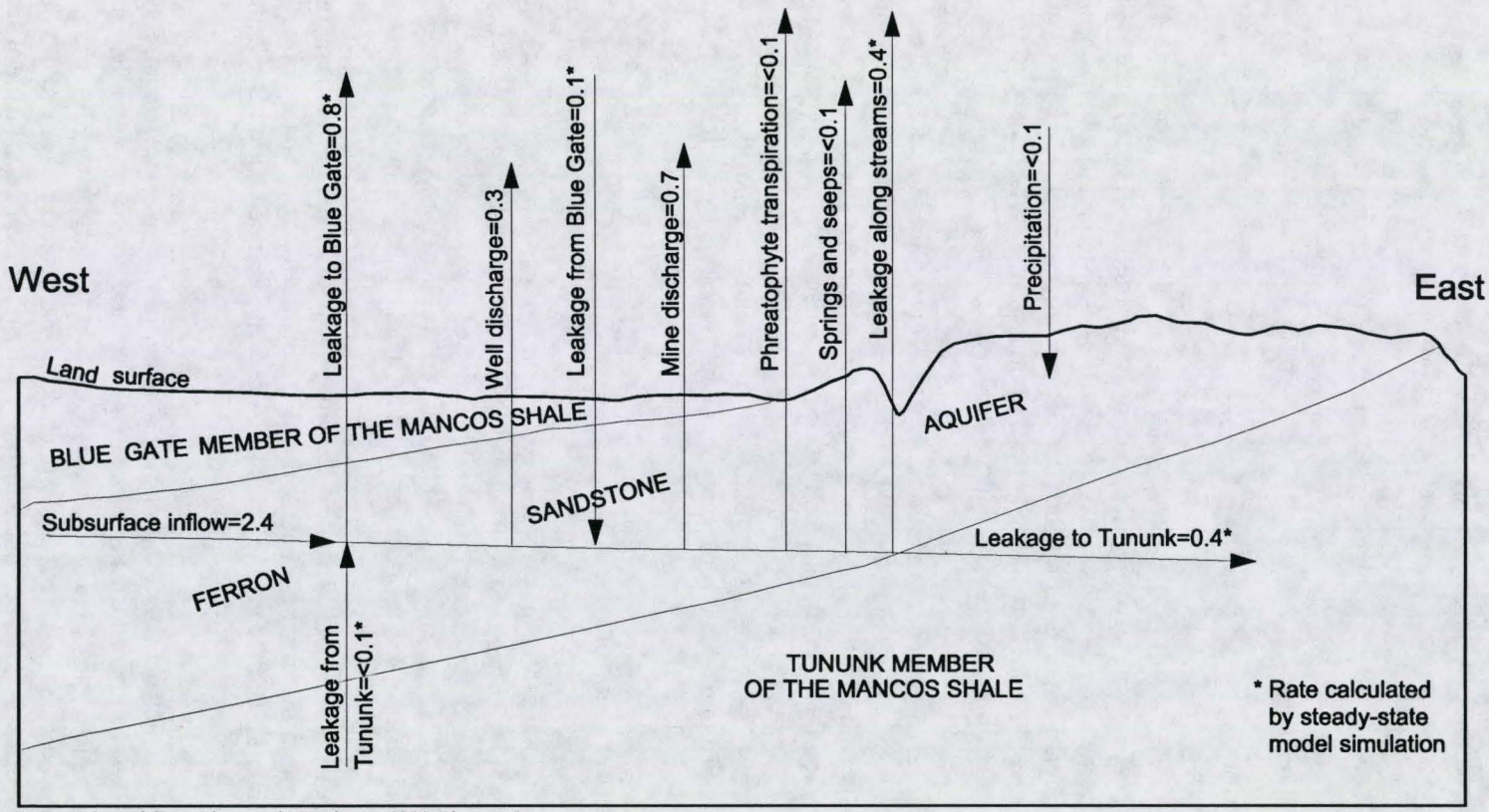
River alluvium can be a pathway for recharge of underlying aquifer units. East of the Wasatch Plateau and throughout most of the Project Area, the alluvium overlies the impermeable Mancos Shale. Alluvium is deposited by streams and is typically composed of varied, non-indurated mixture of gravel, sand, silt, and clay. Due to the textural variability, aquifer properties affecting water movement through alluvium can vary greatly. Rate of flow through alluvial materials can range from $1 \times 10^{-6}$ feet per day for clay to $1 \times 10^{4}$ feet per day for gravel (Freeze and Cherry 1979). The discontinuous nature of alluvial deposits, together with their inconsistent aquifer properties, prohibits them from being considered a regionally continuous aquifer, even though they may be locally significant.

#### *3.2.2.1.2 Ferron Sandstone Aquifer*

Within the Project Area, the Ferron Sandstone aquifer consists of the whole thickness of the Ferron Sandstone Member of the Mancos Shale (Lines and Morrissey 1983). Depths to the top of the Ferron Sandstone in the vicinity of the Project Area range from about 80 feet along the eastern edge to 6,000 along the western edge (Tabet et al. 1995). Thickness varies from 180 to 300 feet (Hintze 1988). Dips range from 2 degrees to 10 degrees toward the northwest, and the member generally thickens downdip and to the south.

Water in the aquifer is confined between shale and siltstone beds within the aquifer and between enclosing shales of the overlying Blue Gate and underlying Tununk members of the Mancos Shale (Lines and Morrissey 1983). The complete thickness of the Ferron Sandstone is usually saturated with water within a short distance of the outcrop area.

In the southern third of Castle Valley, which includes the South Area, water moves through the aquifer from areas of subsurface recharge in the west and northwest toward areas of natural discharge along the Ferron outcrop. The order-of-magnitude estimates presented in **Figure 3–3** indicate discharge exceeds recharge by about 0.1 cubic foot per second; however, the precise degree of imbalance between recharge and discharge is not known. The largest source of recharge to the Ferron Sandstone aquifer is precipitation on the Wasatch Plateau to the west-northwest of Castle Valley that moves downward into the buried Ferron Sandstone through a highly permeable zone of overburden along the Paradise Valley-Joes Valley fault system (Lines and Morrissey 1983).




Note: Adapted from Lines and Morrissey, 1983-Figure 12

Figure 3-3

Diagrammatic section showing sources of recharge to and discharge from the Ferron sandstone aquifer in the Emery area, 1979. Recharge and discharge values are in cubic feet per second.

Much of the water from precipitation that recharges the aquifer at the outcrop to the east/southeast of the South Area close to the San Rafael Swell is likely discharged close to the recharge areas by leakage to underlying strata and to stream alluvium.

In the northern two-thirds of Castle Valley, which includes the North Area, recharge to the aquifer may be limited to a small amount of recharge from precipitation along a narrow strip of Ferron outcrop on the west flank of the San Rafael Swell (Lines and Morrissey 1983). Recharge by subsurface inflows from the west is likely prevented by the offset of the Ferron Sandstone along faults and the resulting break in connection and supply of subsurface inflow water to these northern parts of the aquifer.

#### 3.2.2.1.3 Entrada-Preuss Aquifer

The Entrada-Preuss aquifer consists of the Preuss Sandstone in Castle Valley (Freethey and Cordy 1991). Depths to the top of the Entrada Sandstone in the region range from 1,500 to 4,800 feet (Hunt 1998). Thickness varies from about 150 feet to 950 feet (Hintze 1988). Dips again range from about 2 degrees to 10 degrees toward the west and northwest. Water levels indicate the entire thickness of the aquifer is saturated and that a large volume of water is stored in the aquifer. The aquifer is confined by siltstones of the overlying Curtis Formation and the shaley siltstones and anhydrite beds of the underlying Carmel-Twin Creek.

#### 3.2.2.1.4 Navajo-Nugget Aquifer

The Navajo-Nugget aquifer consists of the Glen Canyon Group (Navajo Sandstone, Wingate Sandstone, and the Kayenta Formations) in the vicinity of Castle Valley and the Project Area. Depths to the top of the Glen Canyon Group range from about 2,000 to 7,000 feet (Witkind 1988). Aquifer thickness ranges from 570 to 970 feet (Hintze 1988). Dip is generally toward the west and ranges from 3 to 7 degrees.

The presence of a thrust fault that created a rubblized zone just below the middle anhydrite zone of the overlying Carmel formation is indicative of past tectonic activity in the Project Area. This fault has been detected in Price CBM Well D–3 at a depth of 5,200 ft, in Price CBM Well D–4 at 5,650 ft, and in Price CBM Well D–5 at 6,220 ft. (Conway 1997). In addition, fracture modeling has shown that horizontal stresses are present in the Navajo formation. Because of the absence of significant vertical displacement, it is difficult to determine whether this tectonic activity has resulted in thrust faults in the Navajo formation. Such faults, if they exist, could significantly affect flow patterns of ground water.

Regionally, the Navajo-Nugget Aquifer is an important aquifer (Freethey and Cordy 1991). In the vicinity of the San Rafael Swell, the aquifer's strata are reported to be very permeable and contain relatively fresh water at a shallow depth (Hood and Patterson 1984). Water in the aquifer is confined by crosscutting sedimentary structures and mudstone interbeds within the aquifer and by shales, limestones and anhydrite of the overlying Carmel-Twin Creek confining unit and underlying shales and sandy shales of the Chinle-Moenkopi confining unit (Freethey and Cordy 1991, Conway 1997). East and up-dip of the Project Area, water in the aquifer in and near the outcrop is unconfined.

Water moves through the aquifer beneath the Project Area mostly to the north in the South Area and to the east in the North Area (Hood and Patterson 1984). These flows are part of a clockwise movement of groundwater in the aquifer around the north end of the San Rafael Swell that continues generally southeast along the east flank toward the Green River (**Figure 3–4**). A notable exception to this movement occurs in the southern portion of the South Area, where discharge from the aquifer is principally to the San Rafael

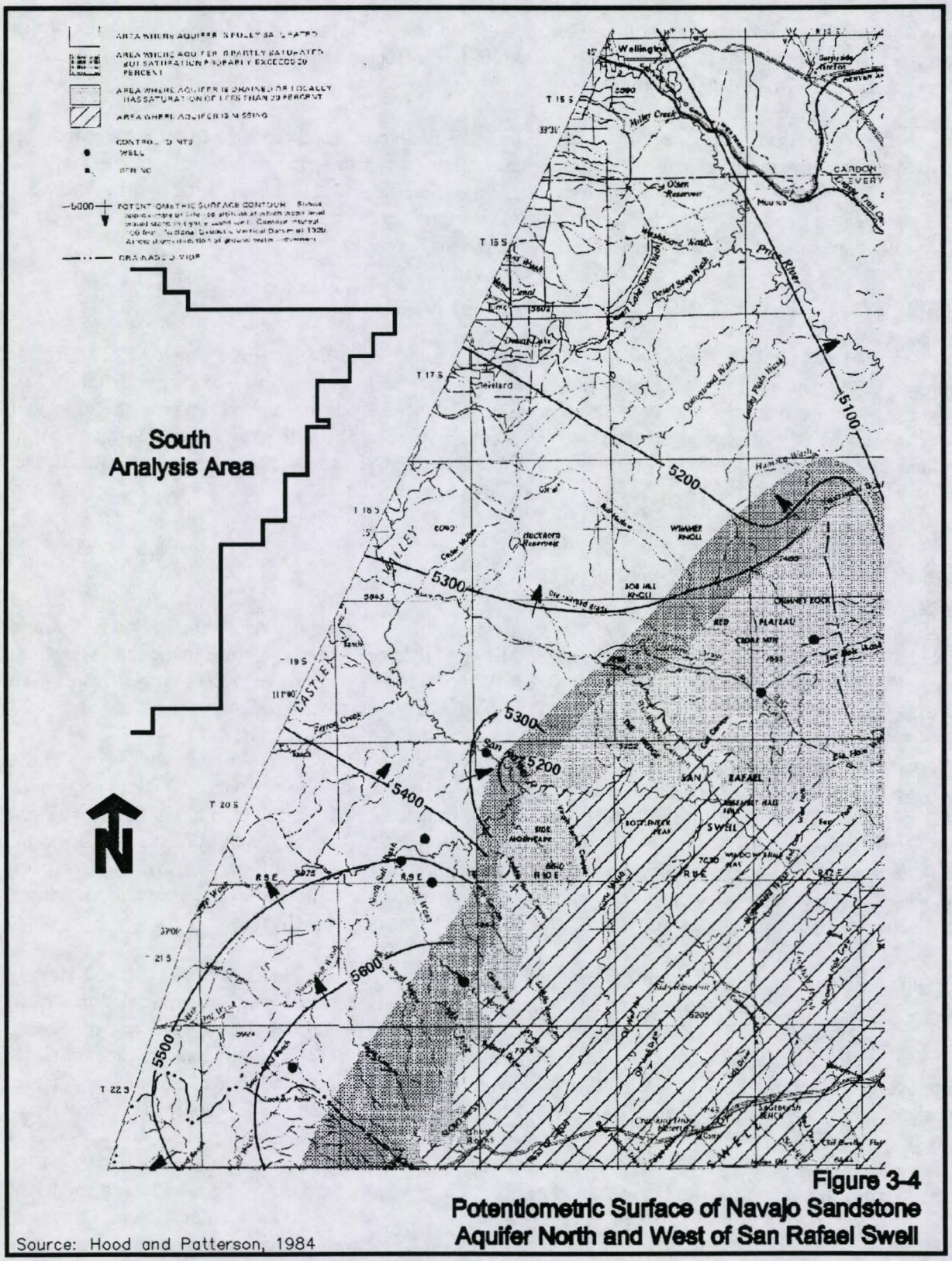



**Figure 3-4**
**Potentiometric Surface of Navajo Sandstone Aquifer North and West of San Rafael Swell**

Source: Hood and Patterson, 1984

River alluvial system west of the San Rafael Swell. This area of discharge coincides with where the river's course and alluvial deposits incise the aquifer adjacent to the San Rafael Swell (Hood and Patterson 1984). Recharge to that portion of the Navajo-Nugget Aquifer beneath the Project Area is from precipitation infiltrating into outcrops of the Glen Canyon Group, which are exposed along the western and northern flanks of the San Rafael Swell. This area of recharge is located generally southeast of the Project Area.

The lower San Rafael and Green Rivers east of the Swell receive lesser amounts of discharge (Hood and Patterson 1984).

### 3.2.2.2 Groundwater Quality

While the quality of groundwater in the Quaternary Alluvium is relatively good and supports a variety of beneficial uses, bedrock aquifers in the Project Area tend to have groundwater with very high concentrations of dissolved minerals and, thus, have limited domestic and commercial utility. The high concentrations of total dissolved solids (TDS) result from the presence of easily dissolved minerals in rocks within the formation and adjacent confining units and from the distance through which the groundwater has passed from the recharge areas to the Project Area. **Table 3–1** summarizes available water quality for the aquifers in the Project Area and compares that data to Utah groundwater quality standards.

#### *3.2.2.2.1 Quaternary Alluvium*

Because the primary source of water stored in the Quaternary Alluvium is the adjacent stream and because the stream and groundwater remain hydraulically connected, Quaternary Alluvium water quality is very similar to stream water quality. Water quality data for streams in the Project Area is presented in **Section 3.2.3.2**.

#### *3.2.2.2.2 Ferron Sandstone Aquifer*

In the southern third of Castle Valley, overall water quality of the Ferron Sandstone aquifer, as defined by presence of dissolved solids, decreases eastward from the Paradise Valley-Joes Valley fault system to the outcrop (Lines and Morrissey 1983). This west to east directional gradient generally coincides with the direction of groundwater movement. TDS concentrations also increase from the bottom to the top of the aquifer in areas downdip from the outcrop.

Water quality data from CBM wells in the Price CBM EIS area (produced water collected for disposal in Price CBM Wells D–1 and D–3), CBM wells in the South Area (produced water collected for disposal in Texaco Well SWD#1), and results from the Buzzard Bench field show TDS concentrations ranging from 6,459 to 23,099 mg/L, with very high concentrations of sodium (1,770 to 2,600 mg/L), chloride (1,412 to 7,450 mg/L), and bicarbonate (2,050 to 10,425 mg/L) (**Tables 3–1** and **3–2**). Total iron concentrations range from < 0.1 to 180 mg/L, averaging 24.1 mg/L and hydrogen sulfide concentrations range from 0 to 62 mg/L and average 7.8 mg/L. Major cation and anion relationships for Wells D–1, D–3, and SWD#1 are illustrated in the form of Stiff diagrams (**Figure 3–5**) and a trilinear diagram (**Figure 3–6**). Groundwater from all three are similar with respect to major ion chemistry and are classified as sodium chloride water types.

While available analytical data do not include many of the parameters regulated by Utah's Administrative Rules for Ground Water Quality Protection (R317–6, Utah Administrative Code), TDS and barium (6.2 mg/L) concentrations make this water unsuitable for drinking water.

## Table 3–1
## Groundwater Quality in the Ferron Sandstone and Navajo-Nugget Aquifers

| Parameters | Utah Groundwater Quality Standards | Ferron Sandstone Aquifer Produced Water Collected for Disposal in: Price CBM Well D–1 | Price CBM Well D–3 | Texaco Well SWD #1 | Navajo-Nugget Aquifer: Price CBM Well D–1 | Price CBM Well D–3 | Price CBM Well D–1 | Price CBM Well D–5 | Texaco SWD #1 | Texaco SWD #2 | Anadarko SWD #1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Regulated Constituents**[1] | | | | | | | | | | | |
| pH (standard units) | 6.5 – 8.5 | 7.93 | 8.71[2] | 7.2 | 5.96 | 6.14[2] | 7.02 – 7.14 | 6.9–7.11 | 5.8 | | 7.3 |
| Nitrate (as N) | 10 | | | | | | | | | <0.08 | |
| Nitrite (as N) | 1 | | | | | | | | | 0.005 | |
| Total Nitrate/Nitrite (as N) | 10 | | | | | | | | | <0.08 | |
| Barium | 2 | 6.2 | | | 0.2 | | | | | | 40–70 |
| Total Dissolved Solids | | 6,459 | 8,402 | 7,010 | 152,428 | 217,264 | 137,116– 138,260 | 87,140–177,624 | 21,600 | 13,100 | 64,997–107,810 |
| Pristine Groundwater | 500 | | | | | | | | | | |
| Drinking Water Quality Groundwater | 500 – 3,000 | | | | | | | | | | |
| Limited Use Groundwater | 3,000 – 10,000 | | | | | | | | | | |
| Saline Groundwater | > 10,000 | | | | | | | | | | |
| Major Cations | | | | | | | | | | | |
| Calcium | | 30.9 | 17.5 | 121 | 3,115 | 1,390 | 855 – 898 | 930–1,440 | 1,920 | 126 | 1,560–1,680 |
| Magnesium | | 11.4 | 15.8 | <0.1 | 626 | 465 | 384 – 389 | 272–530 | 1,530 | 19.1 | 146–366 |
| Sodium | | 1,770 | 2,600 | 2,300 | 41,100 | 78,500 | 47,850– 48,620 | 25,100–48,100 | 3,250 | 4,240 | 22,597–38,658 |
| Potassium | | 41.7 | 63 | 30 | 1,200 | 1,500 | | | 250 | 248 | |
| Hardness | | 124 | 109 | 303 | 10,356 | 5,386 | | | 11,100 | 467 | |
| Major Anions | | | | | | | | | | | |
| Carbonate | | 0 | 420[2] | | 0 | 0[2] | 0 | 0 | 0 | <3 | 0 |
| Bicarbonate | | 3,180 | 3,890 | 3,370 | 855 | 705 | 2,550– 2,610 | 1,850–2,750 | 478 | 1,820 | 3,416–3,904 |
| Chloride | | 1,778 | 2,518 | 1,450 | 93,130 | 116,163 | 69,652– 71,240 | 48,779–92,567 | 10,370 | 4,690 | 33,000–55,000 |
| Sulfate | | 1.2 | < 1.6 | 274 | 2,602 | 3,390 | 3,150–3,200 | 0[2] | 2,030 | 2,400 | 3,750–9,800 |
| Other Constituents | | | | | | | | | | | |
| Strontium | | 2.9 | | | 13 | < 5.0 | | | | | 0.0 |
| Aluminum | | 0.38 | < 5.0 | | < 10.0 | 10.9[2] | | | | | |
| Iron | | 1.76 | < 2.5[2] | < 0.1 | 67 | | | | 227 | 97.8 | 5.7–19.5 |
| Phosphate | | < 0.02 | | | < 0.02 | | | | | | |

Notes:
1. Concentration may have been affected by sample handling/preservation.
2. Units are mg/L unless stated otherwise

Sources: Himes 1996, UDOGM 1996 and 1997, Hurst 1994, anonymous 1997

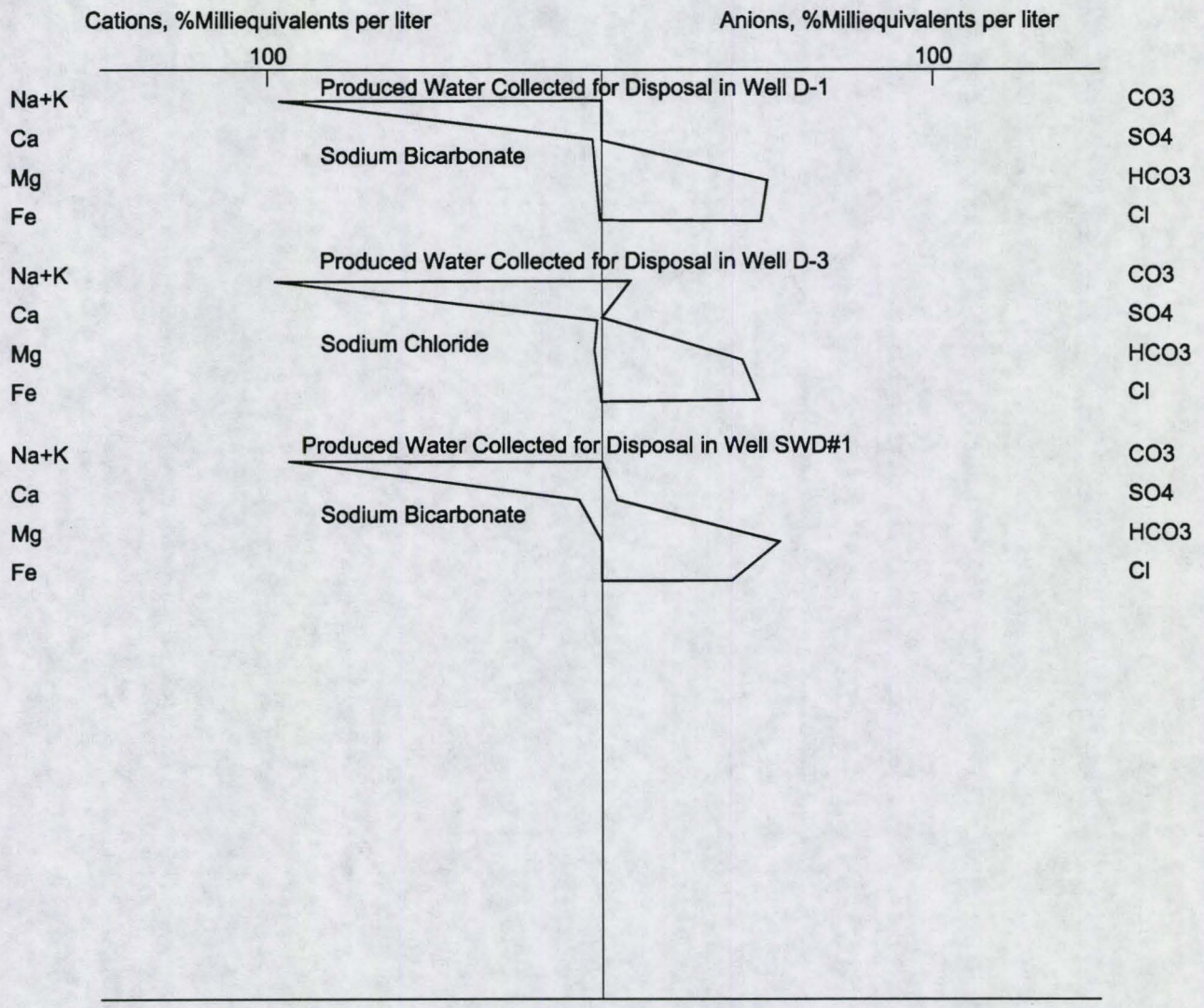
## Table 3–2
## Ferron Water Quality Produced From the Buzzard Bench Field[1]

| Section | Well No. | Area | pH | $H_2S$ | $CO_3$ | $HCO_3$ | Chloride | Sulfate | Calcium | Magnesium | TDS | Total Iron |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 34 | 12 | Grimes Wash | 7.5 | 17 | 0 | 8,875 | 1,800 | 0 | 50 | 11 | 15,206 | 18.4 |
| 35 | 14 | Grimes Wash | 8 | 5 | 30 | 9,540 | 1,900 | 0 | 44 | 2 | 16,805 | 10.8 |
| 35 | 13 | Grimes Wash | 8 | 20 | 0 | 8,069 | 1,412 | 0 | 42 | 12 | 13,415 | 6.4 |
| 2 | 11 | Grimes Wash | 7.9 | 16 | 0 | 7,300 | 1,660 | 0 | 31 | 42 | 12,780 | 10.4 |
| 2 | 48 | Grimes Wash | 7.8 | 25 | 0 | 7,925 | 2,300 | 90 | 40 | 6 | 14,821 | 11.8 |
| 2 | 49 | Grimes Wash | 7.8 | 22 | 0 | 6,440 | 3,540 | 440 | 72 | 19 | 15,358 | 55 |
| 2 | 50 | Grimes Wash | 7.8 | 18 | 0 | 6,950 | 1,950 | 600 | 54 | 13 | 13,660 | 41.4 |
| | | **AVERAGE** | **7.8** | **18** | **4** | **7,871.3** | **2080.3** | **161** | **48** | **15** | **14,578** | **22.6** |
| 4 | 44 | Anadarko | 8 | 5 | 150 | 7,900 | 2,100 | 0 | 48 | 7 | 14,834 | 1.3 |
| 9 | 45 | Anadarko | 8 | 4 | 77 | 10,425 | 3,450 | 0 | 49 | 9 | 20,258 | 7.3 |
| 10 | 47 | Anadarko | 7.6 | 8 | 0 | 8,933 | 4,600 | 0 | 51 | 12 | 19,854 | 3.2 |
| 10 | 42 | Anadarko | 7.5 | 7 | 0 | 8,200 | 2,500 | 0 | 44 | 7 | 15,378 | 9.1 |
| 10 | 43 | Anadarko | 7.6 | 18 | 0 | 7,900 | 2,100 | 0 | 32 | 2 | 14,422 | 6.9 |
| | | **AVERAGE** | **7.7** | **8** | **45** | **8,671.6** | **2950.0** | **0** | **45** | **7** | **16,949** | **5.6** |
| 7 | 64 | Creek West | 7.6 | 0 | 0 | 7,300 | 1,950 | 0 | 25 | 4 | 13,290 | 21.5 |
| 8 | 62 | Creek West | 7.5 | 11 | 0 | 9,200 | 5,000 | 0 | 20 | 17 | 20,770 | 43.0 |
| 8 | 61 | Creek West | 8.4 | 0 | 0 | 6,100 | 2,500 | 0 | 80 | 0 | 12,480 | 23.0 |
| 8 | 46 | Creek West | 7.4 | 19 | 0 | 10,100 | 3,000 | 107 | 52 | 103 | 19,190 | 180.0 |
| 9 | 60 | Creek West | 7.6 | 7 | 0 | 9,350 | 3,150 | 50 | 30 | 20 | 23,099 | 25.5 |
| | | **AVERAGE** | **7.7** | **7** | **0** | **8,410.0** | **3120.0** | **31** | **41** | **29** | **17,766** | **58.6** |
| 9 | 59 | Creek Central | 8 | 12 | 0 | 2,050 | 6,350 | 0 | 56 | 11 | 13,331 | 75 |
| 10 | 58 | Creek Central | 7.7 | 62 | 0 | 9,100 | 3,900 | 0 | 29 | 25 | 18,930 | 38.1 |
| 15 | 67 | Creek Central | 8.3 | 0 | 0 | 8,200 | 3,900 | 0 | 8 | 7 | 17,676 | 25 |
| 16 | 65 | Creek Central | 7.8 | 10 | 0 | 8,200 | 7,000 | 0 | 48 | 10 | 22,873 | 24 |
| 16 | 66 | Creek Central | 7.5 | 2 | 0 | 6,200 | 7,450 | 0 | 68 | 11 | 22,786 | 20.4 |
| | | **AVERAGE** | **7.9** | **17** | **0** | **6,750.0** | **5720.0** | **0** | **42** | **13** | **19,119** | **36.5** |
| 14 | 55 | Creek East | 7.6 | 2 | 0 | 6,700 | 1,600 | 0 | 39 | 10 | 11,873 | 2.6 |
| 23 | 8 | Creek East | 8.1 | 2 | 0 | 9,300 | 3,900 | 0 | 17 | 1 | 19,126 | 10 |
| 24 | 57 | Creek East | 8.3 | 2 | 0 | 7,300 | 3,900 | 0 | 32 | 7 | 16,494 | 16 |
| | | **AVERAGE** | **8.0** | **2** | **0** | **7,766.7** | **3133.3** | **0** | **29** | **6** | **15,831** | **9.5** |

## Table 3–2 (continued)
## Ferron Water Quality Produced From the Buzzard Bench Field[1]

| Section | Well No. | Area | pH | $H_2S$ | $CO_3$ | $HCO_3$ | Chloride | Sulfate | Calcium | Magnesium | TDS | Total Iron |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 2 | Buzzard Bench | 7.9 | 11 | 120 | 7,770 | 3,052 | 0 | 32 | 6 | 16,242 | 2.8 |
| 26 | 4 | Buzzard Bench | 8 | 3 | 136 | 6,910 | 3,145 | 0 | 28 | 6 | 16,459 | 5.4 |
| 35 | 6 | Buzzard Bench | 7.8 | 4 | 232 | 7,279 | 2,104 | 35 | 58 | 16 | 12,719 | 23.5 |
| 35 | 5 | Buzzard Bench | 8.1 | 4 | 325 | 10,087 | 3,934 | 0 | 21 | 14 | 20,714 | 3.1 |
| 34 | 7 | Buzzard Bench | 7.8 | 10 | 222 | 7,024 | 1,759 | 0 | 38 | 6 | 12,484 | 15.6 |
| | | **AVERAGE** | **7.9** | **6** | **207** | **7,814.0** | **2,798.8** | **7** | **35** | **10** | **15,724** | **10.1** |
| | 1 | SWD | 7.8 | 26 | 109 | 7,853 | 2,490 | 2 | 36 | 10 | 14,948 | 6.1 |
| | | **AVERAGE** | **7.8** | **11** | **45** | **7,886.5** | **3,206.3** | **43** | **41** | **14** | **16,525** | **24.1** |
| | | MEDIAN | 7.8 | 8 | 0 | 7,900.0 | 3,000.0 | 0 | 40 | 10 | 15,378 | 13.7 |
| | | MINIMUM | 7.4 | 8 | 0 | 7,900.0 | 1,412.0 | 0 | 8 | 0 | 11,873 | 1.3 |
| | | MAXIMUM | 8.4 | 62 | 325 | 10,425.0 | 7,450.0 | 600 | 80 | 103 | 23,099 | 180.0 |

Note:
1. Units are mg/L for all parameters except pH, which is SU (Standard Units).

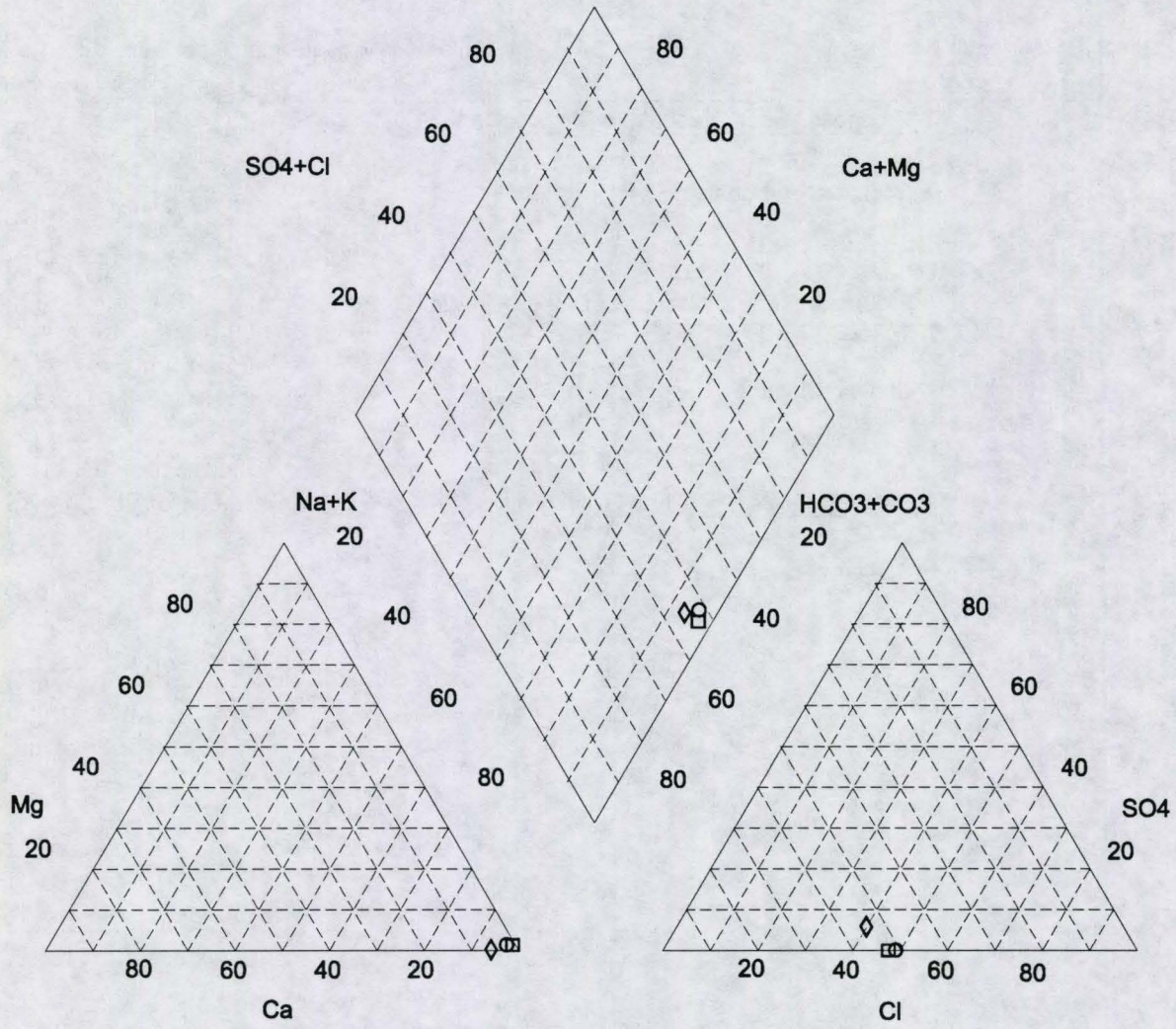



## LEGEND

Well D-1
03/04/1994
River Gas
Well D-3
05/01/1996
River Gas
Well SWD#1
01/10/1996
Texaco

647sand-stif.dwg

Figure 3-5
Stiff Diagrams for wells in the
Ferron Sandstone Aquifer
Produced Water




LEGEND

- ○ Produced Water Collected for Disposol in Well D-1
  03/04/1994
  River Gas
- □ Produced Water Collected for Disposol in Well D-3
  05/01/1996
  River Gas
- ◊ Produced Water Collected for Disposol in Well SWD#1
  01/10/1996
  Texaco

647sand-tri.dwg

Figure 3-6
Trilinear Diagrams for wells in the
Ferron Sandstone Aquifer
Produced Water

#### 3.2.2.2.3 Entrada-Preuss Aquifer

Water quality in the Entrada-Preuss is highest near the recharge areas on the west flank of the San Rafael Swell (TDS less than 1,000 mg/L) and deteriorates with distance from the recharge area (Freethey and Cordy 1991).

#### 3.2.2.2.4 Navajo-Nugget Aquifer

Although fresh water occurs in the aquifer along the perimeter of the San Rafael Swell near the recharge area, water quality degrades with increasing distance from the area of recharge (**Figure 3–7**). Water quality data from four wells in the Price CBM EIS area (Price CBM wells D–1, D–3, D–4, and D–5) and two wells in the South Area (Texaco Wells SWD#1 and SWD #2) show TDS concentrations ranging from 13,100 to 217,264 mg/L, with very high concentrations of calcium (126 to 3,115 mg/L), magnesium (19.1 to 1,530 mg/L), sodium (3,250 to 78,500 mg/L), potassium 248 to 1,500 mg/L), chloride (4,690 to 116,163 mg/L), sulfate (2,030 to 9,800 mg/L), and bicarbonate (478 to 3,904 mg/L). Major cation and anion relationships for Wells D1, D3, D5, SWD#1, and SWD #2 are illustrated in the form of a Stiff diagram (**Figure 3–8**) and a trilinear diagram (**Figure 3–9**). Groundwater from all three are similar with respect to major ion chemistry and are classified as sodium chloride water types.

While available analytical data do not include many of the parameters regulated by Utah's Administrative Rules for Ground Water Quality Protection, TDS concentrations make this water unsuitable for virtually all potential uses.

### 3.2.2.3 Groundwater Use

Water rights in the state of Utah are administered by the Utah Department of Natural Resources (UDNR) Division of Water Rights. This agency has the authority to determine whether or not a water right application or an application to change an existing water right will be approved based on state laws and statutes, including those of the proposed project.

#### 3.2.2.3.1 Quaternary Alluvium

The depths and locations of wells in the Project Area suggest that the majority are completed in the Quaternary Alluvium. These aquifers therefore constitute a locally significant source of water in the Project Area.

#### 3.2.2.3.2 Ferron Sandstone Aquifer

The largest quantities of available water from the Ferron Sandstone aquifer are within about 2 miles of the Paradise Valley-Joes Valley fault system in the vicinity of the South Area (Lines and Morrissey 1983). Pumped wells could produce 100 to 500 gallons per minute. Potential production from wells located in the southern part of Castle Valley is estimated to be 10 to 50 gallons per minute (gpm). In the northern two-thirds of Castle Valley, yields from individual wells in the Ferron Sandstone aquifer would likely be less than 10 gpm.

Because of the locally poor water quality and the depth of the aquifer, the Ferron Sandstone aquifer is not a significant source of usable water in the Project Area. However, greater use is locally made of the aquifer east of the Project Area in a small area on the west flank of the San Rafael Swell where the top of the aquifer

is at a shallower depth and the water quality is higher. The water use from the Ferron in this area is for stock watering purposes.

#### 3.2.2.3.3 Entrada-Preuss Aquifer

Because of its considerable depth and poor water quality, the Entrada-Preuss aquifer does not appear to be a source of usable ground water within or adjacent to the Project Area.

#### 3.2.2.3.4 Navajo-Nugget Aquifer

The Navajo-Nugget aquifer contains water suitable for stock irrigation, and domestic uses within a few miles of the aquifer outcrop both east and west of the San Rafael Swell and in most of the San Rafael Desert, South of Green River (Hood and Patterson 1984). However, as of 1995, the Utah Division of Water Rights regional engineer reported that no water was being withdrawn from the Navajo-Nugget aquifer in the Castle Valley area. Nevertheless, yields of more than 1,000 gpm to individual wells are locally possible in the area (Hood and Patterson 1984).

## 3.2.3 Surface Water

### 3.2.3.1 Water Quantity

Average annual precipitation in the project vicinity varies by elevation. Precipitation ranges from less than 6 inches in the lower elevations (town of Green River, 4,100 feet above mean sea level [amsl]) to more than 40 inches in the headwaters at higher elevations (Wasatch Plateau, 9,000 to 12,000 feet amsl). In these headwaters, 70 percent or more of the total annual precipitation generally falls as snow during October through April (UDNR 1972 and 1982). The Price hydrologic subarea, which includes the cities of Price and Helper and encompasses the North Area, has an average annual precipitation of 11.7 inches. The Cottonwood-Huntington hydrologic subarea of the San Rafael River Basin, which includes the South Area, has an annual precipitation of 6.1 to 8.4 inches.

The wettest months in the Price and Cottonwood-Huntington subareas are July through October. During this period, the areas receive about 41 and 45 percent of the total annual precipitation, respectively. Pan evaporation rates are 62 inches per year and lake evaporation rates are 43 inches per year (National Oceanic and Atmospheric Administration 1979). For the Project Area, the highest evaporation rates usually occur during June, July, and August, whereas the lowest evaporation rates occur during December, January, and February. About 79 percent of the total annual evaporation occurs between May and October and 55 percent of the annual evaporation occurs in June and July. One to four percent occurs during December through February (Utah Division of Water Resources 1975 and 1979).

Most drainages in the area are ephemeral, flowing in response to snowmelt or storm events. The major perennial streams and tributaries in the Project Area experience their highest flows during May, June, and July, accounting for 50 to 70 percent of the annual stream flow. These peak flows are the result of melting snow that accumulates in the higher elevations from October through April (Waddell et al. 1981). The lowest flows occur during the winter months when stream flow is more dependent on bedrock discharge (Waddell et al. 1981).

Average annual flow data have been compiled from USGS stream gaging stations (USGS 1997) and from STORET sites to provide a perspective of perennial stream flow. Upstream from the North Area, the Price

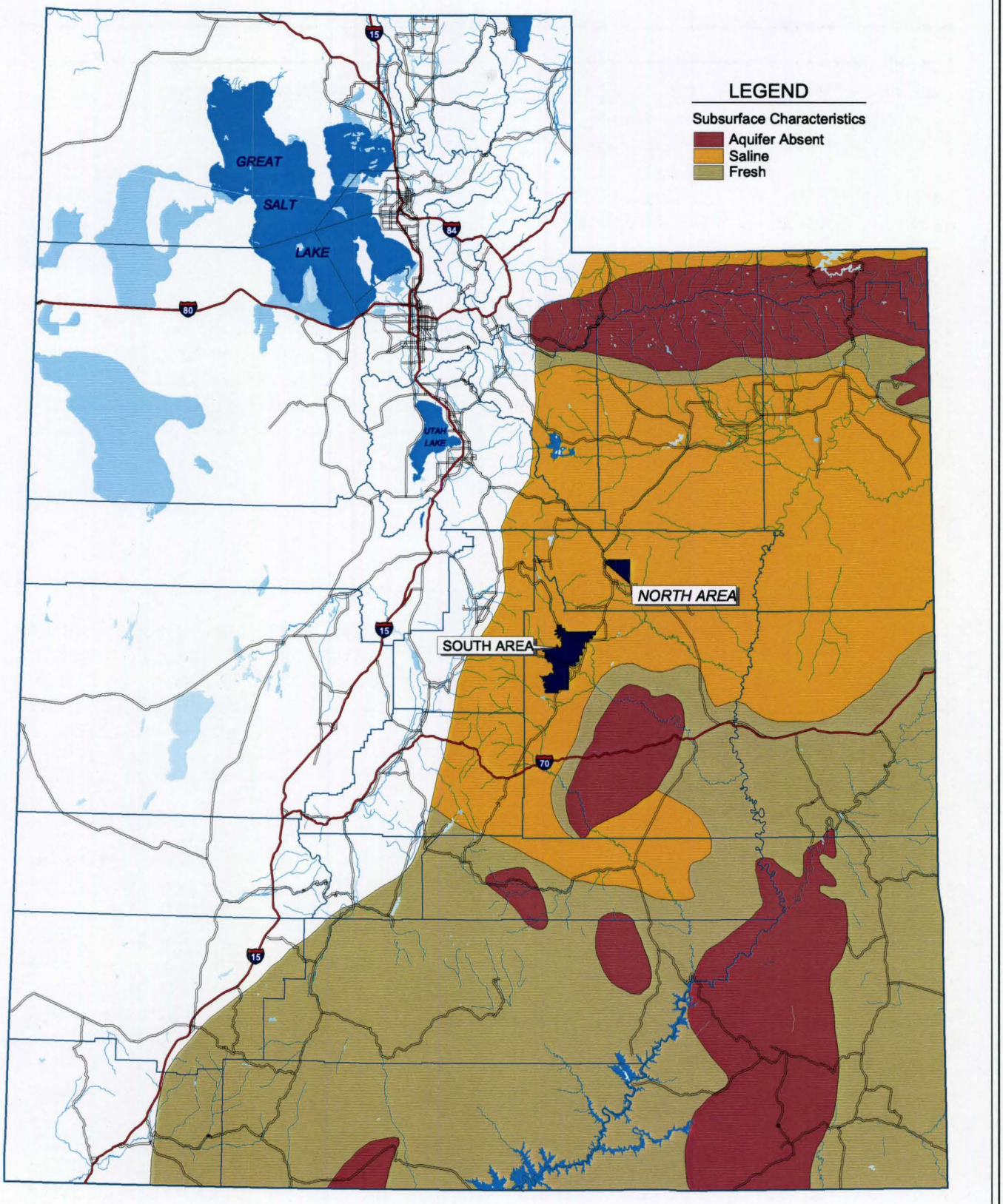



Figure 3-7
Navajo Aquifer
Water Quality Characteristics

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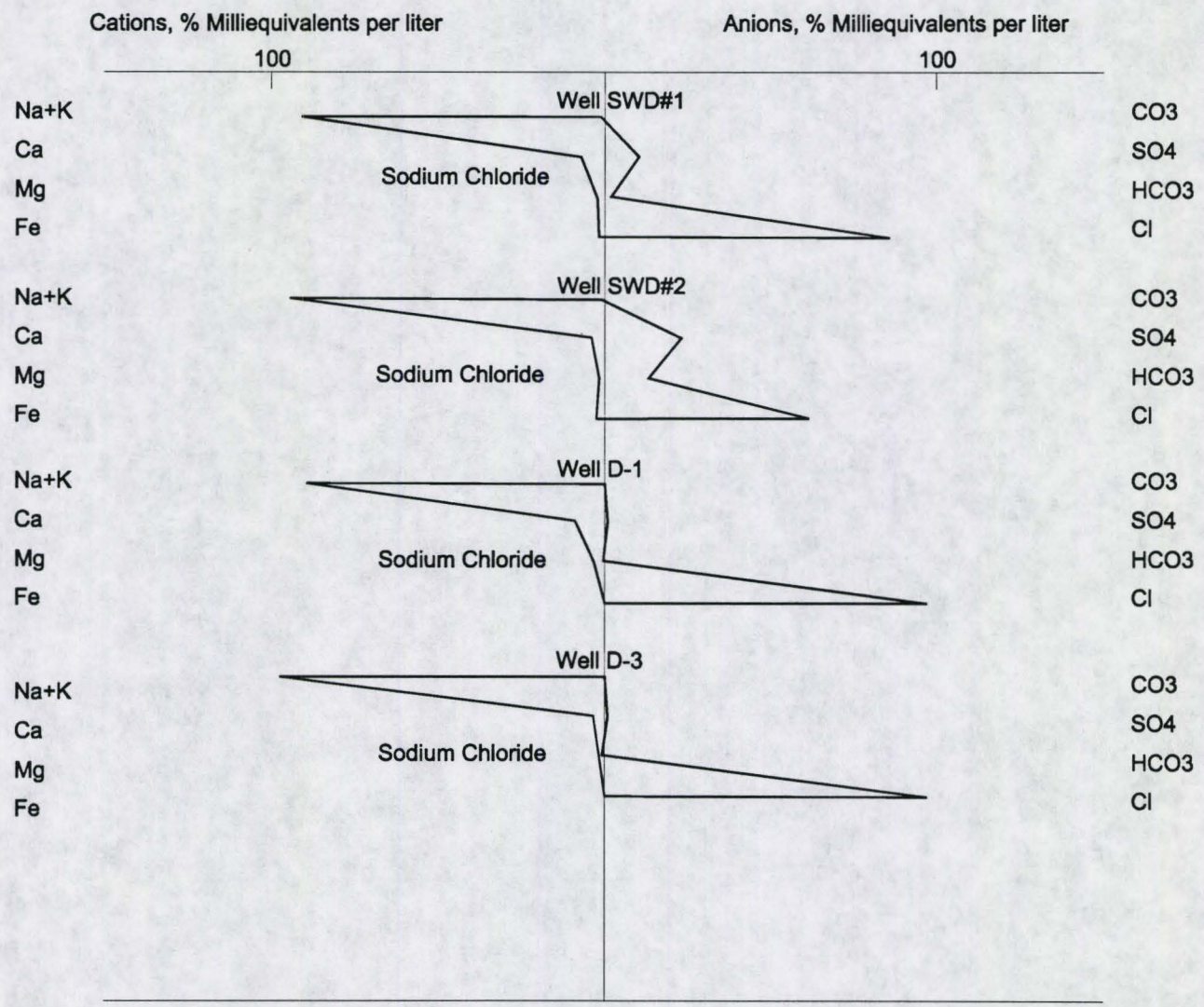



## LEGEND

Well SWD#1, 6112'-6154'
11/10/1997
Texaco

Well SWD#2, 7195'-7296'
11/14/1997
Texaco

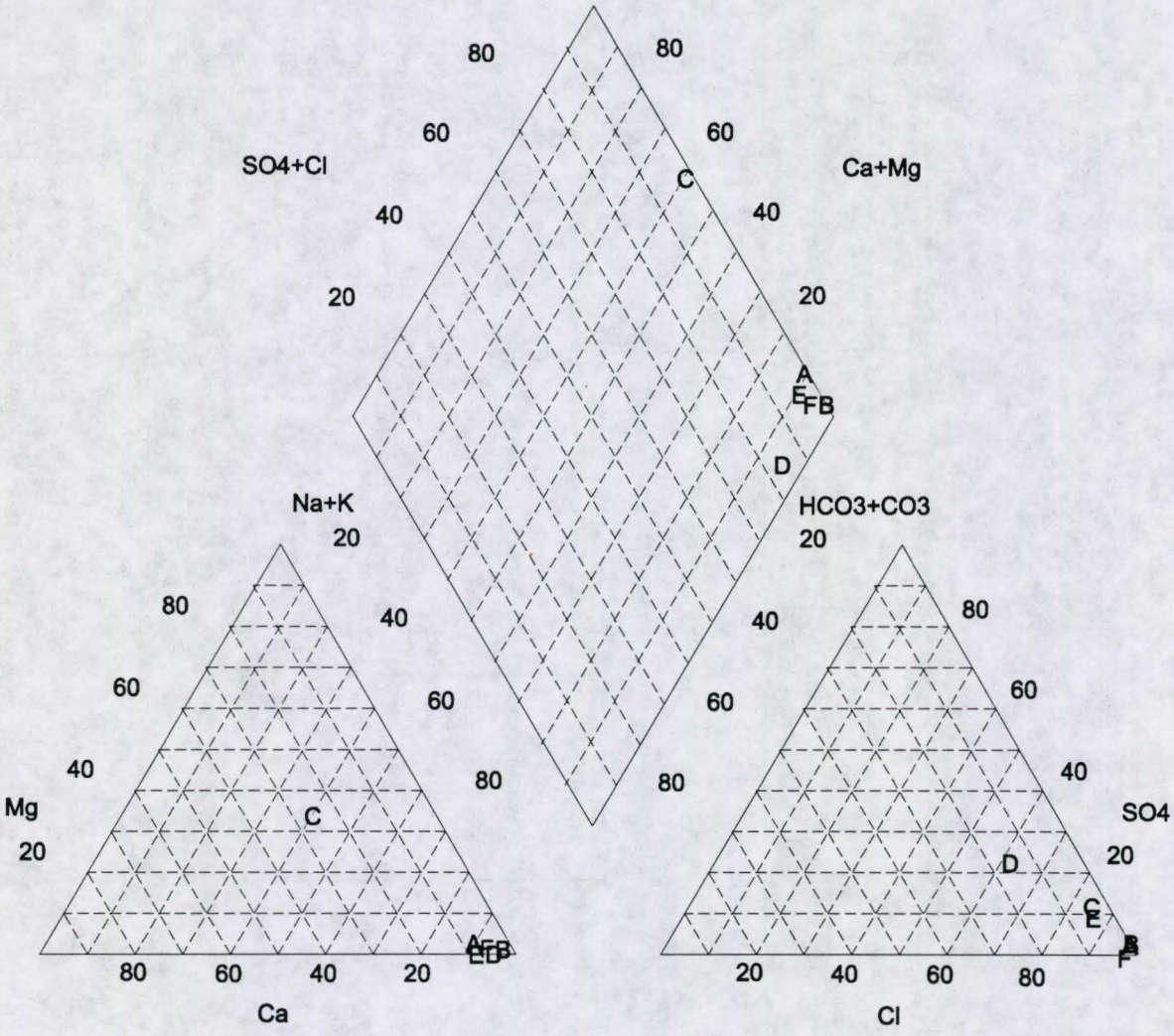
Well D-1
03/04/1994
River Gas

Well D-3
05/01/1996
River Gas

Well D-5, 6980'
09/09/1997

Figure 3-8
Stiff Diagrams for Wells in the
Navajo-Nugget Aquifer

647nava-stif2.dwg




LEGEND

A-Well D-1
03/04/1994
River Gas

B-Well D-3
05/01/1996
River Gas

C-Well SWD#1
02/15/1996
Texaco

D-Well SWD#2
11/14/1997
Texaco

E-Well SWD#1
11/10/1997
Texaco

F-Well D-5
09/09/1997

Figure 3-9
Trilinear Diagrams for Wells in the
Navajo-Nugget Aquifer

647nava-tri.dwg

River near Helper has annual average flows of 110 cubic feet per second (cfs) based on 41 years of data (**Table 3–3**). Downstream from the North Area, the Price River near Wellington has average annual flows of 88 cfs, based on nine years of data. Huntington Creek's annual flow ranges from 42.4 cfs upstream of the South Area to 75.7 cfs downstream near the city of Huntington, based on four and eleven years of data, respectively. Flows in Huntington Creek are influenced by irrigation storage reservoir releases in the headwaters west of the Project Area. Reservoirs include Electric Lake, Cleveland Reservoir, Huntington Reservoir, Rolfsson and Miller's Flat Reservoirs. Similarly, Joe's Valley Reservoir influences flows on Cottonwood Creek within the Project Area. Annual average flows on Cottonwood Creek vary from 1.32 cfs upstream to 54.1 cfs downstream at Castle Dale, based on eleven years of data, which occurred at different times. Downstream of the South Area, 58 years of data have shown an annual average flow on the San Rafael near the confluence with the Green River of 144 cfs. Ferron Creek near Ferron averages 66.6 cfs annually based on 50 years of data. Millsite Reservoir is located west of the Community of Ferron, south of the South Area's boundary. The location of stream gaging stations in the vicinity of the Project Area are presented on **Plate 3–2**.

The Federal Emergency Management Agency (FEMA) has mapped floodplains exhibiting a flooding risk in Carbon County, which are shown on **Plate 3–2**. The 100-year floodplains along the Price River range in width from 100 to 1,800 feet, and average approximately 1,000 feet. Tributaries to the Price River, Miller Creek and Deadman Creek, range in width from 150 to 600 feet. Other Price River tributaries, Hayes Wash, Meads Wash, Cardinal Wash and Drunkard's Wash have 100-year floodplains ranging in width from 50 to 400 feet. FEMA has rescinded the floodplain maps in Huntington and unincorporated areas of Emery County, as there are no 100-year hazards (Gibson 1994 and Watanabe 1996).

Little data on channel cross-sections or substrates were found after contacting representatives of the BLM and Forest Service in the area. A stream inventory survey for a proposed pipeline stream crossing of Cottonwood Creek near Orangeville was conducted. The survey showed that the Cottonwood Creek in that reach is showing signs of instability (Rosgen classification type C4). A C4 stream is a meandering, gravel-dominated stream that is slightly entrenched, having a riffle/pool channel with a well-developed floodplain. The low sinuosity, determined by the survey suggested a transitional situation. This degradation of the stream probably is the result of bank disturbances and flow controls (BLM 1997b).

Channel substrates in the eastern, gently-sloping portion of the Project Area are composed of fine-grained materials derived predominantly from the Manocs shale.

### 3.2.3.2 Surface Water Quality

Regionally, the lowest TDS concentrations occur at higher elevations and increase significantly as the streams flow away from the mountains. The highly saline nature of the Mancos Shale, over which the streams flow in the lower elevations, is largely responsible for this change. The Utah Division of Water Quality (UDWQ) found concentrations of TDS typically range from 100 to 250 mg/L at the headwaters of streams, whereas concentrations range from 1,000 to 6,000 mg/L in the lower reaches of the streams (**Table 3–4**). TDS concentration data for the Price River for 1985 to 1995 ranged from 306 mg/L near Helper for 1985 to 1995, to 1,740 mg/L downstream of Wellington during the 1995 water year. In the South Area, TDS concentrations in Huntington Creek ranged from 212 mg/L upstream to 2,595 mg/L downstream. Cottonwood Creek TDS concentration data ranged from 212 mg/L upstream to 1,041 mg/L downstream. Ferron Creek TDS concentration averaged 812 mg/L between 1985 and 1995. The San Rafael River is typically slightly more saline than the Price River. TDS concentrations averaged 2,781 mg/L in the San Rafael River at U–24 and 2,255 mg/L between 1980 and 1997 in the San Rafael River at Chaffin Ranch.

## Table 3–3
## Stream Flow Discharge Data (in vicinity of Project Area)

| Station | Location [Latitude/Longitude] | Data Water Year(s) | Average Flow (cfs) | Maximum (date) | Minimum (date) |
|---|---|---|---|---|---|
| USGS Station # 09313000 | Price River, near Helper [39 43 08/110 51 55] | 1996 | 127 | 657 (5/17/96) | 7.0 (12/28/95) |
| | | 1935–69, 1980–81, 1991–96 | 110 | 9,340 (9/13/40) | 0.4 (8/21/61) |
| USGS Station # 09314250 | Price River, below Miller Creek, near Wellington [39 43 08/110 51 55] | 1972–81 | 88.3 | 791.7 (10/81) | 8.4 (1/78) |
| USGS Station # 09317997 | Huntington Creek, near Huntington [39 23 07/111 05 15] | 1996 | 95.4 | 548 (5/16/96) | 9.4 (5/2/96) |
| | | 1979–80, 1986–96 | 75.7 | 1,680 (5/24/84) | 3.0 (2/25/81) |
| UDWQ Storet # 493101–03 | Cottonwood Creek, near Straight Canyon [39 17 10/111 16 10] | 1977–88 | 1.32 | 200 (6/5/80) | 0.14 (9/6/78) |
| UDWQ Storet # 493093–03 | Cottonwood Creek, at U10 in Castle Dale [39 12 34/111 01 10] | 1947–1958 | 54.1 | 1,450 (6/4/52) | 0.0 (8/8/56) |
| USGS Station # 09326500 | Ferron Creek (Upper Station), near Ferron [39 06 15/111 12 57] | 1996 | 60.5 | 512 (5/15/96) | 8 (1/27/96) |
| | | 1912–23, 1948–96 | 66.6 | 4,180 (8/27/52) | 0 (10/19/76) |
| USGS Station # 09328500 | San Rafael River, near Green River [38 51 30/110 22 10] | 1996 | 91.3 | 753 (6/12/96) | 11 (9/8/96) |
| | | 1910–18, 1946–96 | 144 | 12,000 (9/2/09) | 0 (various years) |
| USGS Station # 09315000 | Green River, at Green River [38 59 10/110 09 02] | 1996 | 6281 | 24,000 (5/22/96) | 2,070 (9/5/96) |
| | | 1906–1996 | 6192 | 68,100 (6/27/17) | 255 (11/26/31) |

Source: USGS 1997, UDWQ 1997, Hood and Patterson 1984.

Surface water quality monitoring stations in the vicinity of the Project Area are presented on **Plate 3–2** and **Table 3–4**.

Water type also changes with elevation. Streams in the higher elevation of the Wasatch Plateau are typically calcium bicarbonate type waters (i.e., the primary dissolved constituents are calcium and bicarbonate). As the streams flow across the Mancos Shale lowlands, both as natural flow and as irrigation return flow from highly locally saline soils, they change to sodium-sulfate type waters (**Figures 3–10, 3–11** and **3–12**). The waters are alkaline and have high levels of hardness.

Long-term total suspended solids (TSS) data from sites on the Green River, San Rafael River and Cottonwood Creek are very high and could pose limitations for aquatic life. Concentrations reflect the highly erosive nature of the shale deposits through which the rivers flow.

**Table 3–4**
**Surface Water Quality Data (in vicinity of Project Area)**

| Location | Data Years | Average TDS (mg/L) |
|---|---|---|
| Price River at Helper | 1985–95 | 306 |
| Price River above Wellington | 1985 | 323 |
| | 1994–95 | 287 |
| Price River below Wellington | 1985 | 987 |
| | 1994–95 | 1,740 |
| Huntington Creek above Trail Canyon Creek | 1978–82 | 212 |
| Huntington Creek at Huntington | 1985–95 | 2,595 |
| Cottonwood Creek below Straight Canyon | 1974–79 | 212 |
| Cottonwood Creek at U–10 | 1985–95 | 1,041 |
| Ferron Creek at U–10 | 1985–95 | 812 |
| San Rafael River at Chaffin Ranch | 1980–97 | 2,255 |
| San Rafael River at U–24 | 1977–82 | 2,781 |

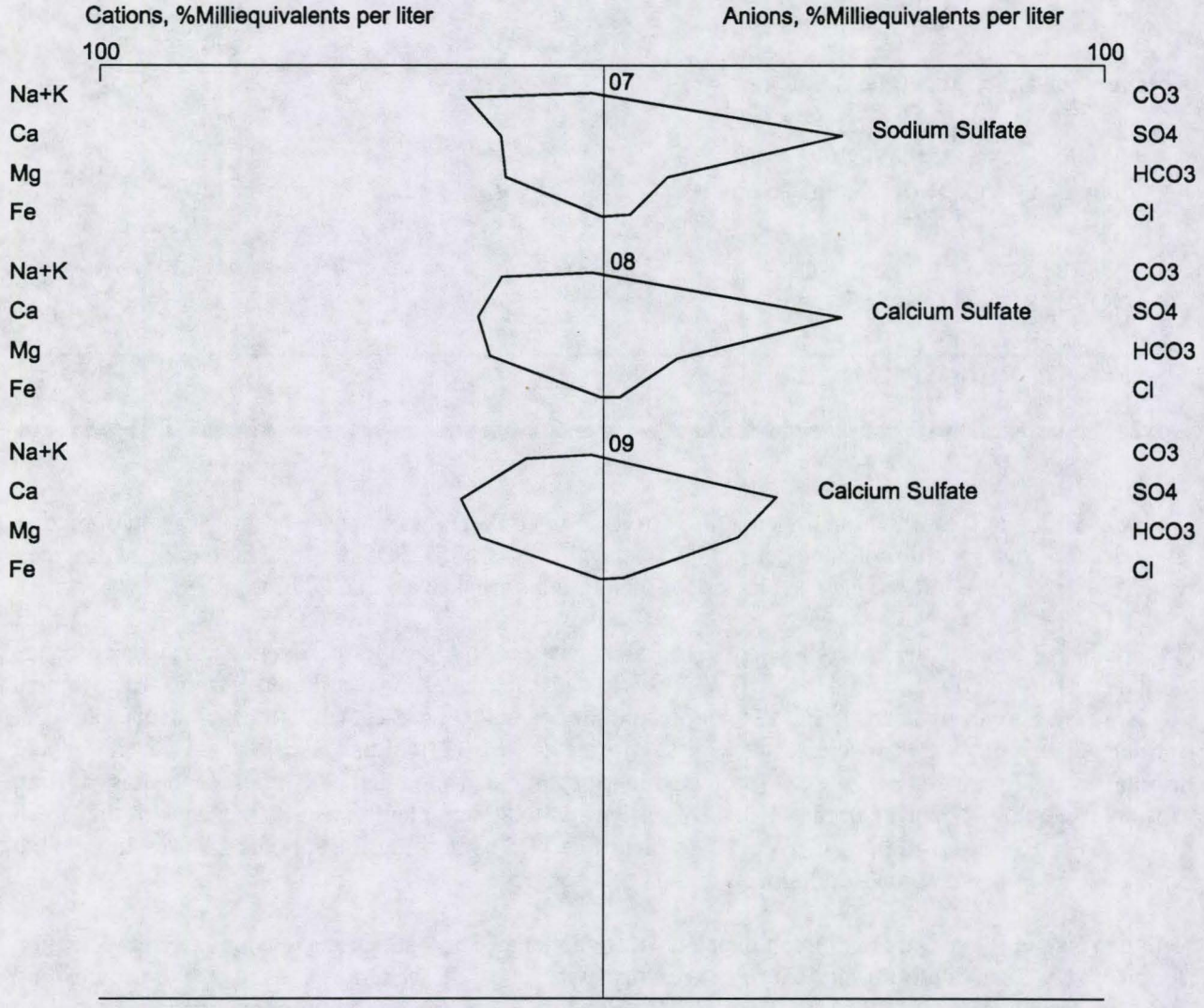
Source: UDWQ 1997

**Table 3–5** summarizes water quality data for various STORET sites. For the site specific period of record, averages for flow, specific conductance, total suspended solids (TSS), TDS and total hardness are provided when available. In addition, the use classes for various sites are provided and defined.

The quality of water in the Price River and San Rafael River is protected for designated uses in accordance with the Utah water quality standards (UDWQ 1994). The Price River and its tributaries from its headwaters to Castle Gate are designated as Class 1C (protected for domestic purposes with prior treatment), Class 3A (protected for cold water species), and Class 4 (protected for agricultural uses). The Price River and tributaries are designated as Class 3C (protected for nongame fish and other aquatic life) and Class 4, from Castle Gate below the intake of the Price City wastewater treatment plant to its confluence with the Green River. The 1996 305B Report (UDWQ 1996) identifies TDS as limiting full support of agriculture along the Price River due to agriculture impacts and natural sources.

The San Rafael River and Huntington Creek are designated as Class 2B (protected non-contact recreation for boating, water skiing, and similar uses, excluding swimming), Class 3C, and Class 4. All of Cottonwood Creek is designated Class 2B and Class 4. In addition, the upper reaches below Straight Canyon are also designated 1C and 3A and Cottonwood Creek below Castle Dale Lagoons is also designated Class 3C. Reaches designated as Class 4 within the South Study Area are not fully supporting of agricultural uses due to elevated levels of TDS (UDWQ 1996).

Salinity standards have been adopted by the states of the Colorado River Basin for different locations on the Colorado River. In part, these standards were set to protect water quality in the Colorado River from increased salinity due to return flow from agricultural lands. In essence, there can be no increase in salinity of waters flowing into the Colorado River. These standards apply to the Green River and to its tributaries.




## LEGEND

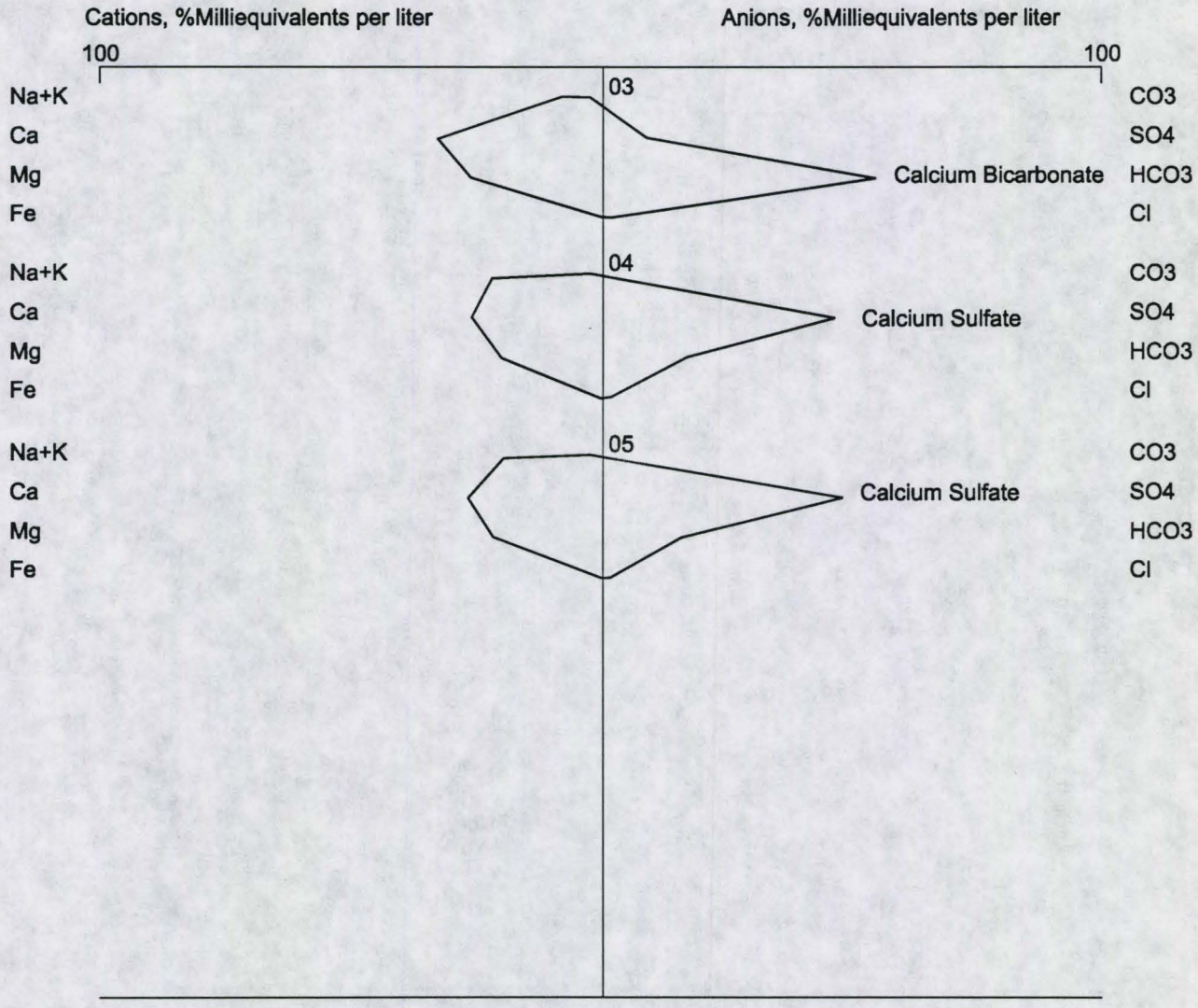
07 DOWNSTREAM
STORET 49323003
01/07/81

08 MIDSTREAM
STORET 49324803
01/06/81

09 UPSTREAM
STORET 493255
01/07/81

647789.dwg

Figure 3-10
Stiff Diagrams for Sites on the Price River




## LEGEND

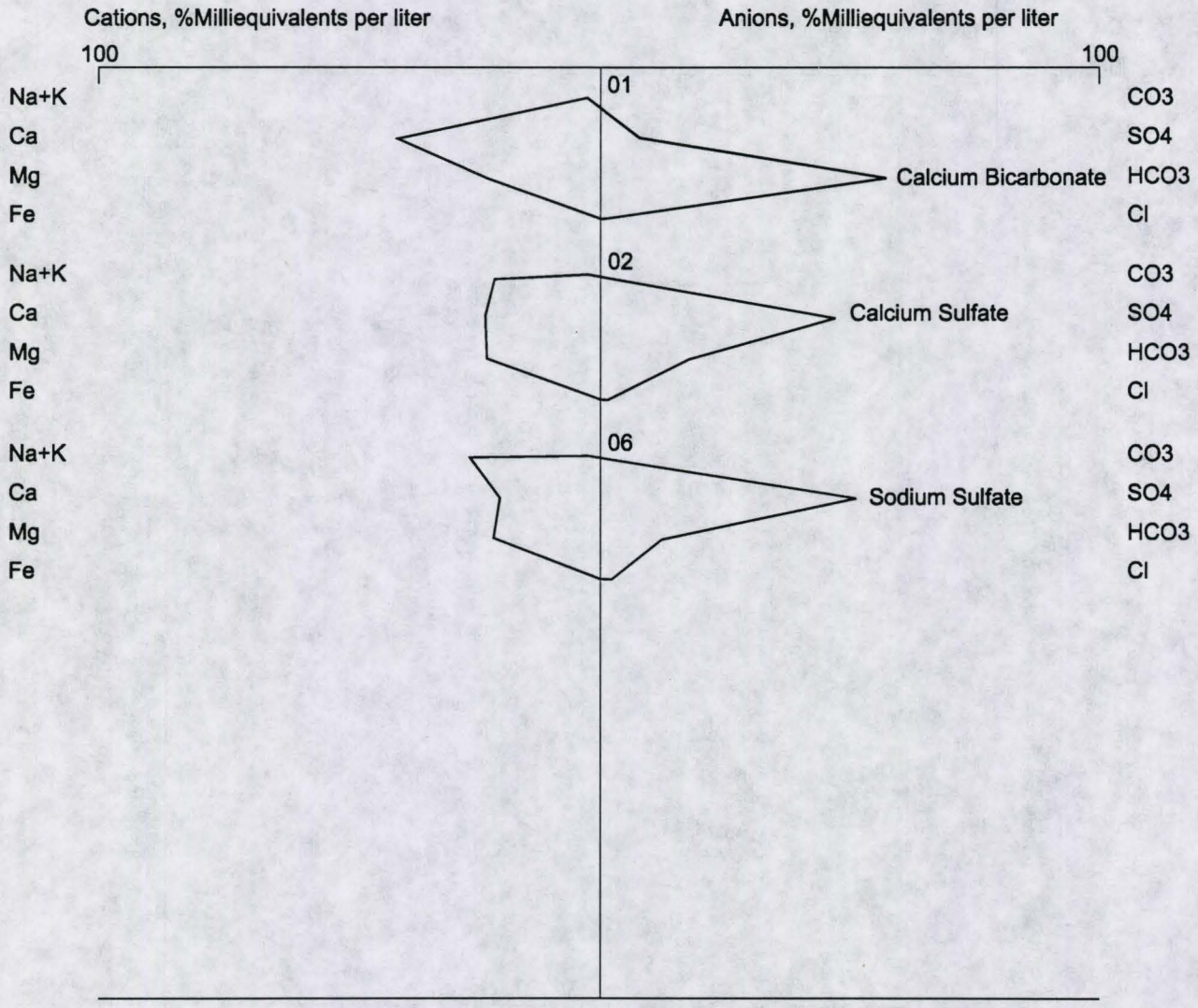
03 UPSTREAM
STORET 49310103
02/08/75

04 MIDSTREAM
STORET 49309403
02/14/75

05 DOWNSTREAM
STORET 49303903
02/14/75

Figure 3-11
Stiff Diagrams for Sites on the Cottonwood Creek

647345.dwg




## LEGEND

01 HUNTINGTON CREEK UPSTREAM
STORET 49305903
02/14/79

02 HUNTINGTON CREEK DOWNSTREAM
STORET 49305203
03/23/83

06 SAN RAFAEL AT CHAFFIN RANCH
STORET 49302703
02/08/83

647126.dwg

Figure 3-12
Stiff Diagrams for Sites on the
Huntington Creek and the San Rafael River

## Table 3–5
## Water Quality Data (Various Storet Sites)

| Storet | Sample Point [Period of Record] | F-Average Specific Conductance (umhos/cm) [# of samples] | L-Average Specific Conductance (umhos/cm) [# of samples] | Average Flow (cfs) [# of samples] | Average TSS (mg/L) [# of samples] | Average Total Hardness (mg/L) [# of samples] | Average TDS (mg/L) [# of samples] | Location | | Use Classes[1] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Latitude | Longitude | |
| **493001-03** | **GREEN R AB CNFL/ COLORADO RIVER** | **730** | **714** | **8828.1** | **716.37** | **248** | **477** | **38 11 25** | **109 53 21** | **1C 2B 3B 4** |
| | [5/83-8/97] | [43] | [52] | [16] | [51] | [52] | [52] | | | |
| **493027-03** | **SAN RAFAEL R AT CHAFFIN RANCH** | **2547** | **2591** | **138.1** | **1867.42** | **973.5** | **2255** | **38 45 32** | **110 08 24** | **2B 3C 4** |
| | [6/80-6/97] | [124] | [127] | [87] | [127] | [126] | [127] | | | |
| **493029-03** | **SAN RAFAEL R AT U24 XING** | **2671** | **3145** | **No Data** | **1034.72** | **1161.9** | **2781** | **38 51 23** | **110 22 13** | **2B 3C 4** |
| | [8/77-6/82] | [48] | [65] | [-] | [47] | [62] | [65] | | | |
| **493047-07** | **DEER CK MINE 001 SED POND OUTFALL** | **2851** | **NA[2]** | **<0.2** | **<15.59** | **NA** | **2034** | **39 21 36** | **111 06 35** | **-** |
| | [10/90-8/97] | [43] | [-] | [10] | [44] | [-] | [44] | | | |
| **493048-07** | **DEER CK MINE 002 OUTFALL** | **838** | **NA** | **10.4** | **<18.00** | **NA** | **558** | **39 21 28** | **111 06 56** | **-** |
| | [2/91-11/93] | [18] | [-] | [3] | [19] | [-] | [19] | | | |
| **493050-03** | **HUNTINGTON CK BL HUNTINGTON LAGOONS OUTFALL** | **3022** | **2870** | **6.4** | **<43.89** | **1200** | **3462** | **39 18 20** | **110 55 11** | **2B 3C 4** |
| | [12/78-9/97] | [23] | [2] | [22] | [9] | [2] | [5] | | | |
| **493051-07** | **HUNTINGTON LAGOONS OUTFALL** | **3608** | **3748** | **0.7** | **<8.92** | **1960** | **3294** | **39 18 46** | **110 55 15** | **-** |
| | [10/97-9/97] | [55] | [14] | [6] | [72] | [2] | [41] | | | |
| | INFLUENT | 2753 | 3246 | NA | 88.63 | 1166.1 | 2579 | | | |
| | [6/87-7/87] | [3] | [9] | [-] | [8] | [4] | [9] | | | |
| | CELL #1 | 3420 | 3398 | NA | 24.5 | 1283.1 | 2825 | | | |
| | [6/87-7/87] | [4] | [8] | [-] | [8] | [4] | [8] | | | |
| | CELL #2 | 3485 | 3404 | NA | 13.38 | 1357.1 | 2845 | | | |
| | [6/87-7/87] | [4] | [8] | [-] | [8] | [4] | [8] | | | |
| | CELL #3 | 3247 | 3448 | NA | 34.83 | 1321.6 | 2888 | | | |
| | [6/87-7/87] | [3] | [6] | [-] | [6] | [4] | [6] | | | |
| **493052-03** | **HUNTINGTON CK AB HUNTINGTON LAGOONS OUTFALL** | **2429** | **2582** | **17.9** | **<128.02** | **1605.9** | **2368** | **39 18 58** | **110 55 22** | **2B 3C 4** |
| | [10/78-7/97] | [115] | [93] | [99] | [101] | [93] | [97] | | | |

## Table 3–5 (continued)
## Water Quality Data (Various Storet Sites)

| Storet | Sample Point [Period of Record] | F-Average Specific Conductance (umhos/cm) [# of samples] | L-Average Specific Conductance (umhos/cm) [# of samples] | Average Flow (cfs) [# of samples] | Average TSS (mg/L) [# of samples] | Average Total Hardness (mg/L) [# of samples] | Average TDS (mg/L) [# of samples] | Location | | Use Classes[1] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Latitude | Longitude | |
| 493057-07 | COOP MINE WATER DISCHARGE 004 TO BEAR CK | 659 | NA | 1.8 | <7.11 | NA | 357 | 39 24 40 | 111 05 30 | - |
| | [11/93-8/97] | [14] | [-] | [2] | [14] | [-] | [14] | | | |
| 493058-03 | TRAIL CANYON CK AB CNFL/ HUNTINGTON CK | 684 | 720 | 0.4 | <1045.4 | 369.4 | 431 | 39 24 55 | 111 07 02 | 2B 3C 4 |
| | [10/78-6/82] | [14] | [11] | [5] | [10] | [10] | [14] | | | |
| 493059-03 | HUNTINGTON CK AB CNFL/TRAIL CANYON CK | 325 | 366 | 42.4 | 43.1 | 195.8 | 212 | 39 24 54 | 111 07 11 | 2B 3C 4 |
| | [10/78-6/82] | [15] | [12] | [3] | [10] | [12] | [14] | | | |
| 493064-03 | TRAIL CANYON CK AB CO-OP MINE | NA | NA | NA | 268 | NA | 536 | 39 25 16 | 111 07 04 | 2B 3C 4 |
| | [2/79] | [-] | [-] | [-] | [1] | [-] | [1] | | | |
| 493071-07 | WILBERG MINE WATER OUTFALL 001 | 1019 | 854 | <3.0 | <7.48 | 359.2 | 680 | 39 19 23 | 111 06 50 | - |
| | [8/76-8/21] | [58] | [8] | [13] | [62] | [5] | [65] | | | |
| 493073-07 | WILBERG SURFACE POND DISCHARGE 003 | 3027 | NA | NA | <36.33 | NA | 1894 | 39 19 09 | 111 07 14 | - |
| | [12/82-8/97] | [28] | [-] | [-] | [29] | [-] | [29] | | | |
| 493077-03 | HUNTINGTON CK BL CNFL/L FK HUNTINGTON CK | NA | 281 | NA | 26 | 152.5 | 160 | 39 30 02 | 111 09 30 | 1C 2B 3A 4 |
| | [7/94] | [-] | [1] | [-] | [1] | [1] | [1] | | | |
| 493078-03 | L FK HUNTINGTON CK AB CNFL/ HUNTINGTON CK | NA | 271 | 32.7 | 15 | 152.5 | 150 | 39 29 59 | 111 09 32 | 1C 2B 3A 4 |
| | [7/94] | [-] | [1] | [1] | [1] | [1] | [1] | | | |
| 493079-03 | NUCK WOODWARD CK 1.5 MI AB CNFL/ HUNTINGTON CK | NA | 303 | 0.1 | 3 | 167.5 | 184 | 39 32 17 | 111 07 51 | 1C 2B 3A 4 |
| | [7/94] | [-] | [1] | [1] | [1] | [1] | [1] | | | |

## Table 3–5 (continued)
## Water Quality Data (Various Storet Sites)

| Storet | Sample Point [Period of Record] | F-Average Specific Conductance (umhos/cm) [# of samples] | L-Average Specific Conductance (umhos/cm) [# of samples] | Average Flow (cfs) [# of samples] | Average TSS (mg/L) [# of samples] | Average Total Hardness (mg/L) [# of samples] | Average TDS (mg/L) [# of samples] | Location | | Use Classes[1] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Latitude | Longitude | |
| 493088-03 | COTTONWOOD CK BL CASTLE DALE LAGOONS EFFLUENT | 1816 | NA | 12 | 10 | NA | NA | 39 10 20 | 110 56 11 | 2B 3C 4 |
| | [8/93-7/97] | [18] | [-] | [18] | [1] | [-] | [-] | | | |
| 493090-07 | CASTLE DALE LAGOONS OUTFALL | 2053 | NA | 1.9 | <7.63 | NA | 1710 | 39 11 30 | 111 00 30 | - |
| | [1/92-8/97] | [32] | [-] | [6] | [33] | [-] | [32] | | | |
| 493093-03 | COTTONWOOD CK AT U10 XING IN CASTLE DALE | 1389 | 1258 | 55.9 | <125.66 | 569.8 | 982 | 39 12 34 | 111 01 10 | 2B 4 |
| | [2/79-7/97] | [124] | [104] | [8] | [100] | [104] | [105] | | | |
| 493094-03 | COTTONWOOD CK AT U57 XING AB CASTLEDALE | 1044 | 1035 | 2 | 71 | 475.2 | 957 | 39 13 53 | 111 03 08 | 2B 4 |
| | [2/79-6/80] | [5] | [5] | [1] | [4] | [5] | [6] | | | |
| 493100-03 | STRAIGHT CYN CK AT USFS BNDY AB CNFL/COTTONWOOD CK | NA | 381 | 297.8 | <8.67 | 195.3 | 201 | 39 16 15 | 111 11 14 | 1C 2B 3A 4 |
| | [6/95-10/95] | [-] | [3] | [3] | [3] | [3] | [3] | | | |
| 493101-03 | COTTONWOOD CK 0.1 MI BL STRAIGHT CN BL JOES VALLEY RES | 313 | 425 | 166 | 5 | 208.5 | 212 | 39 17 10 | 111 16 10 | 1C 2B 3A 4 |
| | [12/74-9/79] | [4] | [12] | [2] | [2] | [11] | [5] | | | |

Notes:

1. Use Classes: 1C – Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Department of Health.
   2B – Protected for boating, water skiing, and similar uses, excluding recreational bathing (swimming).
   3A – Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.
   3B – Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.
   3C – Protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.
   4 – Protected for agricultural uses including irrigation of crops and stockwatering.
2. NA = Not Available

Sources: UDWQ 1997, Utah Bureau of Water Pollution Control 1990.

Current soil loss and soil salinity characteristics of the proposed disturbance areas were modeled. Projected disturbance areas were coupled with GIS information of soil erodibility and salinity characteristics to calculate soil loss using the Revised Universal Soil Loss Equation (RUSLE). Downgradient sediment delivery was estimated to be 40 percent of sediment loss. Soil loss averaged 0.4 and 0.7 tons/acre/year in the North and South areas, respectively and sediment delivery ranged between 0.2 and 0.3 tons/acre/year in the North and South areas, respectively.

Salt delivery calculations utilized sediment delivery results and salinity data from the NRCS. Salt delivery on undisturbed soils was less than 0.02 tons of salt per year on both areas. Additional details about the modeling can be reviewed in **Appendix E**.

### 3.2.3.3 Water Use

The Utah State Division of Water Resources analyzed water budgets on the Price River and San Rafael basins in 1975 and 1979. The results are summarized in **Table 3–6**. The results reflect analyses of the Price River watershed from north of Helper to Woodside, Utah, and analyses of the San Rafael watershed from the west end of the South Area to the San Rafael River near Castle Dale. Inflows to the watershed consist of river flows, drainage imports from other basins, and precipitation. Depletions consist of irrigation, domestic and industrial uses, and wetland storage. Wetland and alluvial storage is responsible for more than 50 percent of the depletions in this reach of the Price River. Irrigation is the next most dominant use and

**Table 3–6**
**Division of Water Resources Water Balance Summary**

| **Project Area Drainage** | | | |
|---|---|---|---|
| **Water Supply Source** | **Annual Supply (acft/yr)** | **Water Supply Source** | **Annual Supply (acft/yr)** |
| **INFLOWS** | | | |
| Price River @ Helper (North Area) | 75,742 | Cottonwood, Huntington & Ferron (South Area) | 129,800 |
| Drainage Imports | | | |
| Canals | 25,383 | | 5,078 |
| Domestic Lines | 2,388 | | |
| Power Plant | | | 7,000 |
| Tributary Inflow | 39,086 | | 2,780 |
| Precipitation | | | |
| Cropland | 19,490 | | 11,472 |
| Wetland | 10,594 | | 2,330 |
| **Total Inflows** | **142,599** | | **125,560** |
| **DEPLETIONS** | | | |
| Irrigation | 27,551 | | 47,478 |
| Domestic & Industrial | 7,283 | | 29,322[2] |
| Wetlands | 42,925 | | 8,250 |
| **River Outflow** | | San Rafael River near Castle Dale | |
| Price River @ Woodside | **75,434** | | **58,180** |

Sources: Utah Division of Water Resources 1975 and 1979, Humphry 1999

domestic and industrial uses are a distant third. The San Rafael River watershed has a different use pattern. Irrigation is the dominant water use in this reach, followed by domestic and industrial uses and wetland storage.

Water supply information for Carbon and Emery counties is provided in **Table 3–7**. For each water system, the population, calculated peak demand, and use are provided. When available, the source type and associated yields for each water system is provided. Surface water supplies, springs and wells are used to provide water for the municipalities. All large municipalities within the Project area use surface water or spring water for their water supplies except Helper, which utilizes a well.

Irrigation and industrial water use for Cottonwood and Huntington Creek for 1984, 1991 and 1996, are provided in **Table 3–8**. Irrigation use has varied between 37 and 56 million gallons per day (mgpd) for Cottonwood Creek, and between 46 and 77 mgpd for Huntington Creek. Industrial use has ranged from 5 to 10 mgpd for Cottonwood Creek and 8 to 11 mgpd for Huntington Creek. The 1996 culinary and secondary water use within communities in Emery County is shown in **Table 3–9**. Culinary water use ranged from 0.19 to 0.52 mgpd, while secondary water use ranged from 0.19 to 1.1 mgpd.

Water rights in the State of Utah are administered by the Utah Division of Water Rights. It is the authority of this agency to decide whether a water right application or an application to change an existing water right will be approved based on state laws and statutes, including those of the proposed project.

A water rights search was conducted for the Project Area. The water rights search reported 290 points of diversion of surface water sources. A total of 5,279.821 cfs and 1,341,588.09 acre feet have been adjudicated. The adjudication of water does not necessarily mean that all of the water is available every year for beneficial use, but reflects legal filings on the water. Water uses are specified as domestic, municipal, irrigation, stockwatering, mining, or mixed use. More than 88 percent of the adjudications are for irrigation in the Project Area. The water rights search identified springs at 16 different locations.

## 3.3 AIR QUALITY

Air quality within a region is affected by the distribution and quantity of air pollutant emission sources, the meteorology, and the topography of a region. The number, type, and spatial distribution of emission sources determine the quantity of pollutants emitted to the ambient air. The meteorology (wind and temperature) of the region affects how the pollutants will be dispersed horizontally and vertically to reduce ground levels ambient air concentrations of pollutants.

### 3.3.1 Climate

Annual precipitation and temperature records exist for Price, Castle Dale, and Hiawatha near the Project Area (Western Regional Climate Center [WRCC] 1997). Price is adjacent to the North Area, Castle Dale is just east of the South Area, and Hiawatha is located approximately 10 miles northwest of the South Area at an elevation about 1,600 feet higher than Price and Castle Dale. Therefore, the Price data are representative of the North Area, the Castle Dale data are representative of the lower elevations in the eastern portion of the South Area, and the Hiawatha data are representative of the higher elevations in the western portion of the South Area.

## Table 3–7
## Water Supply Information (Various Water System Sites)

| Water System # | Name | Population | Calculated Peak Demand (MGPD[1]) | Use | Unit # | Source Type | Source Name | Yield (GPM[1]) | Source Location | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Latitude | Longitude |
| **CARBON COUNTY** | | | | | | | | | | |
| 04001 | Aspen View-Schofield Mt Hm | 270 | 0.012 | Residential | 01 | Spring | Andrew Dairy | 2 | - | - |
| | | | | | 02 | Spring | Tucker Canyon | 5 | - | - |
| | | | | | 03 | Well | Frandsen Well | 30 | - | - |
| 04002 | Carbonville | 100 | 0.08 | Residential | 01 | Wholesale | Price River WID | - | - | - |
| 04003 | Clear Creek Utilities Inc. | 11 | NA | Residential | 01 | Spring | No. 1 Upper | 90 | - | - |
| | | | | | 02 | Spring | No. 2 Middle | - | - | - |
| | | | | | 03 | Spring | No. 3 Lower | - | - | - |
| 04004 | Helper | 3,800 | 1.656 | Residential/ Commercial | 01 | Spring | Spring Canyon | 290 | 39 51 18.0 | 111 05 11.0 |
| | | | | | 02 | Spring | Fish Creek | 50 | 39 46 44.0 | 111 02 44.0 |
| | | | | | 03 | Well (deep) | UP&L | 325 | 39 50 54.0 | 111 01 00.0 |
| 04007 | Price City | 9,407 | 5.000 | Residential/ Commercial | 01 | Spring | Colton | 750 | 39 50 02.0 | 111 00 30.0 |
| | | | | | 02 | Spring | Upper Colton | 750 | 39 49 45.0 | 110 00 22.0 |
| | | | | | 04 | River | Price River | 1,000 | 39 44 48.0 | 110 52 46.0 |
| 04008 | Schofield | 200 | 0.1536 | Residential | 01 | Spring | Green Canyon | 22 | 39 41 48.5 | 111 10 30.0 |
| 04009 | South Price | 400 | 0.184 | Residential/ Industrial | 01 | Wholesale | From PRWID | - | - | - |
| 04010 | Spring Glen | 545 | 0.293 | Residential | 01 | Wholesale | Price River IMP | - | - | - |
| 04011 | Wellington | 2,200 | 0.436 | Residential | 01 | Wholesale | Price River WID | - | - | +- |
| 04012 | East Carbon City | 2,000 | 1.1584 | Residential | 02 | Reservoir | Grassy Trail Reservoir | - | 39 37 18.0 | 110 22 50.0 |
| | | | | | 06 | Well (deep) | SRS Mine Well | - | - | - |
| | | | | | 07 | Well (deep) | 90-1 Well | 21 | - | - |
| 04013 | East Carbonville Water Co | 25 | NA | Residential | 01 | Wholesale | Price River WID | - | - | - |
| 04016 | Sunnyside Town Water Sys | 339 | 0.32 | Residential | 01 | Reservoir | Grassy Trail | - | 39 37 18.0 | 110 22 50.0 |
| | | | | | 03 | Well (deep) | 90-1 Well | 21 | - | - |
| 04018 | Plateau Mine Water System | 222 | 0.012672 | Industrial | 01 | Wholesale | PRWID (Hauled) | - | - | - |
| | | | | | 02 | Spring | Star Point 1&2 | 1 | - | - |
| 04020 | Price River Water Imp Dist | 7,500 | 4.000 | Residential | 01 | Stream | Price River | 2,780 | 39 45 02.0 | 110 53 01.0 |
| 04023 | Schofield Camp Site | 160 | NA | Residential | 01 | Well (shallow) | Camp Site Well | 30 | - | - |
| 04025 | Clear Creek Camp - Alpine | 1,750,130 | NA | Industrial | 01 | Well (deep) | Alpine School Well | 50 | - | - |
| 04028 | Perry's Boat Camp | 50 | NA | Resorts/ Recreation | 01 | Wholesale | Schofield | - | - | - |

## Table 3–7 (continued)
## Water Supply Information (Various Water System Sites)

| Water System # | Name | Population | Calculated Peak Demand (MGPD[1]) | Use | Unit # | Source Type | Source Name | Yield (GPM[1]) | Source Location | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Latitude | Longitude |
| **CARBON COUNTY (continued)** | | | | | | | | | | |
| 04029 | Schofield Lake State Park | 100 | NA | Parks & Recreation | 01 | Well | #1 Well | - | - | - |
| 04031 | Bacon Rine Ridge Water Co | 40 | NA | Residential | 01 | Wholesale | Price WID | - | - | - |
| 04038 | Valley Camp Coal | 25 | NA | Non-trans., Non-community | 01 | Well | Alpine School Well | - | - | - |
| 04040 | Skyline Min | 230 | 0.01 | Non-trans., Non-community | 01 | Well (deep) | Well #1 | 90 | - | - |
| 04049 | Madsen Bay Campground | 36 | NA | Resorts/ Recreation | 01 | Well (deep) | Madsen Bay | 55 | - | - |
| **EMERY COUNTY** | | | | | | | | | | |
| 08001 | Castle Dale | 1,800 | 0.496 | Residential/ Commercial | 01 | Canal | Mammoth-Cot. Creek | 75 | 39 13 53.0 | 111 01 15.0 |
| 08002 | Clawson | 227 | 0.04 | Residential | 01 | Wholesale | Ferron WTP | 50 | - | - |
| 08003 | Emery | 370 | 0.272 | Residential | 02 | Canal | Muddy Creek | - | - | - |
| 08004 | Ferron | 1,900 | 0.4 | Residential | 01 | Reservoir | Millsite-Ferron Creek | 222 | 39 05 58.0 | 111 11 17.0 |
| 08005 | Green River | 1,100 | 0.75 | Residential/ Commercial | 01 | River | Green River WTP | 569 | 38 59 18.0 | 110 08 53.0 |
| 08006 | Huntington | 2,200 | 0.7128 | Residential/ Commercial | 01 | Spring | Big Bear Canyon | 158 | 39 24 15.0 | 111 06 03.0 |
| | | | | | 02 | Spring | Little Bear Canyon | 225 | 39 26 38.0 | 111 08 35.0 |
| | | | | | 04 | Spring | Tie Fork Spring | - | 39 28 17.0 | 111 06 52.0 |
| 08007 | North Emery Water Users Assoc. | 1,500 | NA | Residential | 01 | Spring | Rilda North | 260 | 39 24 12.0 | 111 09 07.0 |
| | | | | | 02 | Spring | Rilda Side Canyon | 30 | 39 24 01.0 | 111 09 06.0 |
| | | | | | 03 | Spring | Rilda Canyon South | 30 | 39 24 08.0 | 111 09 02.0 |
| | | | | | 04 | Spring | North | 30 | 39 24 19.0 | 111 07 05.0 |
| | | | | | 05 | Spring | Middle Spring | 25 | 39 24 16.0 | 111 07 00.0 |
| | | | | | 06 | Spring | South | 80 | 39 24 10.0 | 111 06 50.0 |
| | | | | | 07 | Spring | Birch (Gate/EA) | 60 | 39 24 18.0 | 111 06 43.0 |
| 08008 | Orangeville | 1,400 | 0.448 | Residential | 01 | Canal | Cottonwood Creek | - | 39 14 28.0 | 111 03 19.0 |
| 08013 | Indian Creek Campground | 242 | NA | USFS Campground | 01 | Spring | Spring | - | 39 26 22.0 | 111 14 33.0 |
| 08014 | Joes Valley Campground and Admin. Site | 400 | NA | Residential/ FS Campground | 01 | Spring | Spring | - | 39 17 43.0 | 111 17 43.0 |
| 08016 | Old Folks Flat Campground | 150 | NA | FS Campground | 01 | Spring | Spring | 50 | 39 33 10.0 | 111 09 25.0 |

## Table 3–7 (continued)
## Water Supply Information (Various Water System Sites)

| Water System # | Name | Population | Calculated Peak Demand (MGPD[1]) | Use | Unit # | Source Type | Source Name | Yield (GPM[1]) | Source Location | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Latitude | Longitude |
| **EMERY COUNTY (continued)** | | | | | | | | | | |
| 08020 | Fillmore Subdivision (Joes Valley) | 100 | NA | Residential | 01 | Well (deep) | Well | - | - | - |
| 08023 | Joes Valley Resort | 100 | NA | Residential/ Commercial | 01 | Well | New Well | 3 | 39 20 00.0 | 111 17 00.0 |
| | | | | | 02 | Spring | - | - | 39 20 00.0 | 111 17 00.0 |
| 08024 | Goblin Valley State Park | 25 | NA | Residential/ Parks & Rec. | 01 | Well (deep) | 830 Ft Well | - | - | - |
| 08025 | Cleveland Lloyd Dino Quar | 25 | NA | Residential/ Park & Rec. | 01 | Wholesale | Haul from Price | - | - | - |
| 08030 | Deer Creek Mine | 330 | NA | Industrial | 01 | Stream | WTP | 35 | - | - |
| 08031 | Cottonwood/Wilberg Mine | 350 | 0.015 | Commercial | 01 | Surface | WTP | 22 | - | - |
| 08034 | U.P.L. Huntington Canyon | 230 | NA | Residential | 01 | Well (shallow) | Huntington Well | 211 | - | - |
| 08039 | Cleveland | 550 | 0.31968 | Residential | 01 | Wholesale | Huntington | - | - | - |
| 08040 | Elmo | 310 | 0.1904 | Residential | 01 | Wholesale | Huntington | - | - | - |
| 08041 | Bear Canyon Mine | 30 | NA | Industrial | 01 | Tunnel | Old Mine (Trail) | 20 | - | - |

Note:
1. GPM = gallons per minute
Source: Utah Division of Drinking Water 1993.

**Table 3–8**
**Water Use — Cottonwood Creek and Huntington Creek**

| | Water Used During[1] | | |
|---|---|---|---|
| | 1984 (MGPD) | 1991 (MGPD) | 1996 (MGPD) |
| **Cottonwood Creek** | | | |
| Irrigation | 56.10 | 36.61 | 54.56 |
| Industrial (Pacificorp) | 6.02 | 5.25 | 9.54 |
| **Huntington Creek** | | | |
| Irrigation | 76.62 | 46.28 | 62.57 |
| Industrial (Pacificorp) | 7.53 | 9.28 | 10.82 |
| North Emery Water Users Association | 0.19 | 0.14 | 0.19 |

Note:
1. MGPD = millions of gallons per day.
Source: Page 1997.

As shown on **Table 3–10**, the lower elevations receive less than 10 inches of precipitation annually. Higher elevations in the western portions get approximately 13.5 inches annually. Snow amounts also are low east of the Wasatch Mountains. Price receives 24 inches of snow annually and Castle Dale experiences about 16 inches, while Hiawatha gets about 63 inches. Average high temperatures in the Project Area range from 90°F in July to 35°F in January. Average minimum temperatures range from 7°F in January to 58°F in July.

Meteorological data collected during 1986 at Utah Power and Light's Clawson Power Plant are the closest to the Project Area. As shown on the wind frequency distribution chart (**Figure 3–13**), the predominant wind direction is from the west. The combined frequency when the wind blows from the west and west-northwest is nearly 15 percent. The average amount of time that the wind blows from any of the other 14 directions

**Table 3–9**
**Culinary and Secondary Water Usage, Emery County Communities 1996**

| Community | Total Culinary Water Usage (million gallons per day) | Total Secondary Water Usage (million gallons per day) |
|---|---|---|
| Castle Dale | 0.381 | 0.836 |
| Emery | 0.524 | 0.190 |
| Ferron | | 1.063 |
| Clawson | 0.429 | 0.107 |
| Orangeville | 0.229 | 0.761 |
| Huntington | 0.274 | 0.936 |
| Cleveland | | 0.578 |
| Elmo | 0.191 | 0.383 |

Source: Leamaster 1997.

**Table 3–10**
**Climatology of Ferron Project Area**

| | Price | | | | Castle Dale | | | | Hiawatha | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Average Max Temp (°F) | Average Min Temp (°F) | Avg. Precip (in.) | Avg. Snow (in.) | Avg. Max Temp (°F) | Avg. Min Temp (°F) | Avg. Precip (in.) | Avg. Snow (in.) | Avg. Max Temp (°F) | Avg. Min Temp (°F) | Avg. Precip (in.) | Avg. Snow (in.) |
| JAN | 36.7 | 13.3 | 0.86 | 9.4 | 34.4 | 7.4 | 0.58 | 6.2 | 32.5 | 13.6 | 0.97 | 14.8 |
| FEB | 43.2 | 20.2 | 0.76 | 4.6 | 42.1 | 14.9 | 0.48 | 3.1 | 36.7 | 17.6 | 1.02 | 13.1 |
| MAR | 52.8 | 27.8 | 0.82 | 1.2 | 52.7 | 23.9 | 0.54 | 1.2 | 43.8 | 22.9 | 1.13 | 10.0 |
| APR | 63.0 | 34.4 | 0.53 | 0.2 | 62.3 | 30.9 | 0.48 | 0.4 | 54.6 | 31.3 | 0.94 | 2.9 |
| MAY | 72.5 | 43.0 | 0.81 | | 72.2 | 39.0 | 0.70 | 0.1 | 64.1 | 39.5 | 1.19 | 1.6 |
| JUN | 83.8 | 51.9 | 0.64 | | 82.9 | 47.0 | 0.48 | | 74.8 | 48.5 | 0.96 | |
| JUL | 90.1 | 58.3 | 0.90 | | 88.6 | 53.4 | 0.81 | | 81.5 | 55.8 | 1.30 | |
| AUG | 88.5 | 57.0 | 1.00 | | 86.1 | 51.5 | 0.96 | | 78.7 | 54.0 | 1.80 | |
| SEP | 79.4 | 48.1 | 1.07 | | 77.7 | 42.4 | 0.85 | | 71.0 | 46.4 | 1.34 | 0.2 |
| OCT | 65.5 | 37.5 | 1.26 | 0.3 | 65.3 | 32.0 | 0.77 | 0.2 | 58.7 | 36.2 | 1.22 | 1.0 |
| NOV | 49.5 | 25.6 | 0.64 | 2.7 | 49.3 | 20.6 | 0.47 | 1.0 | 43.2 | 23.7 | 0.84 | 6.6 |
| DEC | 39.8 | 16.4 | 0.54 | 5.8 | 38.0 | 11.7 | 0.50 | 4.0 | 43.6 | 16.3 | 1.01 | 12.7 |
| ANN. | 63.8 | 36.2 | 9.81 | 24.3 | 62.7 | 31.3 | 7.59 | 16.2 | 56.2 | 33.9 | 13.71 | 63.0 |

Source: WRCC 1997

is only four percent of the time. The strongest winds blow from the west with speeds exceeding 21 knots. However, the wind is calm about 28 percent of the time.

The Project Area is subject to prolonged and intense temperature inversions. Temperature inversions occur when the air temperature near the surface is lower than the temperature above the surface (the opposite of a normal atmospheric vertical temperature profile). The depth of the cold air defines the mixing height, i.e., the depth of the atmosphere in which pollutants are confined and not allowed to rise above the mixing height. As a result of a low mixing height and calm to light winds generally associated with inversions, prolonged inversions create a buildup of pollutants confined in a volume close to the surface. Inversions are most intense during winter when shorter daylight hours and snow cover combine to intensify the temperature difference between the surface and higher altitudes. Inversions may persist throughout the day during winter. In summer, early morning inversions are rapidly dissipated by the sunshine warming the air near the ground.

## 3.3.2 Existing Air Quality

National Ambient Air Quality Standards (NAAQS) have been established by the U.S. Environmental Protection Agency (EPA) and the Utah Department of Environmental Quality, Division of Air Quality (UDAQ) for six air pollutants, known as "criteria pollutants". The purpose of the NAAQS is to protect the public health, since pollutant concentrations greater than the standards are considered potentially harmful. For the FNG Project, pollutants of interest are nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), and carbon monoxide (CO), which would be emitted from compressors, pumps, construction equipment, and vehicles

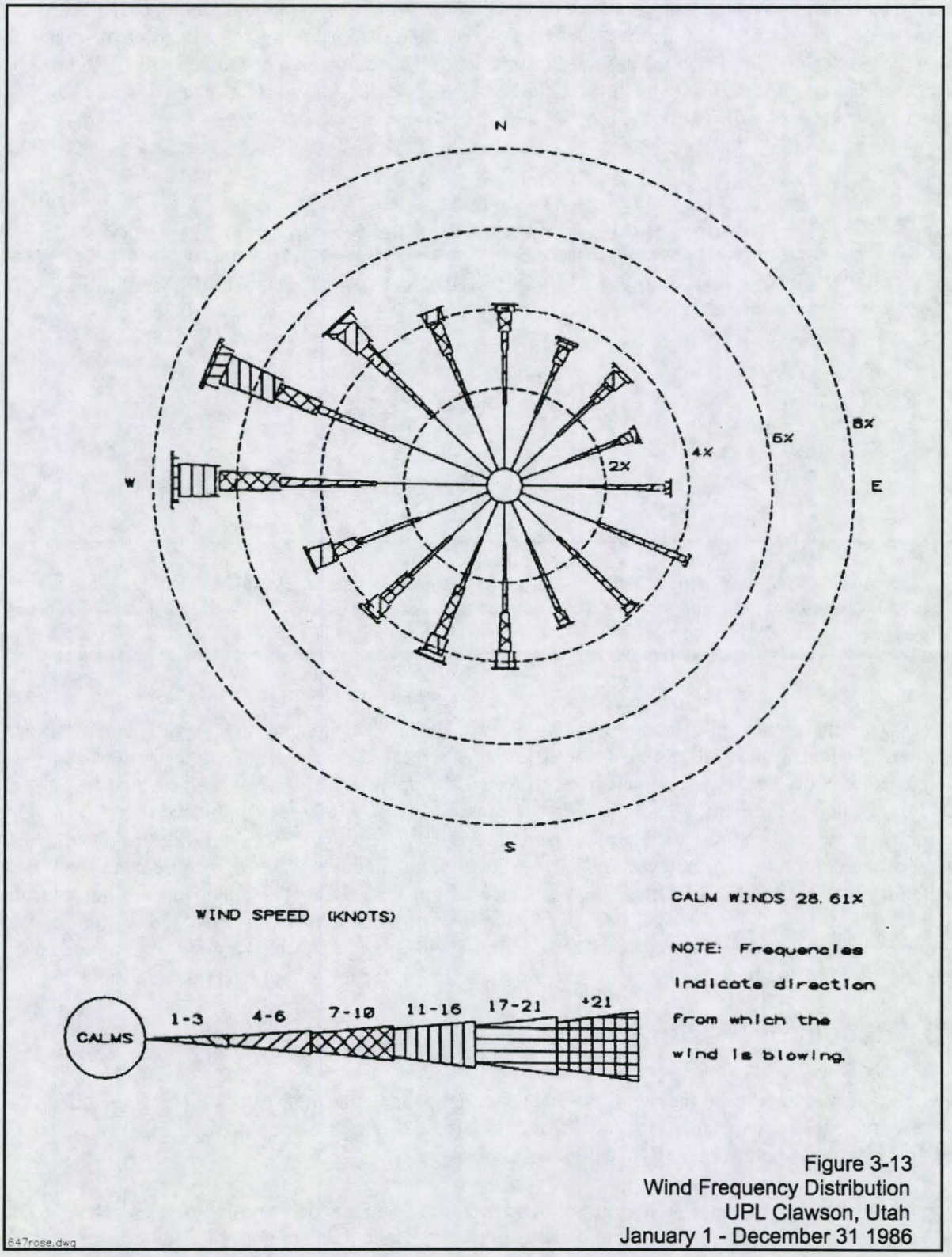



Figure 3-13
Wind Frequency Distribution
UPL Clawson, Utah
January 1 - December 31 1986

and particulate matter that would be generated by construction activities, vehicles traveling on access roads, and wind-blown dust over exposed areas, such as well pads and roads. The regulated particulate matter is $PM_{10}$, which is defined as suspended particles with an aerodynamic diameter of ten microns or less. The State of Utah has adopted the same standards as the NAAQS. The National and Utah standards for $NO_2$, CO, $SO_2$, and $PM_{10}$ are shown on **Table 3–11**.

**Table 3–11**
**National and Utah Ambient Air Quality Standards**

| Pollutant | Averaging Time | Concentration ($\mu g/m^3$)[2] |
|---|---|---|
| Carbon Monoxide | 1 hour[1] | 40,000 |
| | 8 hour[1] | 9,000 |
| Nitrogen Dioxide | Annual arithmetic mean | 100 |
| Sulfur Dioxide | Annual arithmetic mean | 80 |
| | 24-hour | 365 |
| | 3-hour | 1,300 |
| $PM_{10}$ | Annual arithmetic mean | 50 |
| | 24 hour[1] | 150 |

Notes:
1. Concentration not to be exceeded more than one time per year in averaging time period.
2. Micrograms ($\mu g/m^3$) of pollutant per cubic meter of air at standard atmospheric conditions (pressure 29.92 inches mercury, temperature 25 °Centigrade).

The UDAQ has the responsibility to monitor air quality in Utah. Measurements are typically taken in urban areas where ambient pollution levels are expected to be the highest. As a result, no routine monitoring occurs in the project vicinity but some data has been collected (Symons 1997). $PM_{10}$ was measured in 1994 at Sunnyside, Utah, approximately 25 miles east-southeast of Price. Monitoring indicated that the 24-hour concentrations ranged from 11 to 30 $\mu g/m^3$. The annual average concentration was 13 $\mu g/m^3$. The highest 24-hour concentration was 20 percent of the NAAQS and the annual average was 26 percent. $NO_2$ was measured from 1977 to 1981 at Castle Dale, Utah. Measurements indicate the annual average varied from 10 to 18 $\mu g/m^3$. The highest annual $NO_2$ average was only 18 percent of the NAAQS. In lieu of CO measurements in the Project Area, the UDAQ assumes the average CO background assumption to be 8,000 $\mu g/m^3$ for the one-hour averaging period and 2,000 $\mu g/m^3$ for the 8-hour averaging period.

## 3.3.3 Regulatory Status

Based upon the measured data, the remoteness of the region, and the lack of major urban communities, the region around Price is designated as an attainment area for all the criteria pollutants. This means that all criteria pollutants are below the designated levels of NAAQS.

Construction of facilities that would emit pollutants require review and permitting by the UDAQ. The UDAQ requires air dispersion modeling to demonstrate compliance with ambient air standards for sources with a potential to emit more than 40 tons per year of a criteria pollutant. Sources with a potential to emit more than 250 tons per year of a criteria pollutant are considered major sources and require a Prevention of Significant Deterioration pre-construction review and permit. Sources with potential emissions below 250

tons per year are subject to New Source Review permitting. These reviews may be required of natural-gas fired compressors for the FNG Project. The air quality assessment under these reviews includes an estimation of emissions, evaluation of technologies employed to reduce emissions, and an assessment of compliance with NAAQS.

The Companies would be required to apply for an Approval Order from the UDAQ before beginning any construction of an air pollution source. In addition to the permitting activities previously described, an Approval Order would also be required for construction activities greater than 0.25 acres. These activities would include construction of well pads and roads for the Ferron Project. The Approval Order for construction would include the methods to be employed to control fugitive dust associated with construction activities, such as watering, chemical treatment, etc.

## 3.4 SOILS

### 3.4.1 North Area

Soils within the North Area have developed on mesas, benches, hill slopes, toe slopes, and outwash plains. Parent materials are residuum, colluvium, alluvium, and glacial outwash, which were derived from sandstone and shale. These soils have formed on nearly level to moderately-steep slopes. They range from shallow to very deep and are well-drained. They have developed in the semi-arid to arid climatic regime of this area.

According to the Soil Survey of Carbon Area, Utah (Jensen and Borchert 1988), 21 soil mapping units are present within the boundaries of the North Area. A description of each mapping unit is found in **Table 3–12**.

Critical soils were identified using several criteria, including water and wind erosion hazards, salinity, and suitability for reclamation. If a soil has at least one of these criteria above a threshold level, it was designated a critical soil. These criteria are described below.

The Soil Survey of Carbon Area rates each soil mapping unit as having a slight, moderate, high, or very high water erosion hazard. These ratings were determined using soil erodibility and runoff factors as defined in the National Soil Survey Handbook (Natural Resource Conservation Service [NRCS] 1996). The water erosion hazard becomes a critical issue when protective vegetation is removed from a soil such as during and following road and well pad construction. For purposes of this study, soil mapping units having a high or very high water erosion hazard rating were designated "critical soils."

The Carbon Area survey also rates each mapping unit as having a none, slight, moderate, high, or very high wind erosion hazard. These ratings are based on the Wind Erodibility Index as defined in the National Soil Survey Handbook (NRCS 1996). Wind erosion is also a critical issue following removal of protective vegetation. For purposes of this study, soil mapping units having a high or very high wind erosion hazard rating were designated "critical soils."

Table 12 of the Carbon Area survey gives the electrical conductivity range of each mapping unit in mmhos $cm^{-1}$. The National Soil Survey Handbook (NRCS 1996) classifies conductivity ranges into five salinity classes: non-saline, very slightly saline, slightly saline, moderately saline, and strongly saline. Saline soils contain soluble salts in quantities that would tend to impair plant growth during reclamation and pose a potential water quality impact when unprotected soils are subject to erosion. For purposes of this study, soils

## Table 3–12
## Characteristics of North Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Badland | steep–very steep | nearly barren areas of shale at base of Book Cliffs | Mancos Shale | variable | very high | high | variable | unsuitable | yes |
| 3 | Badland-Rubbleland-Rock outcrop complex | steep–very steep | mountain and hill slopes; base of Book Cliffs | Blackhawk Formation & Mancos Shale | variable, boulders, rock outcrop | very high | high | variable | unsuitable | yes |
| 17 | Chipeta-Badland complex | 3%–very steep | Mancos Shale hills | residuum & Mancos Shale | silty clay loam & variable | very high | moderate | moderate | unsuitable (salinity >9 mmhos) | yes |
| 33 | Gerst-Badland-Rubbleland complex | 15–50% | side slopes of mesas & fan terraces | residuum, colluvium, Mancos Shale | extremely stony loam, boulders & variable | high | low | non-saline | unsuitable (>35% coarse fragments) | yes |
| 35 | Gerst-Badland-Stormitt complex | 10%–very steep | hill slopes | residuum, colluvium, glacial outwash, Mancos Shale | cobbly loam, gravelly sandy clay loam & variable | moderate–high | low | non-saline | unsuitable (>35% coarse fragments | yes |
| 37 | Gerst-Strych-Badland complex | 50–75% | side slopes of benches | colluvium, residium, Mancos Shale | extremely stony loam, very stony loam & variable | high | low | non-saline | unsuitable (>35% coarse fragments | yes |
| 41 | Green River-Juva Variant complex | 0–5% | floodplains, alluvial fans, stream terraces | alluvium | silt loam & fine sandy loam | slight | moderate | non-saline to slightly alkaline | poor | no |
| 50 | Haverdad Loam, moist | 1–5% | alluvial fans & valley floors | alluvium | loam | moderate | moderate | non-saline | fair | no |

## Table 3–12 (continued)
## Characteristics of North Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| 65 | Mivida very fine sandy loam | 1–6% | benches, mesas, fan terraces | alluvium | very fine sandy loam | moderate | moderate | non-saline | poor | no |
| 72 | Pathead-Curecanti family association | 50–70% | mountain slopes | colluvium | extremely stony loam & loam | high | slight–moderate | non-saline | unsuitable (>35% coarse fragments) | yes |
| 74 | Penoyer Variant loam | 3–6% | alluvial fans & valley floors | alluvium | loam | moderate | moderate | non-saline | fair | no |
| 80 | Persayo-Chipeta complex | 3–20% | Mancos Shale hills | residuum & alluvium | loam & silty clay loam | moderate–high | moderate | slightly–moderately saline | poor–unsuitable (salinity >9 mmhos for Chipeta) | yes |
| 90 | Ravola loam | 1–3% | alluvial fans & narrow valley floors | alluvium | loam | moderate | moderate | very slightly to slightly saline | poor | no |
| 91 | Ravola loam, eroded | 1–6% | alluvial fans & narrow valley floors | alluvium | loam | moderate | moderate | very slightly to slightly saline | poor | no |
| 93 | Ravola-Slickspots Complex | 1–3% | alluvial fans & floodplains | alluvium | loam | moderate | moderate | very slightly to strongly saline | poor–unsuitable (slickspots strongly saline) | yes |
| 110 | Stormitt gravelly sandy clay loam | 3–10% | benches | glacial outwash | gravelly sandy clay loam | slight | slight | non-saline | unsuitable (>35% coarse fragments) | yes |
| 113 | Strych very stony loam | 3–15% | benches & outwash plains | glacial outwash & alluvium | very stony loam | moderate | slight | non-saline | unsuitable (>35% coarse fragments) | yes |
| 114 | Strych very stony loam, dry | 3–30% | alluvial fans & terraces | alluvium & glacial outwash | very stony loam | moderate | slight | non-saline | unsuitable (>35% coarse fragments) | yes |

## Table 3–12 (continued)
## Characteristics of North Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| 117 | Trag-Beje-Senchert Complex | 3–30% | mountain slopes, side slopes next to drainages | residuum, colluvium, alluvium | clay loam & loam | slight–moderate | slight | non-saline | fair | no |
| 120 | Travessilla-Rock Outcrop Complex | 3%–very steep | benches & mesas | residuum, Mancos Shale, Blackhawk Fm. | fine sandy loam & bedrock | moderate | moderate | non-saline | fair–unsuitable (rock outcrop areas) | yes (rock outcrop areas) |
| 121 | Travessilla-Rock Outcrop-Gerst Complex | 40–70% | canyon sides | residuum, colluvium, Mancos Shale, Blackhawk Fm. | extremely bouldery loam, very channery loam, bedrock | high | slight | non-saline | unsuitable (>35% coarse fragments) | yes |

Haverdad loam, moist, 1 to 5 percent slopes (50)
Mivida very fine sandy loam, 1 to 6 percent slopes (65)
Penoyer Variant loam, 3 to 6 percent slopes (74)
Persayo-Chipeta complex (80)
Ravola loam, 1 to 3 percent slopes (90)
Ravola loam, 1 to 6 percent slopes, eroded (91)
Ravola-Slickspots complex (93)
Rock outcrop-Rubbleland-Travessila complex (96)
Shupert-Winetti complex (107)
Stormitt gravelly sandy clay loam, 3 to 10 percent slopes (110)
Strych very stony loam, 3 to 15 percent slopes (113)
Strych very stony loam, dry, 3 to 30 percent slopes (114)
Trag-Beje-Senchert complex (117)
Travessilla-Rock outcrop complex (120)

classified as "moderately" or "strongly saline" (average conductivity >8 mmhos $cm^{-1}$) were designated "critical soils."

Soil suitability for reclamation has been described in a Forest Service publication (1979). A soil is defined as "unsuitable" for reclamation if it meets any one of the following criteria:

- clay content greater than 60 percent;
- coarse fragments exceeding 35 percent of the soil by volume (i.e. a soil described as stony, channery, or cobbly);
- pH less than 4.5 or greater than 9.1; and
- salinity greater than 9 mmhos/$cm^{-1}$.

Soils found to be unsuitable for reclamation using these criteria were designated critical soils. **Plate 3–3** shows areas where critical soils and slopes greater than 6 percent overlap in the North Area. Using the criteria described above, approximately 10,233 acres (56 percent) of the North Area are covered by areas where critical soils occur on slopes greater than 6 percent.

### 3.4.2 South Area

Soil classifications were compiled using an updated soil survey conducted by the NRCS in 1997. The portions of the South Area and the pipeline corridor not covered by the NRCS were supplemented with the current Emery County Soil Survey. Characteristics of soil types are shown in **Table 3–13**. The same analysis as performed for the North Area was used to determine areas where critical soils occur on slopes greater than six percent. According to the criteria and analysis, approximately 59,029 acres (53 percent) of the South Area are critical soils on slopes greater than six percent (**Plate 3-3**).

## 3.5 VEGETATION

### 3.5.1 Regional Overview

The Project Area is located in the Canyonlands floristic section of the Intermountain region (Cronquist et al. 1972). The topographic relief of this region, and its resulting impact on precipitation, fosters a wide diversity of plant communities. Higher elevations characterizing the Wasatch Plateau to the west and north create moister, cooler environments favored by conifer forests. In contrast, Castle Valley located to the east and south of the Wasatch Plateau presents environments that are restrictive to all but the most arid, desert-like communities found in the region. Wetlands are very limited in extent, and associated with sparsely scattered seeps, ponds, and perennial streams. Riparian areas are found sporadically along perennial streams.

The composition and extent of native plant communities have been modified by the development of urban centers, agriculture, livestock grazing, and by the extraction of coal, oil and gas in the area. Urban development and agriculture have permanently eliminated portions of the native plant communities, and livestock grazing and extraction activities have altered the species composition of plant communities. These factors have influenced the establishment of noxious weeds in the area. While populations of noxious weeds are common where the native plant communities have been disturbed or removed, they do not appear to be invasive into undisturbed communities.

## Table 3–13
## Characteristics of South Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil? |
|---|---|---|---|---|---|---|---|---|---|---|
| As | Abbott silty clay, strongly saline | 1–3% | stream terraces & alluvial fans | alluvium | silty clay | moderate | moderate | strong | unsuitable (salinity >9 mmhos/cm) | yes |
| 100, Ba, BL (2)[1] | Badland | steep–very steep | nearly barren areas of shale at base of the Wasatch Plateau | Mancos Shale | variable | very high | high | variable | unsuitable (badland) | yes |
| 171 | Badland-Chipeta-Persayo complex | 30–60% | steep shale hills & side slopes of structural benches & mesas | Mancos Shale | silty clay, clay loam & variable | very severe | very severe | none–slight; variable | unsuitable (badland and salinity >9 mmhos) | yes |
| 131 | Badland-Persayo-Rock outcrop complex | 35–45% | sideslopes on mesas, structural benches & cestas | Blackhawk Formation & Mancos Shale | cobbley loam & variable | very severe | slight–moderate | non-saline–slight; variable | unsuitable (badland & >35% coarse fragments) | yes |
| BY (3) | Badland-Rubble-land- Rock outcrop complex | steep–very steep | mountain and hill slopes; base of the Wasatch Plateau | Blackhawk Formation & Mancos Shale | variable, boulders, rock outcrop | very high | high | variable | unsuitable (badland & >35% coarse fragments) | yes |
| Bcb | Beebe very fine sandy loam | 1–3% | alluvial fans & floodplains | alluvium | very fine sandy loam | slight | moderate | slight | unsuitable (pH >9.1) | yes |
| BlB (8) | Billings silty clay loam | 1–3% | alluvial fans, floodplains, narrow alluvial valley floors | alluvium | silty clay loam | moderate | moderate | very slight–slight | fair | no |
| BlC2 | Billings silty clay loam | 2–6% | alluvial fans | alluvium | silty clay loam | moderate | moderate | slight–moderate | unsuitable (salinity >9 mmhos/cm) | yes |
| BsB | Billings silty clay loam, moderately well drained | 1–3% | alluvial valley floors | alluvium | silty clay loam | moderate | moderate | moderate | unsuitable (salinity >9 mmhos/cm) | yes |
| SNC | Bowdish-Lazear-Gerst complex | 2–8% | structural benches | alluvium | channery sandy clay loam, loam, clay loam | slight–severe | slight–moderate | slight | unsuitable (>35% coarse fragments) | yes |
| 261 | Brownsto-Podo-Rock outcrop association | 15–65% | mountain sideslopes & hillsides | alluvium, colluvium, residuum | very stony sandy loam, very gravelly loam | moderate | slight | slight | unsuitable (>35% rock fragments) | yes |

## Table 3–13 (continued)
## Characteristics of South Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil? |
|---|---|---|---|---|---|---|---|---|---|---|
| CcE2 | Castle Valley extremely rocky very fine sandy loam, eroded | 0–20% | upland benches & mesas | residuum | gravelly very fine sandy loam | slight to high | slight to high | non-saline | unsuitable (>35% rock fragments) | yes |
| MTH (13) | Cabba family-Guben-Rock outcrop complex | 40–75% | canyon sides | colluvium & residuum | loam & very stony loam | high | none | non-saline | unsuitable (>35% rock fragments) | yes |
| CBF2 (17) | Chipeta-Badland complex | 3%–very steep | Mancos Shale hills | residuum & Mancos Shale | silt clay loam & variable | very high | moderate | moderate | unsuitable (salinity >9 mmhos) | yes |
| CPB (18) | Chipeta-Persayo complex | 1–3% | toe slopes | residuum & alluvium | silty clay loam | moderate | moderate | slight–moderate | unsuitable (salinity >9 mmhos) | yes |
| CPE2 | Chipeta-Persayo Association, eroded | 3–20% | Mancos Shale hills | Mancos Shale | silty clay loam and loam | high | | moderate–strong | unsuitable (salinity >9 mmhos) | yes |
| SlB | Clifsand very fine sandy loam | 1–3% | alluvial fan remnant & bench tops | alluvium | very fine sandy loam | slight | moderate | non-saline–very slight | good | no |
| SlD2 | Clifsand fine sandy loam | 3–10% | alluvial fan remnant & bench tops | alluvium | fine sandy loam | slight | moderate | non-saline–very slight | good | no |
| SmD2, SMD2 | Clifsand-Minchey Complex | 1–8% | mesas, benches & alluvial fan remnants | alluvium | gravelly sandy loam & loam | slight | slight | slight | unsuitable (>35% coarse fragments) | yes |
| DHG2 (20) | Comodore-Datino Varient complex | 40–60% | mountain slopes & toe slopes | colluvium | very stony & extremely stony fine sandy loam | high | none | non-saline | unsuitable (>35% coarse fragments) | yes |
| UFF2 | Doney-Cabba-Podo complex | 20–60% | mountain slopes | residuum & colluvium | loam, gravelly loam, cobbley loam | moderate–severe | slight | slight | poor | yes |
| LYD2 | Farb-Persayo Complex | 3–15% | rolling sandstone & shale hills | Mancos Shale | gravelly fine sandy loam & channery loam | slight–moderate | slight–moderate | slight–moderate | unsuitable (>35% coarse fragments) | yes |

## Table 3–13 (continued)
## Characteristics of South Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil? |
|---|---|---|---|---|---|---|---|---|---|---|
| 456 | Farb-Sandbench-Rock outcrop association | 2%–very steep | cuesta slopes & structural benches | Mancos Shale, eolian material, alluvium | loamy fine sand & gravelly sandy loam | slight | slight–high | slight | unsuitable (>35% coarse fragments | yes |
| Fe, Fr (31) | Ferron silt loam | 0–3% | alluvial fans & alluvial valley bottoms | alluvium | silt loam | slight | none | very slight–slight | fair | no |
| C35 (35) | Gerst-Badland-Stormitt complex | 10–60% | hills lopes | residuum, colluvium, glacial outwash | channery clay loam, gravelly sandy clay loam & variable | moderate–severe | slight | very slight–variable | unsuitable (>35% coarse fragments) | yes |
| 555, 254, NSD | Gerst-Chupedera-Travessilla association | 2–30% | cuestas & structural benches | colium, alluvium, residuum | channery loam, fine sandy loam, gravelly fine sandy loam | moderate–severe | slight–moderate | slight | unsuitable (>35% coarse fragments) | yes |
| NNE2, NTF2 | Gerst-Lazear-Badland complex | 8–30% | rolling shale & sandstone hills | residuum, colluvium, alluvium | clay loam, loam & variable | moderate–very severe | moderate | slight | unsuitable (badland and >35% coarse fragments) | yes |
| NGG2, 569 (37) | Gerst-Strych-Badland complex | 50–75% | side slopes of benches | colluvium, residuum, Mancos Shale | extremely stony loam, very stony loam & variable | high | low | non-saline, variable | unsuitable (>35% coarse fragments) | yes |
| GKC (39) | Glenberg family | 1–3% | floodplains & valley floors | alluvium | very fine sandy loam & fine sandy loam | moderate | high | non-saline | fair | yes |
| GLC (40) | Glenberg family | 3–6% | valley floors & low terraces | alluvium | very fine sandy loam & loam | moderate | moderate | non-saline | fair | no |
| Mx | Glenberg-Colorow-Pherson complex | 0–4% | stream terraces and river floodplains | alluvium | fine sandy loam | slight | slight–moderate | slight | fair | no |
| TY (41) | Green River-Juva Varient complex | 0–5% | floodplains, alluvial fans, stream terraces | alluvium | silt loam & fine sandy loam | slight | moderate | non-saline–slight | poor | no |

## Table 3–13 (continued)
## Characteristics of South Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil? |
|---|---|---|---|---|---|---|---|---|---|---|
| COD2, Sn | Greybull-Utaline-Persayo complex | 3–55% | small mesa remnants & highly dissected alluvial fans | alluvium, colluvium | clay loam, gravelly loam, silty clay loam | moderate–very severe | slight | non-saline–slight | poor | yes |
| UMF2 (46) | Guben-Pathead extremely stony loams | 30–50% | mountain slopes | colluvium & residuum | extremely stony loam | moderate | none | non-saline | unsuitable (>35% coarse fragments) | yes |
| VOH (47) | Guben-Rock outcrop complex | 50–80% | mountain slopes | colluvium | extremely bouldery fine sandy loam | slight | none | non-saline | unsuitable (>35% coarse fragments) | yes |
| 133 | Hanksville-Chipeta complex | 1–12% | alluvial fans, structural benches, small shale hills | alluvium & Mancos Shale | clay & silty clay | severe–very severe | moderate | strong | unsuitable (salinity >9 mmhos/cm) | yes |
| OCA2, C49 (49) | Haverdad loam, alkali | 0–3% | fan terraces, alluvial fans, valley floors | alluvium | loam | moderate | moderate | non-saline–very slight | poor | no |
| ADC, HBC (52) | Hernandez family | 3–8% | fan terraces | alluvium | loam | moderate | moderate | non-saline–very slight | poor | no |
| Hn (55) | Hunting loam | 1–3% | alluvial fans & valley floors | alluvium | loam | slight | moderate | very slight–slight | fair | no |
| Hs (56) | Hunting loam, moderately saline | 1–3% | alluvial fans & valley floors | alluvium | loam | slight | moderate | moderate | unsuitable (salinity >9 mmhos) | yes |
| KeE2 | Kenilworth very stony sandy loam | 0–20% | high benches & old dissected outwash plains | alluvium | very stony sandy loam | slight–moderate | | non-saline | unsuitable (>35% coarse fragments) | yes |
| KlB, KpB (59) | Killpack clay loam | 1–3% | Mancos Shale hills | Mancos Shale | clay loam | moderate | moderate | very slight–slight | fair | no |
| KmB | Killpack clay loam, somewhat poorly drained | 1–3% | gently sloping shale benches | alluvium overlying residuum | clay loam | severe | moderate | moderate | unsuitable (salinity >9 mmhos) | yes |

## Table 3–13 (continued)
## Characteristics of South Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil? |
|---|---|---|---|---|---|---|---|---|---|---|
| KlC2, KpC2 (60) | Killpack clay loam | 3–6% | Mancos Shale hills | Mancos Shale | clay loam | high | moderate | very slight–slight | fair | yes |
| NFE | Lazear-Gerst-Pinon complex | 3–35% | benches & sandstone capped rolling shale hills | residuum & alluvium | gravelly loam | moderate–severe | slight | slight | unsuitable (>35% coarse fragments) | yes |
| NPD | Lazear-Pinon complex | 2–15% | structural benches | | channery fine sandy loam & gravelly loam | moderate | slight | non-saline | unsuitable (>35% coarse fragments) | yes |
| Lb, LS (61) | Libbings silty clay loam | 0–3% | foot slopes & Mancos Shale hills | Mancos Shale | silty clay loam | moderate | moderate | strong | unsuitable (salinity >9 mmhos) | yes |
| HUG, DSG2 (62) | Midfork family-Comodore complex | 50–70% | mountain slopes | colluvium | very channery & very stony loam | high | none | non-saline | unsuitable (>35% coarse fragments) | yes |
| MlB, McB (64) | Minchey loam | 1–3% | benches & mesas | glacial outwash | loam | moderate | moderate | non-saline–very slight | fair | no |
| PdB, 224 (65) | Mivida very fine sandy loam | 1–6% | benches, mesas, fan terraces | alluvium | very fine sandy loam | moderate | moderate | non-saline | poor | no |
| MsB | Minchey-Clifsand complex | 1–3% | tops of alluvial fan remnants | alluvium | loam | slight | slight–moderate | slight | fair | no |
| MsC2 | Minchey-Clifsand complex | 2–6% | gently undulating tops of fan remnants | alluvium | sandy clay loam, gravelly loam | slight | slight | slight | poor | no |
| 175 | Minchey-Greybull-Sagers complex | 2–8% | alluvial fans & structural benches | alluvium & residuum | gravelly loam & loam | moderate–severe | slight–moderate | non-saline–slight | unsuitable (>35% coarse fragments) | yes |
| PaB | Palisade loam, high water table variant | 1–3% | low areas on benches | glacial outwash | loam | low | | non-saline | good | no |
| PdB | Palisade very fine sandy loam | 1–3% | mesas & benches | glacial outwash | very fine sandy loam | moderate | | non-saline | good | no |
| PsC2 | Penoyer very fine sandy loam, eroded | 3–6% | alluvial fans near the bases of mesas | alluvium | very fine sandy loam | high | | non-saline | good | yes |

## Table 3–13 (continued)
## Characteristics of South Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil? |
|---|---|---|---|---|---|---|---|---|---|---|
| PeB, PnA (73) | Penoyer Variant loam | 1–3% | valley floors | alluvium | loam | slight | moderate | non-saline | fair | no |
| PeC2 (74) | Penoyer Variant loam | 3–6% | alluvial fans & valley floors | alluvium | loam | moderate | moderate | non-saline | fair | no |
| PCE2 (80) | Persayo-Chipeta complex | 3–20% | Mancos Shale hills | residuum & alluvium | loam & silty clay loam | moderate–high | moderate | slight–moderate | poor | no |
| KAC (81) | Persayo-Greybull complex | 3–15% | questa back slopes & shale hills | residuum & alluvium | clay loam & loam | moderate | moderate | non-saline–slight | poor | no |
| MUE, MVE (83) | Podo-Cabba family complex | 3–30% | benches, canyon rims, side slopes | residuum & colluvium | gravelly loam | moderate | none | non-saline | unsuitable (>35% coarse fragments) | yes |
| KXH, C84 (84) | Podo-Rock outcrop complex | 50–70% | mountain slopes | colluvium & residuum | very bouldery sandy loam | high | none | non-saline | unsuitable (>35% coarse fragments) | yes |
| Ra (89) | Rafael silty clay loam | 1–3% | alluvial fans, floodplains, valley floors | alluvium | silty clay loam | slight | none | slight–moderate | unsuitable (salinity >9 mmhos) | yes |
| RlB (90) | Ravola loam | 1–3% | alluvial fans & narrow valley floors | alluvium | loam | moderate | moderate | very slight–slight | poor | no |
| RlB2, RlC2 (91) | Ravola loam, eroded | 1–6% | alluvial fans & narrow valley floors | alluvium | loam | moderate | moderate | very slight–slight | poor | no |
| RTB | Ravola silty clay loam | 1–3% | floodplains & alluvial fans | alluvium | silt loam | moderate | moderate | slight–moderate | poor | no |
| RnD (92) | Ravola-Gullied land complex | 1–6% | alluvial fans & dissected narrow valley floors | alluvium | loam | moderate | moderate | very slight–slight | fair | no |
| GU | Ravola-Gullied land-Libbings complex | 0%–steep | alluvial valley floors | alluvium | silt loam, silty clay loam, variable | moderate–very severe | moderate | slight–strong | unsuitable (salinity >9 mmhos/cm) | yes |

## Table 3–13 (continued)
## Characteristics of South Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil? |
|---|---|---|---|---|---|---|---|---|---|---|
| RUB2 | Ravola-Homko complex | 1–3% | alluvial fans, floodplains & alluvial valleys | alluvium | loam & clay loam | slight–severe | moderate | slight–strong | poor | no |
| RlA2 | Ravola-Toddler Complex | 1–6% | alluvial fans & narrow alluvial valleys | alluvium | silt loam & sandy loam | moderate | moderate | slight | fair | no |
| Rv | Riverwash | nearly level | streambeds | alluvium | variable | severe | | variable | variable (unsuitable where >35% coarse fragments) | yes |
| Ry | Rock land | 50–80% | colluvium & rock outcrop | Mancos Shale & Blackhawk Formation | stones, boulders, rock outcrop | severe | | variable | unsuitable (>35% coarse fragments) | yes |
| RO (95) | Rock outcrop | steep–very steep | escarpments & ridges | Mancos Shale & Blackhawk Formation | rock outcrop | severe | | n/a | unsuitable (>35% coarse fragments) | yes |
| EM96,RWG, C96 (96) | Rock outcrop-Rubbleland-Travessilla complex | 30–70% | mesa escarpments & canyon sides | Mancos Shale & Blackhawk Formation | rock outcrop, stones, boulders, very gravelly fine sandy loam | severe | | non-saline, n/a | unsuitable (>35% coarsefragments) | yes |
| 177 | Sager-Killpack association | 1–10% | valley fill on shale pediments | alluvium & residuum | silty clay loam & silty clay | moderate–severe | moderate | slight | fair | no |
| Sa, Sb (99) | Saltair silty clay loam | 0–3% | valley floors | alluvium | silty clay loam | slight | moderate | strong | unsuitable (salinity >9 mmhos) | yes |
| St | Stony alluvial land | nearly level | floodplains & mud rock flows | alluvium | variable | severe | | variable | unsuitable (>35% coarse fragments) | yes |
| ClC, 542 (107) | Supert-Winetti complex | 1–8% | narrow valleys & canyon floors | alluvium | clay loam & very bouldery loam | slight–moderate | none | non-saline | fair | no |
| 561 (113) | Strych very stony loam | 3–15% | benches & outwash plains | glacial outwash & alluvium | very stony loam | moderate | slight | non-saline | unsuitable (>35% coarse fragments) | yes |

## Table 3–13 (continued)
## Characteristics of South Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil? |
|---|---|---|---|---|---|---|---|---|---|---|
| 534, BMD (114) | Strych very stony loam, dry | 3–30% | alluvial fans & outwash plains | glacial outwash & alluvium | very stony loam | moderate | slight | non-saline | unsuitable (>35% coarse fragments) | yes |
| TDA | Toddler-Ravola-Glenton complex | 1–6% | valley floors, floodplains, alluvial terraces, recent alluvial fans | alluvium | fine sandy loam & loam | slight–moderate | moderate | slight–moderate | fair | no |
| 255 | Travessilla-Gerst-Strych association | 12–65% | sideslopes of mesas, structural benches, cuesta scarp faces | residuum, colluvium, alluvium | fine sandy loam, channery loam, very cobbly fine sandy loam | severe–very severe | slight | slight | unsuitable (>35% coarse fragments) | yes |
| RVD, NTD (120) | Travessilla-Rock outcrop complex | 3%–very steep | benches & mesas | residuum, Mancos Shale, Blackhawk Fm. | fine sandy loam & bedrock | moderate | moderate | non-saline, n/a | fair–unsuitable (rock outcrop areas) | no |
| TrB | Trook fine sandy loam | 1–3% | fan remnants | alluvium | fine sandy loam | slight | moderate | non-saline–slight | fair | no |
| TrC | Trook fine sandy loam | 3–6% | fan remnants | alluvium | fine sandy loam | slight | moderate | non-saline–slight | fair | no |
| w | Water | | ponds, streams | | | | | | | |
| Wo | Woodrow silty clay loam | 1–3% | alluvial fans, floodplains, narrow alluvial valleys | alluvium | silty clay loam | moderate | | non-saline–slight | fair | no |
| Mx | Mixed alluvial land | nearly level | stream channels | alluvium | variable | severe | variable | variable | variable (unsuitable where >35% coarse fragments | yes |
| SID2 | Sanpete sandy clay loam, eroded | 3–10% | benches | alluvium | sandy clay loam | severe | | non-saline | fair | yes |

## Table 3–13 (continued)
## Characteristics of South Area Soils

| Map # | Soil Map Unit | Slope | Geomorphic Position | Parent Material | Texture | Water Erosion Hazard | Wind Erosion Hazard | Salinity | Suitability for Reclamation (limiting factor) | Critical Soil? |
|---|---|---|---|---|---|---|---|---|---|---|
| Sn | Sahly colluvial land | gently sloping–steep | on and at the base of slopes | Mancos Shale | mixture of soil, cobblestones, rock fragments | moderate–severe | | variable | unsuitable >35% coarse fragments | yes |

Note:
1 Soil map numbers in parentheses are map numbers used for these map units in the Soil Survey of Carbon Area, Utah (Jensen and Borchert 1988). The soil descriptions for these soils come from this soil survey.

## 3.5.2 Vegetation Types

Utah GAP resources, an analysis of satellite imagery that models vegetation landscapes on the basis of cover types, was used to identify vegetation types within the Project Area.

Eleven vegetation types were identified within the Project Area: pinyon/juniper, salt desert shrub, sagebrush/grassland, barren land, spruce fir, mountain fir, agriculture, wetland and riparian, aspen, mountain shrub, and urban. Some of these vegetation types include several GAP cover types that described vegetation communities that had strong similarities to one another. Specifically, the pinyon/juniper and sagebrush/grassland vegetation types represent combinations of several similar GAP cover types. The distribution and area of each vegetation type are shown on **Plate 3–4** and in **Table 3–14**, respectively.

**Table 3–14**
**Vegetation Types by Facility**

| | Area (acres) | | | |
|---|---|---|---|---|
| **Vegetation Type** | **North Area** | **South Area** | **Pipeline** | **Total** |
| Sagebrush/grass | 10,917 | 34,020 | 68 | 45,005 |
| Pinyon/juniper | 5,315 | 31,359 | 51 | 36,725 |
| Salt desert | 2,079 | 17,244 | 65 | 19,388 |
| Agriculture | 39 | 5,854 | 73 | 5,966 |
| Barren lands | 0 | 2,163 | 0 | 2,163 |
| Mountain fir | 0 | 1,186 | 0 | 1,186 |
| Riparian/wetland | 0 | 886 | 3 | 889 |
| Urban | 0 | 243 | 1 | 244 |
| Spruce fir | 0 | 97 | 0 | 97 |
| Ponderosa pine – mountain shrub | 0 | 89 | 0 | 89 |
| Aspen | 0 | 30 | 0 | 30 |
| TOTAL (ac) | 18,350 | 93,170 | 261 | 111,782 |

A more detailed vegetation and soils description known as the Ecological Site Description has been jointly created by the NRCS and BLM. This document details in depth the drier four of the nine GAP vegetation cover types by breaking these four cover types into sixteen eco-sites (**Table 3–15**). If unique situations arise calling for a more site specific management, these Ecological Site Descriptions will be referred to for guidance.

### 3.5.2.1 Sagebrush/Grass

The sagebrush/grass vegetation type accounts for 45,005 acres (40 percent) of the Project Area. It represents the consolidation of the sagebrush, sagebrush/perennial grass, and grassland GAP cover types. All three types are found in the semi-arid areas (10 to 14 inches of annual precipitation) of Castle Valley on gently-sloping terrain with deep loamy soils. Benches, terraces, alluvial fans and valley floors from about 5,700 to 7,500 feet all provide suitable terrain for this vegetation type.

**Table 3–15**
**Ecological Sites Found Within the Project Area**

| Vegetation Type | Site Name | Site Number | Habitat Type |
|---|---|---|---|
| Salt Desert | Desert Loam | D34X106 | ATCO/ORHY |
| Salt Desert | Desert Loamy Clay (ATOC) | D34X109 | ATCO/HIJA-ORHY |
| Salt Desert | Desert Sandy Loam | D34X115 | ORHY-HIJA |
| Salt Desert | Desert Shallow Clay | D34X117 | ATCO4-HIJA |
| Salt Desert | Desert Very Steep Shallow Loam | D34X133 | ATCO/HIJA-ELSA |
| Sagebrush | Semidesert Sandy Loam | D34X216 | ATCA2-ARTRW/ORHY-STCO4 |
| Sagebrush | Semidesert Shallow Loam (PJ) | D34X233 | JUOS-PIED/ARARN/ELSA |
| Pinyon/Juniper | Semidesert Stony Loam (JP) | D34X247 | JUOS-PIED/ELSA |
| Pinyon/Juniper | Semidesert Very Steep Loam (JP) | D34X253 | JUOS-PIED |
| Pinyon/Juniper | Semidesert Very Steep Shallow Clay | D34X255 | JUOS-PIED |
| Pinyon/Juniper | Upland Stoney Loam (JP) | D34X330 | PIED-JUOS/ARARN/AGSP |
| Pinyon/Juniper | Upland Stoney Loam (PJ) | D34X333 | PIED-JUOS/ARARN/AGSP |
| Pinyon/Juniper | Upland Very Steep Shallow Loam (JP) | D34X342 | PIED-JUOS/CEMO2/ELSA |
| (Sagebrush) | Upland Shallow Clay Loam (JP) | (not assigned) | ELSA-ORHY |
| (Sagebrush) | Upland Loam | (not assigned) | ATCO-ORHY |
| Sagebrush | Semidesert Shallow Loam | (not assigned) | ARNV-ORHY |

Big sagebrush, black sagebrush, and silver sagebrush (*Artemisia cana*) are commonly dominant in this vegetation type. Pinyon and juniper are associated with the moister portions of the sagebrush/grass type, as are bitterbrush (*Purshia tridentata*), snakeweed, winterfat (*Krascheninnikovia lanata = Erotia lanata*), shadscale (*Atriplex confertifolia*) and rabbitbrush (*Chrysothamnus* spp.). Principal perennial grasses are bluebunch wheatgrass (*Agropyron spicata*), sandberg bluegrass, needleandthread, sand dropseed (*Sporobolus cryptandrus*), blue gramma (*Bouteloua gracilis*), Thurber's needlegrass (*Stipa thurberiana*), western wheatgrass, squirreltail, galleta (*Hilaria jamesii*), and Indian ricegrass. The grass component of the sagebrush/grass type increases in dominance with drier environments and cheatgrass (*Bromus tectorum*) is common in disturbed areas.

### 3.5.2.2 Pinyon/Juniper

The pinyon/juniper vegetation type accounts for 36,725 acres (33 percent) of the Project Area. It represents the consolidation of three Utah GAP cover types: pinyon/juniper, pinyon and juniper. Pinyon/juniper woodlands occur in the semi-arid areas (10 to 12 inches of annual precipitation) of Castle Valley on shallow or rocky soils. Benches, mesas, mountain slopes, and outwash plains all provide suitable terrain for this vegetation type. Portions of the pinyon/juniper vegetation type were chained in the 1960s and 1970s to increase forage for livestock and wildlife and improve watershed values. Crested wheat (*Agropyron crisatum*) was interseeded after chaining and is now a dominant grass in the understory of the chained areas.

Juniper (*Juniperus scopularum*) and pinyon (*Pinus edulis*) are co-dominant species in this vegetation type, although juniper may become dominant at lower elevations (5,500 to 7,000 feet), and pinyon may become dominant at higher elevations (> 7,000 feet). Below this open canopy of dwarf conifer trees lies a highly variable understory. Dominant understory shrubs range from big sagebrush (*Artemisia tridentata*),

commonly found in openings underlain by deep loamy soil, to black sagebrush (*Artemisia nova* ) and mountain mahogany (*Cercocarpus montanus*) on shallow, lithic soils. Snakeweed (*Gutierrezia sarothrae*) and little rabbitbrush (*Chrysothamnous viscidiflorus*) are often found in areas of poor range conditions or in unsuccessful range improvement areas.

Common grasses in the pinyon/juniper woodlands include Sandberg bluegrass (*Poa secunda*), needleandthread (*Stipa comata*), Indian ricegrass (*Stipa hymenoides=Oryzopsis hymenoides*), squirreltail (*Elymus elymoides=Sitanion hystrix*), and western wheatgrass (*Agropyron smithii*). Common forb species include stemless golden weed (*Halopappus acaulis=Stenotus acaulis*), oval buckwheat (*Eriogonum ovalifolium*), yellow-eye cryptantha (*Cryptantha flavoculata*), scarlet gilia *(Gilia aggregata = Ipomopsis aggregata*), dwarf cat eye, brittle pricklypear cactus (*Opuntia fragilis*), claretcup cactus (*Echinocereus triglochidiatus*), and heartleaf twistflower (*Streptanthus cordatus*).

### 3.5.2.3 Salt Desert

The salt desert vegetation type accounts for 19,388 acres (17 percent) of the Project Area. Also referred to as the saltbush-greasewood vegetation type, the salt desert occupies arid (6 to 10 inches of annual precipitation) areas of Castle Valley (5,400 to 5,900 feet). Within this moisture and elevational zone, shale hills, alluvial fans, and valley floors all provide suitable terrain. Erosion and extensive gully formation are common, and vegetation can often be locally sparse or absent.

Chenopod shrubs and sub-shrubs dominate the salt desert landscape. Shadscale is common on upland portions, hills support mat saltbush (*Atriplex corrugata*) and Nuttall saltbush, and saline bottoms and washes contain big rabbitbrush and greasewood (*Sarcobatus vermiculatus*). Other characteristic species include Castle Valley saltbush (*Atriplex cuneata*), Mormon tea (*Ephedra* spp.), budsage (*Artemisia spinescens*), horsebrush (*Tetradymia canescens*), snakeweed, and winterfat. Galleta grass, Indian ricegrass, sand dropseed and alkali sakaton (*Sporobolus airoides*) are dominant grasses. Halogeton (*Halogeton glomeratus*) an Eurasian native introduced in the 1930s, is the primary forb, although gray molly (*Kochia vestita*) also occurs. Extensive areas are dominated by cheatgrass.

### 3.5.2.4 Agriculture

This cover type accounts for 5,966 acres (5 percent) of the Project Area. Agricultural lands are scattered throughout the eastern half of the Project Area. Primary crops are alfalfa, small grains (primarily oats and barley), and corn for silage. They may also be irrigated for pasture.

### 3.5.2.5 Barren Lands

The barren lands vegetation type accounts for 2,163 acres (2 percent) of the Project Area. The vegetation type is confined to severe topographical environments such as cliffs or steeply sloped mancos shale. These steep environments are restrictive to vegetation growth, and thus support a depauperate plant community, if any at all.

### 3.5.2.6 Mountain Fir

The mountain fir vegetation type accounts for 1,186 acres (1 percent) of the Project Area. This conifer forest is principally dominated by combinations of white fir (*Abies concolor*) and Douglas fir (*Pseudotsuga*

*menziesii*). Primary associated tree species include ponderosa pine (*Pinus ponderosa*), pinyon pine, Englemann spruce, blue spruce (*Picea pungens*) and sub-alpine fir.

### 3.5.2.7 Urban

While not a vegetation and cover type, urban areas account for 244 acres (<1 percent) of the Project Area. Urban areas encompasses communities, such as Price, Huntington, Kenilworth, and Elmo, and areas disturbed by mining and industrial activity.

### 3.5.2.8 Spruce-fir

The Spruce-fir vegetation type accounts for 97 acres (<1 percent) of the Project Area. The dominant species of this type, Englemann spruce (*Picea englemanni*) and sub-alpine fir (*Abies lasiocarpa*), require temperature and moisture regimes that are limited to the higher elevations of the Wasatch Plateau.

### 3.5.2.9 Ponderosa Pine – Mountain Shrub

The Ponderosa Pine – Mountain Shrub vegetation cover type accounts for 89 acres (<1 percent) of the Project Area. Its extent is restricted to one location within the Project Area, along the western edge of the South Area, south of Cottonwood Creek. The overstory of this cover type is dominated by open stands of ponderosa pine (*Pinus ponderosa*). Woody shrubs, such as serviceberry (*Amelanchier* ssp.), Gambel oak (*Quercus gambelii*), curlleaf mountain mahogany (*Cercocarpus ledifolius*), cliff rose (*Purshia mexicana*), snowberry (*Symphoricarpos* ssp.), chokecherry (*Prunus virginiana*) and ceanothus (*Ceanothus* ssp.), are common in the midstory. The understory is composed of herbaceous species such as Letterman needlegrass (*Stipa lettermanii*), bluegrass (*Poa* ssp.), Indian ricegrass (*Stipa hymenoides*), western wheatgrass (*Agropyron smithii*) and slender wheatgrass (*Elymus trachycaulus*). The extent of herbaceous cover in the understory commonly varies depending upon the density of mid and overstory species.

### 3.5.2.10 Aspen

The Aspen vegetation cover type accounts for 30 acres (<1 percent) of the Project Area. The extent of this vegetation type within the Project Area is restricted to one location in the northwestern edge of the South Area. Widely distributed in North America, aspen (*Populus tremuloides*) is known for its diverse communities. Located in relatively moist environments, the understory community of an aspen grove is luxuriant in diversity and production, especially in comparison to the understories associated with conifer forests. Typical components are shrubby cinquefoil (*Pentaphylloides floribunda*), harebell (*Campanula roundifolia*), Fendler meadowrue (*Thalictrum fendleri*), wild geranium (*Geranium caespitosa*), bluegrass (*Poa* ssp.), and timothy (*Phelum* ssp.).

### 3.5.2.11 Riparian and Wetland Areas

Riparian and wetland communities account for 889 acres (<1 percent) of the Project Area. Wetlands are discussed in this section; riparian areas are discussed separately in **Section 3.6.**

Wetlands are a subset of what the U.S. Army of Engineers (COE) defines as "Waters of the U.S." They are characterized as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas. (40 CFR 230.3, 33 CFR 328.3)

Linked to the presence of water, their extent is naturally limited in the vicinity of the Project Area. While limited in coverage, they are of great importance due to their productivity and species diversity. No wetlands have been identified in the North Area.

### 3.5.3 Noxious Weeds

Utah is experiencing a rapid introduction and spread of noxious weeds throughout the state on all types of land ownership. The potential for noxious weeds to continue to spread on BLM administered lands is great. The number of different noxious and invasive weeds of concern continues to increase. Federal, state, and local governments have entered into partnership to eliminate and prevent the infestation and spread of weeds that cause economic loss of crops and animal production, esthetics and recreational experiences, and general condition of native vegetation and soil stability.

Non-native plant species are increasingly common in the vicinity of the Project Area (BLM 1997c). Characteristically opportunistic in nature, they are very successful at invading into freshly disturbed soil. Their occurrence is therefore commonly tied to the activities which cause ground disturbance. Furthermore, the invasion of non-native plant species is fostered by traffic corridors which serve to transport the seeds of non-native species into previously uncontaminated areas.

Once established, non-native plant species out-compete and eventually replace native species, thereby reducing the forage content of the land, and the overall vigor of the plant community. As a consequence of these effects, many non-native species are viewed as detrimental to the environment, and are regulated as such. A noxious weed is defined by the Utah Noxious Weed Act as any species of plant that is especially injurious to public health, crops, livestock land or other property. The State of Utah has given 17 plant species this designation, and further, has identified 15 new and invading species that have the potential to become noxious. These species are listed in **Table 3–16.**

Emery county has further identified several additional problem species: houndstongue, whorled milkweed, buffalobur and chicory, Russian olive. Control and/or eradication of noxious weeds within the Project Area is managed by local, state, and federal authorities (Emery County, Carbon County, Utah Cooperative Extension Service-Carbon and Emery counties, BLM). Integrated pest management is followed in both counties and entails the implementation of biological, mechanical and chemical controls. Mechanical controls are sometimes impractical, however, in areas with difficult terrain (Winger 1997).

There are several ways that noxious or invasion weeds are being introduced into Carbon and Emery counties. Examples of how these plants and seeds are being transported include: escape of ornamental flowering plants from private yards, transport of livestock within and across county lines, use of recreational vehicles and hunting animals, commercial transport of goods on the railroad lines and highways, and transport of heavy equipment used in the oil and gas fields.

## 3.6 RIPARIAN AREAS

Riparian areas are a "form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence" (Leonard, et al. 1992). The vegetation that visually defines a riparian area is valuable in providing sediment retention, floodflow alternation, nutrient removal and transformation, increased production (relative to uplands) for livestock and wildlife forage, habitat diversity for aquatic and terrestrial wildlife, and

**Table 3–16**
**Noxious Weeds of Concern**

| | | |
|---|---|---|
| **State Listed Noxious Weeds** | | |
| Bermuda grass | Canada thistle | leafy spurge |
| quackgrass | dyers woad | pepperweed |
| medusahead | diffuse knapweed | hoary cress |
| musk thistle | Russian knapweed | field bindweed |
| yellow starthistle | spotted knapweed | perennial sorhgum |
| Scotch thistle | squarrose knapweed | |
| **New and Invading** | | |
| black henbane | yellow toadflax | yellow nutsedge |
| camel thorn | water hemlock | wild proso millet |
| dalmatian toadflax | St. Johnswort | velvetleaf |
| goatsrue | purple starthistle | silverleaf nightshade |
| jointed goatgrass | poison hemlock | purple loosestrife |

streambank stability. Riparian areas are an important resource on public lands and are managed as such (Almand and Krohn 1978, BLM 1991b). Their occurrence is generally associated with flowing water and they can be characterized as wetland or non-wetland.

Riparian communities were inventoried on BLM land for the North and South areas. As shown on **Plate 3–4**, the majority of riparian communities on private land occurs in natural drainages (Huntington Creek and Cottonwood Creek). Several wells have been drilled in riparian areas on private land along Cottonwood Creek. Approximately 20 percent of the riparian vegetation within the South Area can be found along man-made canals southwest of Castle Dale, Utah.

The BLM defined three general types of riparian communities on the basis of species dominance. Cottonwood (*Populus angustifolia, P. fremontii*) dominated riparian areas are typically located along perennial streams, such as Huntington Creek or Cottonwood Creek. These communities are representative examples of desert riparian streams with narrow floodplains. Other common species within these communities include elm (*Ulmus* sp.), Russian olive (*Elaeagnus angustifolia*), tamarisk, copperweed, coyote willow (*Salix exigua*), saltgrass (*Distichlis spicata*), and horsetail (*Equisetum arvense*). Big sagebrush (*Artemisia tridentata*), greasewood (*Sarcobatus vermiculatus*), and rubber rabbitbrush (*Chrysothamnus nauseosus*) are found on the adjacent narrow floodplains.

Tamarisk (*Tamarisk ramosissima*) dominated communities also are present along perennial streams and maybe found near irrigation canals. These communities may intermix with the cottonwood community or may be found as monocultures.

The least common of the three types of riparian community is the grass community. This community is dominated by saltgrass (*Distichlis spicata*), and sedges (*Carex* sp.) and typically occurs as the perennial drainages pass through salt desert shrub communities.

# 3.7 WILDLIFE

## 3.7.1 Aquatic Species

Information for this section of the report was gathered from three primary sources. First, resource management agencies were contacted for information on fish species status, occurrence, and use of habitats within the Project Area. Second, both published and unpublished literature was used to supplement the agencies' information. Third, field surveys of the aquatic resources were conducted on October 21 to 23, 1997. The survey locations are shown on **Plate 3–2**. The surveys included macroinvertebrate sampling and electroshocking.

### 3.7.1.1 North Area

Reconnaissance surveys in October 1997 documented that drainages within the North Area are intermittent and unable to support fish. Therefore, no fish species occur within the North Area.

### 3.7.1.2 South Area

The fisheries resource within the South Area is restricted to Huntington and Cottonwood Creek drainages, as well as numerous ponds and reservoirs. Huntington Lake contains a bass and trout fishery. The ponds and reservoirs are reported to have nonnative stocked game fish species such as trout, bass, and bluegill. The San Rafael River (downstream of the Project Area) contains mountain sucker, bluehead sucker, flannelmouth sucker, mottled sculpin, speckled dace, Utah chub, carp, bluegill, catfish, red shiner, fathead minnow, sand shiner, and green sunfish (Masslich and Holden 1995, BLM 1997c).

Huntington and Cottonwood Creek drainages within the South Area were considered the analysis area for this project. During October 1997, the analysis area was surveyed for fish and macroinvertebrates. Three stations on Cottonwood Creek and two stations on Huntington Creek were surveyed. Additionally, three tributaries to Huntington Creek were surveyed (Meetinghouse, Fish, and Deer Creeks). Results of these surveys are described below and summarized in **Table 3–17**.

#### *3.7.1.2.1 Cottonwood Creek*

Brown trout were the only trout collected in Cottonwood Creek during the 1997 survey. In addition to brown trout, nonnative Snake River cutthroat trout were found in 1980 (UDWR 1980). Therefore, cutthroat may still occur in limited numbers within the Cottonwood Creek drainage.

Native species collected from Cottonwood Creek in 1997 included speckled dace, mottled sculpin, and bluehead sucker. Additionally, a flannelmouth sucker was collected in 1980 (UDWR 1980), indicating the potential for this species to still occur in limited numbers in Cottonwood Creek. Bluehead sucker and flannelmouth sucker are Utah state-listed sensitive species/species of special concern and are discussed further in **Section 3.8.3**.

Utah chub was newly found in Cottonwood Creek during the 1997 surveys. This species is not native to the drainage. It presumably came from Joe's Valley Reservoir, located upstream of the sample station. This reservoir has a increasing population of Utah chub (Cavalli 1998).

**Table 3–17**
**Summary of Fish Electroshocking Results From Stations in Huntington, Meetinghouse, Fish, Deer, and Cottonwood Creeks**
**October 21–23, 1997**

| Fish Species | Sample Stations (Number of Fish/Mile[1]) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | CC1 | CC2 | CC3 | HC1 | HC2 | MC1 | FC1 | DC1 |
| **Salmonidae (trout)** | | | | | | | | |
| Brown trout (*Salmo trutta*) | 53 | 70 | 158 | 211 | 282 | no | no | no |
| Cutthroat trout (*Oncorhynchus clarki*)[2] | 0 | 0 | 0 | 35 | 35 | fish | fish | fish |
| Rainbow Trout (*Oncorhynchus mykiss*) | 0 | 0 | 0 | 0 | 18 | | | |
| **Cyprinidae (minnows)** | | | | | | | | |
| Speckled dace (*Rhinicthys osculus*)[3] | 70 | 0 | 0 | 0 | 0 | | | |
| Utah chub (*Gila atraria*) | 0 | 18 | 0 | 0 | 0 | | | |
| **Catostomidae (suckers)** | | | | | | | | |
| Bluehead sucker (*Catostomus discobolus*)[3] | 53 | 0 | 0 | 0 | 0 | | | |
| **Cottidae (sculpins)** | | | | | | | | |
| Mottled sculpin (*Cottus bairdi*)[3] | 158 | 246 | 246 | 0 | 0 | | | |
| Total Population Estimate | 334 | 334 | 405 | 246 | 334 | 0 | 0 | 0 |
| Total Number of Species | 4 | 3 | 2 | 2 | 3 | 0 | 0 | 0 |

Notes:
1. Population estimates were calculated using the statistical program MicroFish 3.0 (Deventer and Platts 1989)
   - At each stream station, 300-foot reaches were electroshocked (two passes)
   - CC = Cottonwood Creek; HC = Huntington Creek; MC = Meetinghouse Creek; FC = Fish Creek; DC = Deer Creek; See **Plate 3–2** for exact locations of stations.
   - Average Daily Flows (cfs) during the survey were: Cottonwood = 96 cfs; Huntington = 162 cfs; Meetinghouse = <1 cfs; Fish = <1 cfs; Deer = <1 cfs.
   - Huntington Creek was running higher-than-normal flows for October due to reservoir releases, making sampling efficiency questionable especially for potential sculpins.
2. Cutthroat trout collected were not the native Colorado River cutthroat trout subspecies (*Oncorhynchus clarki pleuriticus*)
3. Fish species native to the drainage

As with the fish survey, aquatic macroinvertebrates were sampled at three stations within Cottonwood Creek in the fall of 1997. The methods consisted of compositing three quantitative Surber (1 square foot) samples within riffle habitats. Several metrics were applied to the macroinvertebrate data with the following results.

The biotic indices applied to the Cottonwood Creek data suggested excellent-to-good biotic condition, with most species having relatively low pollution tolerances (**Table 3–18**). Accordingly, more than 90 percent of the organisms collected came from the orders ephemeroptera (mayflies), trichoptera (caddisflies) and plecoptera (stoneflies), or EPT orders, which are generally considered indicators of high water and habitat quality. However, abundance, richness, and diversity values were found to be only fair. These results suggest that Cottonwood Creek historically had excellent biotic condition (as shown by the presence of cleanwater taxa) but that their populations are currently depressed.

#### *3.7.1.2.2 Huntington Creek*

Reservoir releases into Huntington Creek during the 1997 survey created abnormally high flows of 162 cfs, compared to a normal flow of 30 to 40 cfs, at the two sample stations. This, along with the resulting high turbidity, made fish sampling difficult. Therefore, the 1997 fish and macroinvertebrate data collected in Huntington Creek should be considered minimum population estimates, with sculpins and other small fish potentially being missed entirely.

## Table 3–18
## Macroinvertebrate Bioassessment Metrics for Stations in Huntington, Meetinghouse, Fish, Deer, and Cottonwood Creeks, October 21–23, 1997

| | Sample Stations[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | CC1 | CC2 | CC3 | HC1 | HC2 | MC1 | FC1 | DC1 |
| **General Metrics** | | | | | | | | |
| Total Abundance (# / ft²) | 40 | 28 | 47 | 66 | 70 | 9 | 15 | 59 |
| Total Abundance (# / m²) | 434 | 301 | 506 | 707 | 753 | 100 | 161 | 639 |
| Total Number Taxa | 17 | 11 | 16 | 19 | 18 | 9 | 10 | 11 |
| # EPT Taxa | 11 | 9 | 9 | 14 | 12 | 6 | 6 | 5 |
| % EPT Taxa | 90.1 | 94.0 | 76.6 | 82.2 | 80.0 | 89.3 | 82.2 | 94.4 |
| % Dominant Taxon | 62.8 | 34.5 | 27.7 | 44.2 | 29.5 | 50.0 | 48.9 | 52.8 |
| % Chironomidae | 1.7 | 4.8 | 5.0 | 6.6 | 13.3 | 0.0 | 0.0 | 0.0 |
| EPT/Chironomidae | 54.50 | 19.75 | 15.43 | 12.46 | 6.00 | --- | --- | --- |
| **Diversity Indices** | | | | | | | | |
| Shannon (H) | 2.21 | 2.68 | 3.22 | 2.92 | 3.26 | 2.42 | 2.47 | 1.71 |
| Evenness (e) | 0.35 | 0.73 | 0.81 | 0.53 | 0.72 | 0.78 | 0.70 | 0.36 |
| **Biotic Indices** | | | | | | | | |
| HBI | 3.7 | 3.5 | 4.3 | 3.4 | 4.1 | 4.8 | 3.6 | 4.3 |
| CTQ | 91.3 | 75.9 | 83.5 | 84.3 | 83.1 | 94.9 | 82.6 | 90.8 |
| **Percent Composition Per Order** | | | | | | | | |
| Ephemeroptera | 10.7 | 29.8 | 37.6 | 17.3 | 37.6 | 21.4 | 4.4 | 38.8 |
| Plecoptera | 12.4 | 25.0 | 8.5 | 17.8 | 10.5 | 0.0 | 22.2 | 2.2 |
| Trichoptera | 66.9 | 39.3 | 30.5 | 47.2 | 31.9 | 67.9 | 55.6 | 53.4 |
| Odonata | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Diptera | 5.0 | 6.0 | 10.6 | 7.1 | 16.2 | 3.6 | 0.0 | 2.8 |
| Coleoptera | 5.0 | 0.0 | 0.0 | 9.1 | 3.8 | 7.1 | 8.9 | 1.1 |
| Hemiptera | 0.0 | 0.0 | 2.1 | 0.0 | 0.0 | 0.0 | 2.2 | 0.0 |
| Miscellaneous Taxa | 0.0 | 0.0 | 10.6 | 1.5 | 0.0 | 0.0 | 6.7 | 1.7 |

Notes:

1 For station locations, refer to **Plate 3–2**.

Abundance — Under certain types of stresses, this value may be increased (by tolerant organisms) or reduced (by lowering the number of nontolerant organisms).

Total # of Taxa — The total number of taxa (richness) generally increases with increasing biotic condition.

# EPT Taxa — The total number of distinct taxa within the orders Ephemeroptera, Plecoptera, and Trichoptera. This value summarizes taxa richness within the insect orders generally considered sensitive to pollution.

% EPT Taxa — The percent contribution of the orders Ephemeroptera, Plecoptera, and Trichoptera.

% Dominant Taxon — The percent contribution of the most numerous taxon found. Undisturbed environments generally support communities having large numbers of species with no individual species present in overwhelming abundance.

% Chironomidae — The percent contribution of the family Chironomidae. Disproportionate dominance of this generally tolerant group usually indicates poor biotic condition.

EPT/Chironomidae — Skewed population having a disproportionate number of the tolerant chironimids relative to the more sensitive EPT group may indicate environmental stress.

Shannon H — A diversity index where relative abundances of the different taxa are taken into account. In general, values from 3 to 5 indicate clean water (good), 1 to 3 moderately polluted water (fair), and values below 1 indicate heavily polluted water (poor).

Evenness — The measure of how evenly the individuals are distributed among species. Values greater than 0.5 are considered to characterize natural stream communities. Even slight levels of degradation can reduce evenness below 0.5, and generally below 0.3.

HBI — The HBI (modified Hilsenhoff biotic index) summarizes the benthic community's overall tolerance to pollution. 0.00-3.75 (excellent), 3.76-4.25 (very good), 4.25-5.00 (good), 5.01-5.75 (fair), 5.76-6.5 (fairly poor), 6.51-7.25 (poor), and 7.26-10.00 (very poor).

CTQ — (Community Tolerance Quotient). Similar to the HBI, each individual organism in a sample has a preassigned tolerance value. Mean values range from 40 to 108. The higher numbers indicate more tolerant communities and may show stressed conditions.

Brown trout was the dominant species found in Huntington Creek during the 1992 and 1997 surveys. Additionally, cutthroat trout and rainbow trout were found in limited numbers during both surveys. The cutthroat trout collected in 1997 were not the native Colorado River cutthroat trout subspecies. Potential occurrence of this subspecies is discussed in **Section 3.8.3.**

The native species mottled sculpin probably still occurs in Huntington Creek. Although not found in 1997, mottled sculpins were found in Huntington Creek during the 1992 surveys (UDWR 1992). This species was not found in 1997, most likely because of the high flows/turbidity encountered during the survey.

No suckers were found in Huntington Creek during either survey. However, the presence of spawning suckers (bluehead or mountain) in three tributaries to Huntington Creek in 1982 indicates that they potentially occur in limited numbers within the mainstem of Huntington Creek. Whether the suckers found in 1982 were bluehead or mountain suckers is unknown (Berg 1997).

No fish were found in Meetinghouse, Fish, and Deer creeks during the October 1997 surveys. However, June 1982 surveys found a significant number of spawning bluehead/mountain suckers in Fish and Deer creeks (UDWR 1982). The lack of suckers in 1997 is likely due to the survey being conducted outside of the suckers spawning season. The 1982 data indicate that Fish and Deer creeks are potentially important tributaries for bluehead/mountain sucker spawning and recruitment to Huntington Creek.

The 1982 surveys found nonnative trout immediately above the mouths of Deer Creek and Meetinghouse Creek, indicating occasional resting or feeding in the extreme lower section of these creeks. No trout were found above these confluence areas during either 1982 or 1997.

A notable difference between the 1982 and 1997 Huntington Creek surveys was that speckled/longnose dace were found in Fish Creek in 1982 and not in 1997. This indicates that the species may no longer occur there. Whether the species found in 1982 was speckled dace or longnose dace was unknown (Berg 1997).

As with the fish survey, aquatic macroinvertebrates were sampled at two stations in the mainstem of Huntington Creek and one station in three of its tributaries: Meetinghouse, Fish, and Deer creeks. Bioassessment metric results in the mainstem of Huntington Creek were similar to Cottonwood Creek's results. Abundance and richness values were slightly higher than in Cottonwood. As expected, data from the three small tributary streams indicated lower abundance, richness, and diversity than Huntington Creek. Macroinvertebrate data collected by the Forest Service from Huntington Creek in the same stream section showed similar results to the 1997 data (Mangum 1982).

## 3.7.2 Terrestrial Wildlife

Wildlife habitats that would be affected by the project include the areas that would be physically disturbed by the construction of wells, access roads, pipelines, and production facilities. Also indirectly, habitats surrounding these actions would be affected. However, the shape and extent of the areas affected would vary by species and by facility.

Eleven vegetation types have been identified within the Project Areas. They include pinyon-juniper, salt desert shrub, sagebrush-grassland, barren land, spruce fir, aspen, mountain fir, ponderosa pine-mountain shrub, agricultural, wetland and riparian, and urban. The characteristics of each type are described in **Section 3.5**.

Information for this section of the report was gathered from three primary sources. First, resource management agencies were contacted for information regarding the general area. Agencies contacted included the U.S. Fish and Wildlife Service (USFWS), BLM, and UDWR. Second, both published and unpublished literature was used to supplement the agencies' information. Third, a site reconnaissance of the area was conducted in October, 1997. The following discussion describes each of the major wildlife groups within the Project Area.

### 3.7.2.1 Big Game

The Project Area is within herd unit areas for mule deer, elk, and pronghorn antelope. These species occur throughout the Project Areas in areas of suitable habitats. The UDWR has identified various types of ranges for each species, including critical and high value winter ranges. These types of ranges are defined as:

- Critical or crucial ranges are sensitive use areas that are limited in availability or provide unique qualities for high interest wildlife. These areas constitute irreplaceable, critical requirements for these species.

- High value ranges are intensive use areas that due to relatively wide distribution do not constitute critical values but which are highly important to high interest wildlife.

#### *3.7.2.1.1 Elk*

Elk occurred within the mountainous regions of Utah historically. However, due to unlimited hunting, elk populations in the state diminished until 1898 when elk hunting was prohibited. Elk transplants were initiated in 1912 and continued until 1925. Today elk again occur within the mountainous regions of the state and are considered a big game species.

Within the Project Area, elk may be found in any of the eleven vegetation types, except urban. However, they would most likely be found in more common types, such as pinyon-juniper and sagebrush-grassland. Elk also would use the limited amounts of forest types present in the South Area, including mountain fir, aspen, and spruce-fir. Use of some vegetation types, such as barren lands and salt desert shrub, probably is limited to minor foraging, lounging, and travel between more suitable types.

For 1998, UDWR is revising the herd unit boundaries for elk. Previously, the North Area was part of UDWR's Range Creek Herd Unit (#24) and the South Area was part of the Manti Herd Unit (#23). With the revisions proposed by UDWR, the North Area would be encompassed by the Anthro/Range Creek Herd Unit (#11) and most of the South Area would be encompassed by the Manti-Nebo Herd Unit (#16). Although small portions of the South Area and pipeline corridor east of State Highway 10 would be encompassed by the San Rafael Herd Unit (#12), any elk using these small areas would probably be elk from the Manti-Nebo Herd Unit.

Although the North Area occurs within UDWR's Anthro/Range Creek Herd Unit, elk do not use or inhabit the North Area. Furthermore, habitats present within the North Area have not been delineated as critical or high value ranges. Elk occupy the habitats present in other portions of the Anthro/Range Creek Herd Unit.

The South Area occurs within the Manti portion of the Manti-Nebo Herd Unit, which contains the largest elk herd in Utah. The target winter population for this portion of the Herd Unit is 12,000 elk, which accounts for most of the 13,400 target population for the entire Manti-Nebo Herd Unit. Additionally, UDWR wants

to attain a minimum bull to cow ratio of 8 bulls to 100 cows (as measured during the biennial winter aerial census) with at least four of the eight bulls being mature (2.5 years of age or older).

In general, the Manti subpopulation of elk spends summers west of the Project Area at higher elevations in the Manti-La Sal National Forest. Winters are spent at lower elevations in and near the Project Area. Portions of areas (**Plate 3–5**) where the elk winter within the South Area have been delineated as crucial winter range and high priority winter range. The 16,410 acres of crucial winter range occur west of Huntington on the lower slopes of East Mountain (**Plate 3–5**), primarily north of Danish Bench. About 7,940 acres of high priority winter range have been delineated near the mouth of Huntington Canyon, in the Cottonwood Creek drainage, and along the east-facing slopes in the Rock Creek drainage (**Plate 3–5**).

The proposed pipeline corridor occurs within the Manti-Nebo Herd Unit and the San Rafael Herd Unit. However, no crucial or high priority winter ranges have been delineated along the pipeline corridor.

#### *3.7.2.1.2 Mule Deer*

Within the eastern portion of Utah, mule deer occur throughout the area with the highest populations occurring within mountainous regions. Their populations fluctuate based on weather conditions, such as drought and severe winters. Overall, populations have declined in eastern Utah due to severe drought conditions from 1988 through 1992. This was followed by the severe winter of 1992–1993. These conditions resulted in high deer mortalities but deer populations appear to be increasing recently.

Mule deer occur throughout the entire Project Area and may be found in any of the eleven vegetation types, except urban. However, they would most likely be found in more common types, such as pinyon-juniper and sagebrush-grassland. Use of some vegetation types, such as barren lands and salt desert shrub, probably is limited to minor foraging, lounging, and travel between more suitable types.

As discussed for elk, UDWR is revising the herd unit boundaries for deer. Previously, the North Area was part of UDWR's Range Creek Herd Unit (#32) and the South Area was part of the Northeast and Southeast Manti Herd Units (#30 and #31). With the revisions proposed by UDWR, the North Area would be encompassed by the Anthro/Range Creek Herd Unit (#11) and most of the South Area would be encompassed by the Manti-Nebo Herd Unit (#16). Small portions of the South Area and pipeline corridor east of State Highway 10 would be encompassed by the San Rafael Herd Unit (#12). UDWR has delineated a total of 1,440,510, 2,249,971, and 59,796 acres of identified ranges (year-long, summer, and winter) within the Anthro/Range Creek, Manti-Nebo, and San Rafael herd units, respectively.

In its Draft Management Plan for the Anthro/Range Creek Herd Unit, the UDWR indicates its target winter herd size for the Range Creek subpopulation (which includes the North Area) is 6,000 wintering mule deer. The target winter herd size for the entire Herd Unit is 8,500 deer. UDWR also has established a goal for the herd of a post-season buck to doe ratio of 15:100, with 30 percent of the bucks being three point or better.

Almost all of the North Area has been delineated as crucial winter range or high priority winter range (**Plate 3–6**). The 11,850 acres of crucial winter range occupy most of the northeast portion of the North Area. High priority winter range (almost 6,230 acres) is more concentrated in the northwest portion and along the southern boundary. Only a small area in the southeast corner of the North Area (270 acres) has not been delineated as crucial winter range or high priority winter range.

According to its Draft Management Plan for the Manti-Nebo Herd Unit, the UDWR would manage the Manti Mountain or Wasatch Plateau portion of the unit (which encompasses almost all the South Area and pipeline corridor) to achieve a target population size of 38,000 deer. The target winter herd size for the entire Herd Unit is 60,600 animals. UDWR also has established a goal for the herd of a post-season buck to doe ratio of 15:100, with 30 percent of the bucks being three point or better.

Both crucial winter range and high priority winter range have been delineated within the South Area (**Plate 3–6**). Most of the 31,290 acres of crucial winter range occurs along the east face of the escarpment in and between the Cottonwood Creek and Huntington Creek drainages. A smaller area of crucial winter range occurs in the Rock Creek drainage in the southwest part of the South Area. About 26,120 acres of the South Area have been delineated as high priority winter range. This range extends from the South Area's northern boundary to its southern boundary along the face of the escarpment. Neither the eastern part of the South Area nor the pipeline corridor encompass any crucial or high priority winter ranges.

#### *3.7.2.1.3 Pronghorn Antelope*

The Icelander Wash Herd Unit (#11) encompasses the Project Area. Within this unit, about 793,600 acres of pronghorn habitat have been identified, most of which is managed by the BLM. In 1996–1997, ratios of fawns to does and bucks to does before the hunting season was about 31 to 100 and 30 to 100, respectively (Evans and Westphal, 1997). Pronghorn antelope typically inhabit open vegetation types where trees are limited and visibility is high. Thus, within the Icelander Wash Herd Unit, pronghorns are expected to occur primarily within the sagebrush grasslands, salt desert shrub, agricultural, and barren vegetation types.

Although the Project Area occurs within the Icelander Wash Herd Unit, it is isolated from the rest of the Herd Unit by major highways and their fences. Thus, no antelope currently occupy either the North Area or the South Area. Furthermore, no critical or high priority pronghorn ranges have been delineated within the Project Area or along the pipeline corridor.

### 3.7.2.2 Raptors

General distribution records and field observations made by biologists of the UDWR, BLM, and Forest Service document the occurrence of a variety of raptors in the Project Area and immediate vicinity. Species identified include the red-tailed hawk, ferruginous hawk, rough-legged hawk, golden eagle, bald eagle, prairie falcon, peregrine falcon, American kestrel, great horned owl, short-eared owl, and northern harrier. Furthermore, surveys and other observations have documented the presence of nests for five species. They are the golden eagle, ferruginous hawk, red-tailed hawk, prairie falcon, and peregrine falcon. Although no records exist to document nests of other species, several additional species probably nest in the Project Area, including the northern harrier, American kestrel, and great horned owl. All raptors and their nests are protected from take or disturbance under the Migratory Bird Treat Act (16 USC, § 703 et seq.). Golden eagles and their nests also are protected under the Bald Eagle Protection Act, amended in 1973 (16 USC, § 669 et seq.).

Intensive aerial surveys were conducted during May of 1997 and 1998 to identify and locate raptor nests within the Project Area. These surveys located a total of 140 raptor nests that were encompassed by the North and South areas and pipeline corridor or within ½ mile of their boundaries. Twenty-nine and 111 of the 140 raptor nests were encompassed by, or within ½ mile of, the North and South areas, respectively. One golden eagle nest located in the South Area also is within the proposed pipeline corridor or within ½ mile of the

corridor. Most of these nests are located along the pediments which trend northeast-southwest through the western portion of the Project Area.

Most of the nests (68 percent) were associated with golden eagles (**Table 3–19**). Fourteen (10 percent) were those of unidentified falcons, five (4 percent) were those of prairie falcons, five (4 percent) were peregrine falcons, five (4 percent) were red-tailed hawks, and the other fourteen (10 percent) were unidentified. Additionally, 69 (50 percent) were tended or active for at least some time during the 1997 or 1998 nesting seasons, or both.

### 3.7.2.3 Upland Game

#### *3.7.2.3.1 Chukar*

Chukars inhabit areas of rocky, grassy, or brushy slopes and creek bottoms in the mountains and rugged canyons of the desert. In 1996, Carbon and Emery counties represented 2.10 and 2.97 percent of the chukar harvest in the state, respectively (Mitchell et al. 1996). Long-term harvest and production trends suggest chukar populations are relatively stable in Utah (BLM 1997c). However, brood surveys suggest brood production in 1996 was slightly below average (Mitchell et al. 1996). No critical chukar habitat has been identified within the Project Area.

#### *3.7.2.3.2 Ring-necked Pheasant*

Ring-necked pheasants occur in open country, cultivated areas, wet meadows, riparian areas, and overgrown weedy ditches and fields. Statewide 1996 pheasant roadside counts were above 1995 counts, however, hens appeared to have fewer young. In 1996, Emery and Carbon counties represented 4.31 and 2.16 percent of the state's total pheasant harvest, respectively (Mitchell et al. 1996). Statewide pheasant harvests are decreasing in population due to the loss, degradation, and fragmentation of habitats (Mitchell et al. 1996).

**Table 3–19**
**Number and Status of Raptor Nests Within the Project Area**

| | North Area | | | South Area | | | Pipeline Corridor | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | | | Total | | | Total | | |
| Species | No. | Percent | Number Active/ Tended | No. | Percent | Number Active/ Tended | No. | Percent | Number Active/ Tended |
| Falcon | 6 | 20.7 | 5 | 8 | 7.2 | 6 | - | - | - |
| Golden Eagle | 14 | 48.3 | 5 | 81 | 73.0 | 34 | 1[a] | 100 | 1 |
| Peregrine Falcon | 1 | 3.4 | 1 | 4 | 3.6 | 4 | - | - | - |
| Prairie Falcon | 1 | 3.4 | 1 | 4 | 3.6 | 4 | - | - | - |
| Red-tailed Hawk | 3 | 10.4 | 1 | 2 | 1.8 | 1 | - | - | - |
| Ferruginous Hawk | 2 | 6.9 | - | - | - | - | - | - | - |
| Unidentified | 2 | 6.9 | 1 | 12 | 10.8 | 6 | - | - | - |
| Total | 29 | 100 | 14 | 111 | 100 | 55 | 1 | 100 | 1 |

Note:
a This nest also is in the South Area

#### 3.7.2.3.3 Desert Cottontail

Within this portion of Utah, desert cottontails inhabit desert and submontane habitats especially sagebrush grass lands and agricultural lands. In 1996, Carbon and Emery counties accounted for 5.92 and 5.64 percent of the state's harvest of desert cottontails, respectively (Mitchell et al. 1996). Within Utah, the population of desert cottontails is still below the 1988 high. This decline is due to the severe winter of 1992–93 and seven years of drought conditions (BLM 1997c). However, 1996 roadside counts suggest the population density has increased from 1995.

#### 3.7.2.3.4 Mourning Doves

The mourning dove is a common spring and fall migrant and summer resident in the Project Area. Because mourning doves are able to adapt to a wide variety of habitats, they may occur in all vegetation types present in the Project Area, including coniferous forests, residential areas, and agricultural areas. Mourning doves' needs include trees in proper relation to open areas for nesting and roosting, a combination of wild and cultivated foods for feeding, and a source of water. Weed patches and grains in proximity to nesting and roosting cover provide excellent food. The mourning dove is a highly popular game bird. Due to this popularity, UDWR tracks mourning dove hunter success, distribution of harvest, and hunting pressure. UDWR's most recent summary of these parameters suggests Carbon and Emery counties account for about 4 percent of Utah's total 1996 harvest of mourning doves (Mitchell et al. 1996). In 1996, abut 200,000 mourning doves were harvested in Utah.

### 3.7.2.4 Furbearers/Predators

Furbearers and predators expected to occur within the Project Area include coyotes, skunks, bobcats, raccoons, and fox. These species are expected to occur through out both the North and South Areas and some species may be locally abundant. Mountain lions occur within rough habitats in the foothill and canyon country. Lions are closely associated with mule deer, which is their principle prey species. Consequently, critical habitats for the lion are considered to overlap with the crucial and high priority ranges delineated for mule deer in the Project Area.

### 3.7.2.5 Small Mammals

Small mammal species occurring within the Project Area probably include the deer mouse, least chipmunk, Richardson's ground squirrel, Belding ground squirrel, and bushy-tailed woodrat. Small mammal species are expected to occur within all habitat types within both the North and South Areas.

### 3.7.2.6 Waterfowl and Shorebirds

Within the Project Area, Huntington Lake, which is in the northeast portion of the South Area, comprises the largest single area of habitat for waterfowl and shorebirds. However, waterfowl and shorebirds also use small ponds and irrigation ditches that are scattered across private and Federal lands within the Project Area. Waterfowl species expected to occur include northern pintails, mallards, snow geese, American widgeon, and common and red-breasted mergansers. Shorebird species may include greater and lesser yellowlegs, red-necked phalaropes, short-billed dowitchers, and least sandpipers (BLM 1997c).

#### 3.7.2.7 Songbirds

Numerous songbirds occur within the Project Area. Species anticipated to occur include the chipping sparrow, rock wren, canyon wren, scrub jay, American robin, black-billed magpie, yellow warbler, and western flycatcher. The density and number of songbirds vary by vegetation type and season.

#### 3.7.2.8 Reptiles and Amphibians

Numerous species of reptiles and amphibians occur within the Project Area. Amphibian species, such as the tiger salamander, red-spotted toad, Woodhouse's toad, and northern leopard frog, are expected to occur within riparian and wetland habitats. Reptile species, including night snakes, western terrestrial garter snakes, western rattlesnakes, and pine snakes, are expected to occur within drier habitats in the Project Area.

## 3.8 SPECIAL-STATUS SPECIES

This section discusses species that have a special-status designation associated with them. This special-status designation includes:

- species listed as threatened or endangered, proposed for listing as threatened or endangered, or considered as a candidate for listing as threatened or endangered by the USFWS,
- species listed as sensitive by the BLM or Forest Service, and
- species listed as threatened, endangered, or a species of special concern by the State of Utah.

Initially, 61 species with one or more of these special-status designations were considered in this analysis. They included 17 species of plants, 1 species of reptile, 9 species of fish, 23 species of birds, and 11 species of mammals (**Table 3–20**). An initial evaluation of the species suggested the presence of 13 of the 61 species is unlikely due to a lack of potentially-suitable habitats or the Project Area is not within the species' range (**Table 3–20**). These species were not considered further in the analysis. The other 48 species that have at least some potential to occur in the Project Area were evaluated and are discussed below.

### 3.8.1 Special-Status Plant Species

#### 3.8.1.1 Creutzfeldt-flower

Creutzfeldt-flower is a member of the Borage family and is endemic to central Utah in Carbon and Emery counties. Like many members of Cryptantha, the creutzfeldt-flower is a perennial with salverform (trumpet shaped) white flowers that are produced from late April to June. It is distinguishable by its narrowly spatulate to oblanceolate leaves that, while glabrous above, have undersides covered with appressed bristles that are blistered at the base.

Potentially-suitable habitats for this species are defined as shadscale and mat atriplex communities on the Mancos Shale Formation between 5,250 and 6,495 feet. Seven occurrences of Creutzfeldt-flower were located in the South Area during surveys conducted in 1997 (Intermountain Ecosystems 1997). Four occurrences were found around Rowley Flats, one of which was the largest and most contiguous occurrence. Two occurrences were north and south of Buzzard Bench. Finally, a small population was found at Diversion Hollow. The total number of individuals at all seven locations was about 14,000.

## Table 3–20
## Summary of Special-Status Species

| Common Name | Scientific Name | Lifeform [1] | USFWS Status[2] | BLM Sensitive | Forest Service Sensitive | Utah State Status[2] | Occurrence in Project Area[3] |
|---|---|---|---|---|---|---|---|
| Graham beardtongue | *Penstemon grahamii* | P | C | | | | 1 |
| Barneby reed-mustard | *Schoenocarmbe barnebyi* | P | E | | | | 1 |
| Jones cycladenia | *Caclyadenia humilis* var. *jonesii* | P | T | | | | 1 |
| Last chance townsendia | *Townsendia aprica* | P | T | | | | 1 |
| Maguire daisy | *Erigeron maguirei* | P | E | | | | 1 |
| San Rafael cactus | *Pediocactus despainii* | P | E | | | | 2 |
| Winkler cactus | *Pediocactus winkleri* | P | T | | | | 3 |
| Wright fishhook cactus | *Sclerocactus wrightiae* | P | E | | | | 2 |
| Creutzfeldt-flower | *Cryptantha creutzfeldtii* | P | | | ✓ | S | 3 |
| Low hymenoxys | *Hymenoxys depressa* | P | | | | S | 2 |
| Canyon sweetvetch | *Hedysarum occidentale* var. *canone* | P | | | ✓ | | 3 |
| Silver milkvetch | *Astragalus subcinereus* var. *basalticus* | P | | | | S | 2 |
| Smith wild buckwheat | *Eriogonum corymbosum* var. *smithii* | P | | | | S | 1 |
| Mussentuchit gilia | *Gilia tenuis* | P | | | | S | 1 |
| Jones indigo bush | *Psorothamnus polyadenius* var. *jonesii* | P | | | | S | 1 |
| Psoralea globemallow | *Sphaeralcea psoraloides* | P | | | | S | 2 |
| Alcove bog orchid | *Habenaria zothecin* | P | | | | S | 1 |
| Utah milk snake | *Lampropeltis triangulum pleuriticus* | R | | | | S | 2 |
| Bonytail chub | *Gila cypha* | F | E | | | E | 4 |
| Colorado squawfish | *Ptychocheilus lucius* | F | E | | | E | 4 |
| Humpback chub | *Gila cypha* | F | E | | | E | 4 |
| Razorback sucker | *Xyrauchen texanus* | F | E | | | E | 4 |
| Roundtail chub | *Gila robusta* | F | | | | T | 4 |
| Leatherside chub | *Gila copei* | F | | | | S | 1 |
| Flannelmouth sucker | *Catostomus latipinnis* | F | | | | S | 3 |
| Bluehead sucker | *Catostomus discobolus* | F | | | | S | 3 |
| Colorado River cutthroat trout | *Oncorhynchus clarki pleuriticus* | F | | | ✓ | S | 4 |
| White-faced ibis | *Plegadis chihi* | B | | | | | 5 |

## Table 3–20 (continued)
## Summary of Special-Status Species

| Common Name | Scientific Name | Lifeform [1] | USFWS Status[2] | BLM Sensitive | Forest Service Sensitive | Utah State Status[2] | Occurrence in Project Area[3] |
|---|---|---|---|---|---|---|---|
| Osprey | *Pandion haliaetus* | B | | | | S | 5 |
| Northern goshawk | *Accipiter gentilis* | B | | | ✓ | S | 2 |
| Ferruginous hawk | *Buteo regalis* | B | | | | T | 3 |
| Swainson's hawk | *Buteo swainsoni* | B | | | | S | 2 |
| Bald eagle | *Haliaeetus leucocephalus* | B | T | | | T | 3 |
| Peregrine falcon | *Falco peregrinus* | B | E | | | E | 3 |
| Snowy plover | *Charadrius alexandrinus* | B | | | | | 5 |
| Mountain plover | *Charadrius montanus* | B | | | | S | 5 |
| Long-billed curlew | *Numenius americanus* | B | | | | S | 5 |
| Black tern | *Chlidonias niger* | B | | | | S | 5 |
| Caspian tern | *Sterna caspia* | B | | | | S | 5 |
| Yellow-billed cuckoo | *Coccyzus americanus* | B | | | | T | 2 |
| Short-eared owl | *Asio flammeus* | B | | | | S | 2 |
| Burrowing owl | *Athene cunicularia* | B | | | | S | 3 |
| Bewick's wren | *Thryomanes bewickii* | B | | | | | 2 |
| Loggerhead shrike | *Lanius ludovicianus* | B | | | | | 3 |
| Common yellowthroat | *Geothlypis trichas* | B | | | | | 2 |
| Yellow-breasted chat | *Ichteria virens* | B | | | | S | 2 |
| Grasshopper sparrow | *Ammodramus savannarum* | B | | | | S | 2 |
| Lark bunting | *Calamospiza melanocorys* | B | | | | | 5 |
| Brewer's sparrow | *Spizella breweri* | B | | | | | 2 |
| Dwarf shrew | *Sorex nanus* | M | | | | S | 2 |
| Spotted bat | *Euderma maculatum* | M | | | ✓ | S | 3 |
| Small-footed myotis | *Myotis leibii* | M | | | | S | 2 |
| Fringed myotis | *Myotis thysanodes* | M | | | | S | 2 |
| Townsend's big-eared bat | *Plecotus townsendii* | M | | | ✓ | S | 2 |
| Big free-tailed bat | *Nyctinomops macrotis* | M | | | | S | 2 |
| Brazilian free-tailed bat | *Tadarida brasiliensis* | M | | | | S | 2 |

## Table 3–20 (continued)
## Summary of Special-Status Species

| Common Name | Scientific Name | Lifeform [1] | USFWS Status[2] | BLM Sensitive | Forest Service Sensitive | Utah State Status[2] | Occurrence in Project Area[3] |
|---|---|---|---|---|---|---|---|
| Ringtail | *Bassariscus astutus* | M | | | | S | 3 |
| Black-footed ferret | *Mustela nigripes* | M | E | | | E | 1 |
| Northern river otter | *Lutra canadensis* | M | | | | S | 1 |
| Thirteen-lined ground squirrel | *Spermophilus tridecemlineatus* | M | | | | S | 1 |

Notes:

1. B=bird, M=mammal, P=plant, R=reptile.
2. E=endangered, PE=proposed endangered, T=threatened, C=Candidate, S=species of special concern.
3. 1. Species presence unlikely due to lack of potentially-suitable habitats or the Project Area is not within the species' range.
   2. Potentially-suitable habitats occur or may occur in the Project Area. However, the species' presence has not been confirmed or documented.
   3. Potentially-suitable habitats are present in the Project Area and the species' presence in or near the Project Area has been confirmed and documented.
   4. Species presence in the Project Area's streams has not been confirmed or documented, but it may occur in potentially-suitable habitats upstream or downstream of the Project Area.
   5. Species may migrate through the Project Area.

Sources: Harris 1997, UDWR 1997

### 3.8.1.2 Low hymenoxys or Depressed bitterweed

Low hymenoxys or depressed bitterweed (Hymenoxys depressa) is a member of the Composite family and is endemic to Utah in Emery, Duchesne, Wayne, Garfield, and Sevier counties. Like most members in Hymenoxys, low hymenoxys is a perennial herb with a taproot that produces yellow ray and disk flowers. The plant is distinguishable by the several characteristics. Most apparent is its caespitose form and solitary flower heads, which are subtended by long, villous green involucres 4 to 6 millimeters wide. Also of note, the caudex branches of low hymenoxys are clothed with a marcescent thatch of erect to ascending leaf bases, and the leaves are linear, with sharp apical points. Low hymenoxys blooms from late May to June.

Potentially-suitable habitats for this species are defined as ephedra, sagebrush, shadscale and pinyon-juniper communities on fine silty clay to clay loam soils between 4,400 to 7,120 feet in elevation. Consequently, the sagebrush/grassland and pinyon-juniper vegetation types within the Project Area may provide potentially-suitable habitats for the low hymenoxys.

### 3.8.1.3 Canyon sweetvetch or Coal sweetvetch

Canyon sweetvetch, also referred to as Coal sweetvetch or western sweetvetch, is a member of the Pea family and is endemic to Carbon, Emery and Duchesne counties. Like most sweetvetch, canyon sweetvetch is a perennial herb that produces inflorescence that extend from the axils and fruits that are constricted between the seeds (a loment). The flowers are pink to red-purple, blooming in late June-mid-August, and the wing-like petals of the flower are shorter than the keel. Canyon sweetvetch is distinguishable from other species primarily by its more robust habit, and by its leaflets, which are decidedly obtuse, have readily visible veins, and are notched at the apex.

Potentially suitable habitat for this species is defined as pinyon-juniper and sagebrush communities between 5,000 and 8,000 feet in elevation. Four occurrences of the canyon sweetvetch were found in the South Area during surveys conducted in 1997 (Intermountain Ecosystems 1997). It was very abundant along streambanks and shaded draws in pinyon-juniper and shrub vegetation types. It was found in association with shaded, intermittent or perennial streams between 6,000 and 7,000 feet from just north of Huntington Creek south and west to Cottonwood Creek.

### 3.8.1.4 San Rafael Cactus

San Rafael or Despain cactus is a member of the Cactus family and is endemic to Central Utah in Emery County. This species of cactus is a small, depressed, hemispheric plant approximately 3.8 to 6 centimeters tall. Its pale yellowish spines are more than 4 millimeters long and are not obscured by the woolly pale yellowish caducous hairs. The plant blooms late April to early May, producing yellowish to peach colored flowers. While visible during this period, the San Rafael cactus is imperceptible during the rest of the year because most or all of the plant shrinks below ground surface.

Potentially-suitable habitats for this species are defined as open pinyon/juniper community on limestone gravels at 6,000 to 6,200 feet.

### 3.8.1.5 Winkler cactus

Winkler cactus is a member of the Cactus family and is endemic to Central Utah in Emery County. On August 20, 1998, the USFWS listed the cactus as a threatened species. The Winkler cactus has a similar

range and morphology to the San Rafael cactus, so much so that there is doubt as to whether or not the two can be considered separate species. Ken Heil is currently conducting DNA studies on Pediocactus spp. to determine if *P. winkleri* and *P. despainii* are separate species.

Seven occurrences of the cactus were found in the South Area during the 1997 survey (Intermountain Ecosystems 1997). The occurrences extended from West Clawson Reservoir south to Diversion Hollow. The total number of individuals at all seven locations was probably between 500 and 1,000. These several populations of cactus have been tentatively identified as Winkler cactus.

As with the San Rafael cactus, the Winkler cactus essentially is visible during late April and early May only when environmental conditions are appropriate for flowering. During the rest of the year and when environmental conditions during late April and early May are not appropriate for flowering, the Winkler cactus is imperceptible because most or all of the plant shrinks below ground surface.

### 3.8.1.6 Wright fishhook cactus

Wright fishhook cactus is a member of the Cactus family and is endemic to Emery and Wayne counties, Utah. Like other members in Sclerocactus, this species is a perennial with thick succulent spiny stems. Depressed and hemispheric in shape, this genus earns its name from its hooked spines. Its identifying characteristics are the length of its spines (short) and the color and size (2 to 3.5 centimeters long) flowers. Except during its flowering period (April through May), Wright fishhook cactus is not identifiable in the field because its identifying characteristics key on the blooms.

Potentially-suitable habitats for this species are found on the Mancos Shale Formation from 4,790 to 6,120 feet in communities ranging from the salt desert shrubland to pinyon/juniper.

### 3.8.1.7 Silver milkvetch or Basalt milkvetch

Silver milkvetch is a member of the Pea family. It is endemic to eastern Sevier County, western Emery County, and, possibly, Bryce Canyon National Park. Like many members of Astragalus, silver milkvetch has alternate leaves that are odd-pinnately compound and its flowers are born on axillary racemes. Furthermore, the keels of the flowers are blunted instead of beaked. Silver milkvetch is distinguishable by several characteristics. Its yellowish flowers are 8.5 to 11 millimeters long and suffused with purple; its pods are 3.5 to 5.5 millimeters wide at maturity; and its leaflets are elliptic-oblong to oblong. Silver milkvetch flowers from May through July.

Potentially-suitable habitats for this species are pinyon-juniper and ponderosa communities between 4,520 and 7,970 feet in elevation.

### 3.8.1.8 Psoralea globemallow

Psoralea globemallow is a member of the Mallow family and is a Colorado Plateau endemic found in the southwestern Emery and Wayne counties. Like all globemallows, Psoralea globemallow is a perennial herb with stellate hairs and reddish orange flowers. This species is distinguishable from other members of the genus by its trifoliate or simple and entire lower leaves and yellowish canescent erect stems.

Potentially-suitable habitats for this species are zuckia-ephedra communities on saline and gypsiferous Entrada siltstone, between 4,000 and 6,000 feet of elevation.

#### 3.8.1.9 Alcove bog-orchid

Alcove bog-orchid is a member of the Orchid family and is endemic to Emery, Garfield, San Juan, Grand and Uinta counties, Utah, and Moffat County, Colorado. Like all members of the bog orchid family, the Alcove bog orchid is a glabrous perennial that produces small flowers in a spike-like raceme. The flowers of this family are distinctive, producing a two lipped corolla that supinates or twists upside down upon opening. Its solitary erect stem is surrounded by sheathing basal and cauline leaves. The Alcove bog orchid is distinguished from other species in the Habenaria family by its spur-like petal, which is 1.5 to 2 times as long as its lip. This species blooms from late July to August.

Potentially-suitable habitats for the Alcove bog orchid are restricted to the moist environments scattered in the desert shrub and oak brush communities, such as seeps, hanging gardens and stream areas. Elevational range is approximately 4,360 to 8,690 feet.

### 3.8.2 Special-Status Wildlife Species

#### 3.8.2.1 Bald Eagle

The Project Area supports a population of wintering bald eagles. One known nest is located outside the Project Area. The mule deer winter range provides a good forage base for the wintering bald eagles.

Eagles are expected to winter within areas of suitable habitat within the Project Area. Feeding areas, diurnal perches, and night roosts are fundamental elements of bald eagle winter range. Although eagles can fly as far as 24 kilometers (15 miles) to and from these elements, they primarily occur where all three elements are available in comparatively close proximity (Swisher 1964).

Food availability is probably the single most important factor affecting winter eagle distribution and abundance (Steenhof 1978). Fish and waterfowl are the primary food sources where eagles occur along rivers, lakes, streams, and dams. Waterfowl, such as dead, sick, or crippled individuals are often taken when fish are not readily available (Shickley 1961 and Spencer 1976). Eagles are often attracted to wintering concentrations of waterfowl. In some regions, such as Utah, carrion can also be an important food source.

Observations indicate perch sites usually must have three properties before they attract eagles. First, they must be in plain view of potential food sources. Second, they are largely within 160 feet (50 meters) of water, (Vian 1971 and Stalmaster et al. 1979). Finally, perches are usually in areas that are free from human disturbance.

Roosts may be used by individual birds or small to large groups of birds. Also, roosts can be used in successive years. Large, live trees of dominant or co-dominant species that occur in sheltered areas (e.g., in the protected slopes of a valley or ravine or behind a bluff) are preferred (Lish 1975).

Nest sites are the primary habitat feature important to breeding eagles. Although nests are usually located in trees, they can also occur on the ground or on cliff ledges. Eagles prefer to nest in live trees and construct the nest just below the top of the tree (Todd 1979). Nests can be found in any tree large enough to hold a nest. Nests are also usually close to water and food sources. Good visibility from the nest and a clear flight path to and from the nest are essential requirements (Grubb 1976).

Within Utah, the presence of only four bald eagle nests has been documented. These nests are located in riparian habitats along the Colorado and Jordan rivers and in a shelterbelt near the town of Castle Dale (UDWR 1997). The nest near Castle Dale is about two miles east of the South Area's boundary. This nest was active in 1997 and 1998.

### 3.8.2.2 Peregrine Falcon

Peregrine falcons occupy a wide variety of habitats. They are typically associated with open country near rivers, marshes, and coasts. Cliffs are the preferred nesting substrate, however, tall man-made structures (i.e.: high rise buildings and towers) may be used (Spahr et al. 1991).

Breeding begins in March when males establish territories. Three to four eggs are laid in mid-April. Incubation lasts from 33 to 34 days. The young hatch in mid-May. Young generally fledge in 6 weeks and remain dependent on the adults for several weeks (Spahr et al. 1991).

Peregrines typically prey on birds such a waterfowl, shorebirds, grouse, and pigeons. Prey is taken by striking from above after a high speed dive. Foraging occurs within 10 miles of the nest, however, 80 percent occurs within a one mile radius of the nest (Spahr et al. 1991).

Peregrine falcons usually migrate to Mexico or Central America in the fall. However, some birds may stay on their breeding grounds year-round if food supplies are available (Spahr et al. 1991).

Although peregrine populations are currently recovering within the Colorado Plateau region of Utah, the northern Wasatch portion has not reestablished a self-sustaining population (UDWR 1997). The presence of one peregrine nest has been documented within ½ mile of the South Area's boundary. However, this nest was not active during the 1997 breeding season. A second peregrine nest also was identified, but its location is more than one-mile outside the South Area.

Two additional falcon eyries were found within and near the Project Area during the 1998 raptor survey flights. One active eyrie was found just outside of the North Area boundary.

### 3.8.2.3 Black-footed Ferret

Black-footed ferrets are primarily nocturnal animals that are nearly always associated with prairie dogs. Prairie dogs are the ferret's source of prey and the prairie dogs' burrows provide dens and rearing areas for the ferret's young. A single white-tailed prairie dog colony of 200 acres (80 hectares) or a complex of smaller colonies occurring within a circle with a 4.3-mile (7-kilometer) radius that totals 200 acres (80 hectares) is considered to be the minimal size necessary to constitute potential habitat for the black-footed ferret (USFWS 1989). For black-tailed prairie dogs, the minimum colony size suitable for ferrets is 80 acres (32 hectares).

The historic range of the ferret encompasses both the North and South Areas. However, no observations of ferrets within the Project Area have been documented. The Utah Natural Heritage Program has documented three sightings near the Project Area. One sighting occurred in 1966 northeast of Price, but may have been a domestic ferret. Three were reported between Price and Huntington near Highway 10 in 1984. Two were reported northwest of Wellington in 1984. Surveys conducted for the Price CBM Project Area in 1995 did not find ferrets (BLM 1997c).

No prairie dog colonies have been identified on BLM lands within the North or South Areas. However, prairie dog colonies do exist on private lands within the South Area (Ludington 1997).

### 3.8.2.4 Spotted bat

Spotted bats occur in a variety of vegetation types. These types range from ponderosa pine and spruce-fir forests to deserts. Spotted bats range from Idaho and Montana to Queretaro, Mexico. Within Utah, they have been found in a variety of vegetation types, including open ponderosa pine, desert scrub, pinyon-juniper, and pastures. They typically roost singly in crevices in steep cliff faces.

In 1997 a bat study was conducted on the Manti-La Sal National Forest immediately northwest of the South Area. The results of this survey suggested spotted bats were widely distributed, although in low densities, throughout the study area (Sherwin et al. 1997). Based on this study, the spotted bat is anticipated to occur within areas of suitable habitat within the Project Area.

### 3.8.2.5 Big free-tailed bat

The big-free-tailed bat inhabits caves and mines in southern Utah where it forms maternity colonies. The southern two-thirds of the state contains the northern most extension of this species range, however, they are very rare within the state. No big free-tailed bats were observed during the 1997 Manti-La Sal bat study (Sherwin et al. 1997). However, they may occur within areas of suitable habitat in the Project Area.

### 3.8.2.6 Fringed Myotis

The fringed myotis typically occurs in areas of ponderosa pine, pinyon-juniper, saltbush, scrub oak, and greasewood. This non-migratory bat generally roost in rock crevices, caves, mines, buildings, and trees (Colorado Division of Wildlife [CDOW] 1984). Foraging typically occurs over water courses, above the shrub canopy, and in woodlands. The diet consists of moths, beetles, and spiders (CDOW 1984). No fringed myotis were observed during the 1997 Manti-La Sal bat study (Sherwin et al. 1997). However, they may occur within areas of suitable habitat in the Project Area.

### 3.8.2.7 Small-footed myotis

Small-footed myotis roost in crevices and cavities of cliffs and rocks, as well as caves and mines. Within Arizona they have been found from the hot deserts to the lower edge of the oak belt (Hoffmeister 1986). No small-footed myotis were observed during the 1997 Manti-La Sal bat study (Sherwin et al. 1997). However, they may occur within areas of suitable habitat in the Project Area.

### 3.8.2.8 Townsend's big-eared bat

The Townsend's big-eared bat occurs in a wide variety of habitats which include juniper/pine, shrub/steppe grasslands, deciduous, and mixed coniferous forests. They may also be found at elevational ranges from sea level to 10,000 feet (CDOW 1984). These non-migratory bats hibernate from October to February in a variety of places. The hibernaculm vary from caves, old mine shafts, rocky outcrops, and abandoned buildings (CDOW 1984).

This species is one of the most common bats found in caves and abandoned mines within Utah. The presence of Townsend's big-eared bats in the town of Ferron was documented during late summer in 1992 (Forest

Service, no date). They have also been found using inactive coal mines as hibernacula on the Ferron Ranger District (Forest Service, no date). However, in a 1997 bat study conducted on the Manti-La Sal National Forest immediately northwest of the South Area, no Townsend's big-eared bats were located (Sherwin et al. 1997).

### 3.8.2.9 Brazilian free-tailed bat

The Brazilian free-tailed bat is a migratory species that inhabits the southern portion of the state. They typically form large maternity colonies in caves and mines. No Brazilian free-tailed bats were observed during the 1997 Manti-La Sal bat study (Sherwin et al. 1997). However, they may occur within areas of suitable habitat in the Project Area.

### 3.8.2.10 Dwarf shrew

Dwarf shrews typical inhabit talus slopes, and rocky areas within the higher mountains and may occur in subalpine meadows within the spruce-fir belt (Hoffmeister 1986). Within Utah this species is only found in the southeastern portion of the state. This species may occur within the spruce-fir and mountain fir vegetation types of the Project Area.

### 3.8.2.11 Ringtail

Ringtails are most commonly associated with rocky, boulder-strewn riparian areas. In general, these areas are within one quarter mile of a water source. Ringtails are known to utilize riparian habitats within the Project Area.

### 3.8.2.12 Ferruginous hawk

Ferruginous hawks forage in areas of little or no vegetation cover. Extensive wooded and mountainous areas are avoided. Nests may be located in bushes, junipers, or sagebrush in relatively open areas. Ground nests are typically located on hillsides, rocky outcrops, low ledges, rockpiles, erosional remnants, low cliffs, buttes, rocky pinnacles, and river cutbanks. The birds return to breeding areas in late February and early March.

The presence of active nests within the North or South Areas has not been documented. However, five nests occur in the pipeline corridor or within ½ mile of its boundary. One abandoned nest was observed in the South Area, but no individuals were observed in conjunction with this nest (Ludington 1997).

### 3.8.2.13 Mountain plover

Mountain plovers utilize high, dry, shortgrass prairies. Within these habitats, areas of blue gramma and buffalograss are most often utilized. In addition, areas of mixed grass associations dominated by needle-and-thread and blue gramma are also utilized (Armbruster 1983).

Nests consist of a small scrape on flat ground in open areas. Most nests are placed on slopes of less than 5 degrees, and occur in areas of buffalo grass, blue gramma, scattered cacti, and western wheatgrass. These areas typically support vegetation that is less than 3 inches tall in April (Armbruster 1983).

A small population of plovers is known to occur within the Uinta Basin. However, its status elsewhere in the state is not known. Therefore, this species may utilize suitable habitats within the Project Area.

### 3.8.2.14 Long-billed curlew

Long-billed curlew nest in the upland meadows and rangelands of northern and central Utah. Foraging typically occurs in moist meadows and upland habitats. This species may occur within suitable habitats within the Project Area.

### 3.8.2.15 Northern goshawk

Northern goshawks occur in a variety of habitats, depending on the time of the year. During the breeding season, they are primarily associated with dense forests. During the non-breeding season, use of habitats is more varied and may include coniferous forests, riparian areas, and sagebrush shrublands (Johnsgard 1986).

Nest sites are generally in mature coniferous, mixed hardwood, and deciduous forests with a closed canopy. Typically, nest trees are in the oldest stands of an area which exhibit a high tree density. Of secondary importance for nest tree location is slope, most nests are on moderate to flat slopes (0 to 30 percent) with a NE to NW exposures of in canyons protected by such slopes (Reynolds et al. 1992). There is also some preference for nesting near water (Fowler 1988). Nests are generally occupied from early March through late September (Reynolds et al. 1992).

Foraging habitat for nesting goshawks usually consists of woodlands with large, mature trees. However, goshawks are characteristically opportunistic foragers and may use deep forests as well as forest edges. Goshawks forage in the ground-shrub, shrub-canopy, and canopy zones of the forest. Although common prey species include both birds and small mammals, birds make up the largest portion of their diet (Fowler 1988).

Goshawks occur throughout Utah in the mature mountain forests and valley cottonwood habitats. Although the occurrence of goshawk nests within the Project Area has not been documented, a slight chance exists that they may nest in the limited spruce-fir and mountain fir vegetation types and forage in the sagebrush grassland salt desert shrub, agricultural, and wetland/riparian vegetation types within the Project Area.

### 3.8.2.16 Northern harrier

Northern harriers are typically ground nesters that nest in tall grass or in brush and shrubs. They generally hunt over grasslands and wet meadows. They forage on a wide variety of species ranging from birds to rodents. However, voles are the most common species taken. No harrier nests have been identified within the Project Area. However they do occur within areas of suitable habitat.

### 3.8.2.17 Burrowing owl

Burrowing owls are commonly associated with rodent colonies, especially prairie dog colonies. Within Utah, burrowing owls generally occur within desert valleys and grasslands that support prairie dogs. No burrowing owl populations have been identified within the Project Area, but it is likely they occur within prairie dog colonies in or near the Project Area.

### 3.8.2.18 Black tern

The black tern is typically associated with sloughs, marshes, and wet meadows (American Ornithologists' Union 1983). Black terns nest in either small or large marshes which contain extensive stands of emergent vegetation and some open water (Johnsgard 1986). Nests may occur on either emergent vegetation or on

muskrat houses. Also some birds have been recorded to nest in mountain parks up to 8,000 feet in elevation (Rose 1993). The diet of the tern generally consists of insects (Johnsgard 1986).

Within Utah, the black tern is known to nest in wetlands associated with northern lakes such as Utah, Pelican, and Great Salt Lake. In addition to the lakes, they are also known to occur along the Green and Bear rivers. Suitable habitat within the Project Area is very limited for this species, however, they may occur seasonally.

### 3.8.2.19 Short-eared owl

The short-eared owl is a resident species within Utah. They are most commonly associated with central and northern wetlands and deserts within the state. No nests for this species has been identified within the Project Area, but they may occur within areas of suitable habitat.

### 3.8.2.20 White-faced ibis

White-faced ibises are associated with freshwater and brackish marshes. Generally these areas contain cattails, bulrushes, and phragmites (Johnsgard 1986). Typically ibises may be found foraging for insects, worms, crawfish, mollusks, small frogs, newts, and leeches along rivers, streams, and irrigated fields (Armbruster 1983). This species has not been confirmed to occur within the Project Area, but they may occur seasonally in suitable wetland habitats.

### 3.8.2.21 Snowy plover

Snowy plovers occur on barren sandy beaches and flats. Habitat for this species is restricted to the wetland vegetation type and, therefore, would be very limited in the Project Area.

### 3.8.2.22 Bewick's wren

Bewick's wrens occur in rough, low growing brushy areas that support heavy overhead cover. These areas may include riparian habitats through the sagebrush and pinyon-juniper vegetation types (Johnsgard 1986). Bewick's wrens may occur within the sagebrush grassland, riparian, and pinyon-juniper vegetation types within the Project Area.

### 3.8.2.23 Loggerhead shrike

The loggerhead shrike is typically associated with open vegetation types. Typically these include agricultural areas, sagebrush shrublands, desert scrub, pinyon-juniper woodlands, and montane meadows (Johnsgard 1986). This species generally hunts by perching and watching for prey. Prey species include small vertebrates, mice, snakes, and occasionally birds (Armbruster 1983). After seizing its prey this species caches it either in trees or on sharp objects including barb wire fences (Armbruster 1983).

Loggerhead shrikes were found during breeding bird surveys conducted for the Price CBM EIS immediately north of the South Area. Therefore, loggerhead shrikes are expected to occur within areas of suitable habitat throughout the Project Area.

### 3.8.2.24 Grasshopper sparrow

Historically, the grasshopper sparrow was abundant within the state. This species nests in semi-colonial groups in dry grasslands with mid-height to short clumps of grass with very little shrub cover. Currently, the grasshopper sparrow is only known from a few sites in northern Utah. The grasshopper sparrow may occur within the Project Area within areas of suitable habitat.

### 3.8.2.25 Lark bunting

This species typically occurs in short-grass and mixed-grass habitat types. They may be found in fallow fields, weedy roadsides, and hayfields. This species may occur within the agriculture vegetation type within the Project area.

### 3.8.2.26 Brewer's sparrow

This species is typically found in semi-desert scrub habitats. These areas may include mountain mahogany or sagebrush habitats (Johnsgard 1986). Brewer's sparrows may occur within the sagebrush and salt desert shrub vegetation types within the Project Area.

### 3.8.2.27 Osprey

The osprey is sparsely distributed within Utah. This species feeds almost exclusively on fish. Therefore, they are generally distributed around mountain lakes and along the Green River. The historical range has been reduced throughout the state and almost all known nesting occurs at Flaming Gorge Reservoir. Potentially-suitable habitats for the osprey are limited within the Project Area and are not expected to occur regularly.

### 3.8.2.28 Swainson's hawk

The Swainson's hawk is a neotropical migrant in the state of Utah. This raptor species nests in trees near open desert grasslands, shrub-steppe, and agricultural fields. They most commonly occur within the northern valleys and West Desert of Utah. Within Utah, Swainson's hawk populations have increased from 1966 to 1994. However, poisonings in South America since 1994 has decreased Swainson's populations in Utah. Swainson' hawks may occur within the agricultural, sagebrush grassland and pinyon-juniper vegetation types throughout the Project Area.

### 3.8.2.29 Yellow-billed Cuckoo

Within Utah the yellow-bellied cuckoo nests in localized riparian valleys through out the state. This species is declining due to a loss of habitat and urban development. The riparian vegetation type within the Project Area may support yellow-billed cuckoos.

### 3.8.2.30 Caspian tern

The Caspian tern occurs within Utah in association with islands, dikes, and wetlands around the Salt Lake. They may also be found near Utah Lake. Habitats for the Caspian tern is limited within the Project Area and are not expected to regularly occur.

#### 3.8.2.31 Common yellowthroat

The common yellowthroat is a neotropical migrant to the state of Utah. They are most commonly associated with wetland and riparian habitats. Common yellow throats may occur within the limited areas of wetland and riparian vegetation types within the Project Area.

#### 3.8.2.32 Yellow-breasted chat

Yellow-breasted chats are a neotropical migrant that inhabits riparian and wetland habitats. Although this species occurs through out the state, its decline appears to be linked to loss of habitat. Habitats are limited for the yellow-breasted chat within the Project Area.

#### 3.8.2.33 Utah milk snake

Utah milk snakes inhabit semi-arid areas, pine forests, deciduous forests, and suburban areas. This species is nocturnal. Within Utah, the milk snake is found in the eastern and central portions of the state. This species may occur throughout the Project Area within areas of suitable habitat.

### 3.8.3 Special-Status Aquatic Species

#### 3.8.3.1 Endangered Colorado River Fishes

The following four species of fish occur in the Upper Colorado River basin and are listed as endangered. The USFWS manages these species according to the "Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin" (Recovery Program). The primary concern addressed by the Recovery Program is the depletion of water from the Upper Colorado River basin. As a result of the Recovery Program's implementation, mandatory mitigation exists for depletions of water from the Upper Colorado River basin.

##### *3.8.3.1.1 Bonytail Chub*

The bonytail chub is generally associated with open water areas of large river channels. Water depths of 3 to 4 feet with uniform depth and velocity are preferred. In addition, shifting, sandy substrates are chosen. Adults most often feed on terrestrial insects that it takes from surface feeding (Behnke and Benson 1983). Adults typically do not spawn until they are 5 to 7 years old. Spawning occurs in water temperatures near 65°F during June and July (Behnke and Benson 1983). No bonytail chubs were identified during the 1997 fish surveys conducted within the Project Area. Since 1980, the nearest occurrence of bonytail chubs was in the Green River in Desolation and Cataract Canyons (Sigler and Sigler 1996). Both of these locations are at least 120 river miles downstream of the Project Area.

##### *3.8.3.1.2 Colorado Squawfish*

Adult Colorado squawfish prefer the deeper areas of river channels while, first year fish utilize quiet backwater areas and side channels (Woodling 1985). Adults generally spawn at 6 to 7 years of age. Adults are predacious and generally feed on other fishes. Spawning is thought to take place during mid-summer in water temperatures between 68° to 72°F (Woodling 1985). However, juveniles generally feed on small invertebrates (Behnke and Benson 1983). No squawfish were identified during the 1997 fish surveys

conducted within the Project Area. However, squawfish have recently been found downstream of the Project Area in the Price River. They were found up to a diversion located one mile south of the town of Wellington, 88.5 miles upstream of the Green River.

#### 3.8.3.1.3 Humpback Chub

The humpback chub is typically associated with deep, swift waters such as those found in canyons. Young humpback chubs prefer quiet backwater areas, much like that of young squawfish. The humpback feeds on invertebrates by foraging on the river bottom. However, they have also been observed to surface feed (Behnke and Benson 1983). Spawning typically occurs from May through July. Water temperatures for spawning are near 65°F. However, not much is known about the spawning habitats of the humpback.

Currently, the largest known population occurs in the Black Rocks area downstream of Grand Junction CO. Suitable habitat for the humpback chub does not occur within the Project Area and no humpback chubs were identified during the 1997 fish surveys conducted within the Project Area. The nearest recent occurrence of humpback chubs was in the Green River in Desolation, Cataract and Westwater Canyons (Sigler and Sigler 1996). These locations are at least 120 river miles downstream of the Project Area.

#### 3.8.3.1.4 Razorback Sucker

The razorback sucker is typically associated with off channel ponds and backwater areas. In addition, eddies, backwater areas, gravel pits, flooded bottoms, and flooded mouths of tributaries are utilized (Behnke and Benson 1983). Adults generally feed on small invertebrates and algae which they remove from the substrate.

Spawning generally occurs from January and February through April. Spawning typically occurs over gravel bars, silt, cobbles, and in off channel ponds. In addition, spawning occurs when water temperatures are between 54° and 68°F and depths range from 1 to 20 feet (Behnke and Benson 1983). However, non-native fish prey upon the eggs thereby reducing reproductive success. After hatching the young prefer shallow littoral zones for the first few weeks (Behnke and Benson 1983).

The USFWS has proposed designating the Colorado River from Rifle, Colorado to Lake Powell as critical habitat for the razorback (USFWS 1993). No razorback suckers were found during the 1997 fish surveys conducted within the Project Area. They are scarce to rare in the Green River near Vernal, Utah to Lake Powell (Sigler and Sigler 1996). They historically occurred commonly in the Price river downstream of the Project Area, and have recently been found at the mouth of the San Rafael River (Berg 1997).

### 3.8.3.2 Sensitive Species

#### 3.8.3.2.1 Roundtail chub

Adult roundtail chub typically occur in slow moving water adjacent to fast moving water. Generally, groups of adults occur in quiet swirling water and move into fast water to feed. Adults generally feed on aquatic and terrestrial insects; however, larger chubs will sometimes feed on other fish. The young-of-year typically prefer shallow river runs, while juveniles occur in river eddies and irrigation ditches (Woodling 1985). Spawning takes place over gravel substrates and occurs in early summer (Woodling 1985).

Within Utah, the roundtail chub is known from the Colorado River Basin main stem and its tributaries (Sigler and Sigler 1996). No roundtail chubs were found during the 1997 fish surveys although large populations

were found in the San Rafael River in 1997 and are thought to occur at the mouths of Cottonwood, Huntington, and Ferron creeks (Berg 1997). They potentially still occur downstream of the Project Area in the lower Price River. However, recent surveys recorded no roundtail chubs in the Price River (Berg 1997).

#### 3.8.3.2.2 Flannelmouth sucker

This species is endemic to the Colorado River Basin. Habitats include slow-flowing, lower gradients of larger rivers. Introduction of non-native fish species, habitat loss, and changes in flow regimes has caused a decline in populations of this species. Flannelmouth suckers were found during the 1980 UDWR electroshocking surveys within the Project Area (Cottonwood Creek). Additionally, recent studies found good populations of flannelmouth suckers from the Price River downstream of the Project Area (Masslich and Holden 1995 and Berg 1997). Although flannelmouth suckers were not found during the 1997 surveys, they probably occur in limited numbers within the Project Area.

#### 3.8.3.2.3 Bluehead sucker

Bluehead suckers occur in fast flowing, rocky riffles in small to large rivers. Occupied habitats are generally in higher gradient reaches. Changes in flow regimes, habitat loss, and introduction of non-native fish species are the major cause of decline for this species. They are widely distributed in the Green River (Sigler and Sigler 1996). Bluehead suckers were found during the 1997 electroshocking surveys within the Project Area (Cottonwood Creek). Additionally, they have been found throughout the Price River (Berg 1997).

#### 3.8.3.2.4 Colorado River cutthroat trout.

Historically the Colorado River cutthroat trout occurred in most waters of the upper Colorado River basin. However, competition from introduced non-native trout have reduced their numbers throughout their range. In addition, angling pressure has contributed to their decline.

The ecology of the Colorado River cutthroat is similar to that of all cutthroats, in that they occur only in cold water habitats. Generally the diet of juveniles and young cutthroats consists of insects. However, as they age they become more predaceous, forage species may include sculpins and dace (Baxter and Simon 1970). They are spring spawners that typically spawn over gravel substrates with water temperatures generally near 45°F (Woodling 1985).

No individuals of this subspecies were found during the 1997 fish surveys of the Project Area. Furthermore, they are not expected to occur downstream of the Project Area. A non-pure population of Colorado trout was recently found in Crandall Canyon, a tributary to Huntington Creek, that is upstream of the Project Area (Berg 1997).

## 3.9 CULTURAL RESOURCES

Cultural resources are the nonrenewable remains of prehistoric and historic human activity, occupation, or endeavors as reflected in cultural districts, sites, structures, buildings, objects, works of art and natural features that were of importance in human history and prehistory. Cultural resources are the physical remains themselves, areas where significant events occurred (even if physical evidence of the events no longer remains), and the environment surrounding the actual resources. The Utah BLM defines a cultural resource site as a discrete locus of human activity that is presumed to be interpretable.

Significant cultural resources are defined as those districts, sites, objects, or natural features that are listed on or meet the criteria for nomination to the National Register of Historic Places (NRHP). Significant cultural resources are generally more than 50 years old, retain essential integrity of location, design, setting, materials, workmanship, feeling, and association, and meet one or more of the criteria for eligibility (36 CFR § 60.4). Prehistoric sites lacking distinctive architectural or artistic elements are most often evaluated as eligible under criterion d, the potential to yield information important in prehistory. The importance of the information that a prehistoric site may be likely to yield is judged in terms of its potential contribution to widely recognized and accepted research questions. An important aspect of evaluating prehistoric sites is the element of contextual integrity or the presence of a discrete association of artifacts or features that can be meaningfully placed in a cultural historical context of age and cultural affiliation. Large quantities of data may have little or no meaning if they lack secure association or context, and cannot be placed culturally or temporally by secure association with chronometric or typologically diagnostic comparative materials. In some cases, prehistoric sites may have specific associations with important persons or events in Native American history and tradition that may make them eligible.

Historic sites can be eligible under any or all of the criteria for eligibility. Frequently, association with specific historic persons or events or outstanding artistic or architectural features are emphasized, but many historic sites also have the potential to yield important historical archaeological information. As with prehistoric sites, the context and association of the information that an historic site may yield is important in assessing the potential importance of that information.

## 3.9.1 Regional Overview

The Project Area spans the north end of the Castle Valley, which extends westward from the San Rafael Swell to the Wasatch Plateau. The broader region in which this is located is the Colorado Plateau southwest of the Uinta Basin. The western portions of the South Area are dominated by deep canyons and narrow mesas. East of the canyons is a broad area of pediment benches and shale flats crosscut roughly west to east by Ferron Creek, Cottonwood Creek, Huntington Creek, and numerous smaller washes. Runoff from the Wasatch Plateau provides adequate and reliable water along the major drainages, but ambient precipitation is scanty. The canyons and the principal drainages have long been focal areas for human activities. The latter circumstances have made irrigation and surface water rights very important in local history. The North Area is located on sandstone and shale benches and flats extending south from the Book Cliffs. This area is crosscut by numerous south flowing washes and gulches tributary to the Price River.

The general area that includes Castle Valley is known for numerous rock art sites and many Fremont period sites in the canyons and closely adjacent ecotone settings. The comparatively brief history of the region has been dominated by Mormon settlement beginning in the 1870s, the arrival of the railroad, coal mining made feasible by the railroad, and the development of farming and ranching. The known prehistory and history of the region has been summarized by Spangler (1993) from the perspective of research in Nine Mile Canyon to the northeast. The latter treatment is much more exhaustive than is possible within the constraints of this environmental impact document.

### 3.9.1.1 Prehistory

Prehistoric investigations in nearby canyon areas, such as Nine Mile Canyon have been heavily oriented to later architectural sites and to the canyon areas where rockshelters, rock art, and masonary dwellings can be found. From cultural ecological and processual perspectives, this provides a very biased sample of the prehistory of the region, and gives a very narrow perspective of potential settings for significant sites.

Spangler's (1993) overview of the Price River Resource Area, which focuses heavily on the Nine Mile Canyon area, indicates that the majority of prehistoric sites are found in the desert scrub settings with easy access to pinyon-juniper and to riparian resources. In a broader regional perspective, investigations have been more balanced.

The Paleoindian or Pre-Archaic cultural period, particularly in the perspective of Late Pleistocene big game hunters, is poorly represented on the northern Colorado Plateau, and essentially unrepresented in the Castle Valley. There may be some potential for isolated Paleoindian surface finds in the study area, but substantial areas of in situ late Pleistocene or early Holocene sediments that would be likely to yield significant buried cultural levels of this time period have not been identified.

The Desert Archaic is represented in dry cave deposits and open sites in eastern Utah. Several investigator's have suggested a northern Colorado Plateau variant of the Desert Archaic, or, possibly a distinct northern Colorado Plateau Archaic culture. Schroedl's (1976) proposed Northern Colorado Plateau Archaic sequence was based heavily on excavations in cave and canyon settings near and similar to portions of the Price River area, including Sudden Shelter. The Archaic adaptations on the northern Colorado Plateau are characterized by generalized hunting and gathering subsistence strategies that are differentiated principally by differences in projectile point types, and some variations in perishable technologies such as basketry. Those adaptations remained essentially unchanged for thousands of years until the adoption of the bow and arrow and the development of horticulture.

Around 2000 years ago, Formative horticulture is evident in the region. Some researchers have suggested a substantial hiatus between the Archaic and Formative, or the migration of new populations into the region. Transition to formative adaptations is characterized by incipient horticulture, semi-permanent dwellings, and the absence of ceramics. Cermanics become well developed in the Formative periods.

Around A.D. 700, attributes considered diagnostic of Formative culture become conspicuous in the region. These include evidence of horticulture and associated storage facilities, masonry residential architecture, rock art, and ceramics. Fremont sites are the most readily recognized archaeological manifestation in the region. It is unknown whether Fremont was an indigenous development or was introduced from elsewhere. The presence of ceramics and masonry architecture makes the identification of these sites comparatively easy. These sites have been discovered predominately in canyon and ecotone environments, but have also been identified on the shale benches and piedmont slopes around the edges of the Mancos Lowlands.

In the twelfth to thirteenth century, the sedentary Fremont horticulturalists are no longer present and are replaced by Numic groups. Historic Numic groups in the region include Ute, Shoshone, Paiute, and Goshute. This corresponds roughly to a period when southwestern populations were consolidating into fewer and larger settlements, and peripheral or marginal horticultural areas were being abandoned. Many of these areas are subsequently occupied by dispersed nomadic bands of Numic, Yuman, or Athapaskan hunter-gatherers (Lipe 1983). The post-Formative transition this being clearly Ute territory by the time of Euroamerican entry into the region.

Euroamerican contact began with the Spanish Trail, a travel route from Santa Fe through Nevada to the missions of Southern California, crossing east of the Project Area. There were no settlements or way stations established in the vicinity of the Project Area. The later Gunnison Trail followed a more northerly route in this area, passing through Woodside and north around Cedar Mountain, and then southwesterly past Castle Dale where it rejoined the old Spanish Trail (Emery County Historical Society 1981). Euroamerican contacts with the Ute in these early years were peaceful and sporadic. However, as more Euroamericans passed through the region, the Ute began to resist. Black Hawk's band and occasional parties from other bands

began raiding white settlements in the mid 1860s, and cavalry and militia were mobilized to chase the Ute until Black Hawk finally withdrew to the Uinta Basin in 1867. The aridity and remoteness from major travel routes of Castle Valley were probably major factors in its late settlement, but the use of the area by Ute raiding parties in the 1860s probably contributed. The Ute bands certainly had traditional localities in this area, but the historic accounts do not provide insights into traditional settlement locations or collecting areas.

No responses have been received from Native American groups that would aid in identifying potential traditional Cultural Properties or areas of traditional Native American concern in the Project Area. Archaeological resource types likely to be present in portions of the Project Area that may be of concern to the Ute Tribe and may fit the formal legal definition of traditional Cultural Properties (Parker and King 1990) include rock art panels, mineral or stone procurement areas, vision quest sites, communal/ceremonial dance grounds, monumental stone cairns or alignments, medicinal or sacred plant gathering areas, and unmarked burials. Although none of these site types have been identified to date as traditional Cultural Properties or areas of Native American concern, these types of archaeological resources should be evaluated in keeping with NPS Bulletin 38 (Parker and King 1990).

### 3.9.1.2 History

The dominant economic activity in Carbon County has long been coal mining, while agriculture has also been important in Emery County. Euroamerican presence in the area had begun with transitory Spanish *entradas*, traders from New Mexico, explorers, and fur trappers. But there was no sustained Euroamerican presence in the area until the establishment of permanent Mormon settlements in the 1870s. The first Mormon settlements were in Castle Valley at Huntington, Ferron and Castle Dale, and Price was settled a short time later. The arrival of the Denver and Rio Grande Railroad in Price increased the importance of that settlement, and stimulated the further development of the coal mining town of Scofield and new settlements at Wellington and Helper. The Denver and Rio Grande Railroad was a major regional railroad that linked Castle Valley to import regional and more distant markets. However, this railroad had been preceded by smaller lines such as the Calico Railroad. Many of the early homesteads failed, and the development of coal reserves, made more feasible by the railroad, was fundamental to the area that would become Carbon County. The coal camps attracted many non-Mormon immigrants to the region. Some coal camps, notably Standardville, remained more strongly Mormon in character, but generally the region was characterized by a mix of Mormon and non-Mormon influences.

The arrival of the railroad in Utah, and the demand for coal from the precious metal mining industry were critical in the development of the coal industry in Utah, and its influences on settlement and economic development (O'Neil 1981). There are numerous traces of active and abandoned railroad grades, railroad support facilities, and features related to railroad construction scattered about the landscape. Initially amicable relationships between the railroads and the Mormons deteriorated and led to numerous conflicts and accusations. Among other sentiments, the Mormons accused the railroads of bringing in other ethnic groups and discriminating against hiring Mormons.

The railroads and development of the coal industry also stimulated ranching and farming, which remained dominant in Emery County. Ranches and farms had a large market in the local mining towns and were also provided access to larger markets by the railroads. The importance of ranching and farming encouraged the development of additional agricultural lands, and cooperative irrigation projects became an important feature of social and economic development.

## 3.9.2 Known Cultural Resources

In order to assess potential impacts to significant cultural resources in the Project Area, a Class I cultural resource inventory was conducted. The Class I inventory consisted of a files search at the Utah Division of State History, Salt Lake City, a files search at the BLM Price Field Office, Price, a review of pertinent regional history and prehistory, and a review of applicable theoretical and methodological literature. Locations of previous investigations and previously recorded cultural resource sites were plotted on project maps, and information was tabulated on site type, general environmental setting, cultural affiliation, and National Register evaluation/recommendation. Available ethnographies and the BLM General Land Office Historic Index were also consulted for information on the approximate locations of historic Native American camps and historic homestead entries that may not be recorded as cultural resource localities.

Over the past two decades there have been a number of cultural resource investigations in the Project Area, but only a small portion of the Project Area has been intensively investigated. The majority of past cultural resource investigations have been narrow linear corridors for seismic exploration, pipelines, transmission lines or road improvements, or small block surveys of a few acres or less for borrow pits, exploratory drill sites, gauging stations, stock ponds, and other very localized actions. Over the years, a few Class II sample studies have been conducted that have selected larger, widely scattered blocks for intensive survey (e.g., Hauck 1979 and Black and Metcalf 1986).

The Class I inventory for the Project Area indicated that 96 sites had been recorded previously in the Project Area, predominantly in Emery County. Previously recorded sites include 55 prehistoric sites, 35 historic sites, five sites with both historic and prehistoric materials, and one site that lacked materials indicative of age or had misplaced documentation. Thirty-one of the 96 sites were recommended as eligible for the National Register of Historic Places (20 prehistoric, 9 historic, and two with both prehistoric and historic materials). Fifty of the sites were recommended not eligible (27 prehistoric, 21 historic, one mixed, and one of undetermined age), and 15 sites were unevaluated (5 historic, 8 prehistoric and two mixed). **Table 3–21** gives a brief list of the previously documented cultural resources in the study area, the general site type, chronological period, if known, approximate size and National Register recommendation.

The largest class of historic sites consisted of 12 dumps and cultural material scatters lacking identifiable features or structural remnants. Other sites included four farms or ranches, seven abandoned coal mines, three irrigation canals, two isolated corrals, two temporary camps, a bridge, two isolated cabins, a road, and a rock shelter. Historic sites recommended eligible included one ranch, three canals, an abandoned mine and mine town, a road, a rock shelter, and two dump areas. Historic materials mixed with prehistoric materials included a mining camp, an historic inscription, a dump area, and two sparse cultural material scatters. None of the latter materials were considered potentially eligible.

Prehistoric sites are predominantly lithic scatters of unknown age or affiliation (n=27). Five lithic scatters with diagnostic materials included two Fremont sites, two Archaic sites, and one site with both Fremont and Archaic materials. Seven of the surface lithic scatters were considered eligible for the Register. Nine prehistoric camps and three rock shelters with prehistoric components were identified. Eight of the camps and two of the rock shelters were considered eligible. In addition, potentially eligible Fremont period sites with masonry structures were identified. The seven remaining sites included four lithic procurement or reduction areas, one hunting station, a mixed cultural material scatter (with ceramics), and an isolated hearth.

**Table 3–21**
**Cultural Resource Sites within the Ferron Natural Gas Project Area**

| SITS No. | H/P | Site Type | Period | Size ($m^2$) | Evaluation |
|---|---|---|---|---|---|
| 42CB96 | P | lithic scatter | unk | 1,200 | not eligible |
| 42CB97 | P | hunting station | unk | 49 | not eligible |
| 42CB98 | P | lithic scatter | unk | 225 | not eligible |
| 42CB335 | P | lithic scatter | unk | 1 | not eligible |
| 42CB385 | H | Kenilworth Mine & Townsite | | >121,500 | eligible |
| 42CB533 | H | irrigation canal | 1887-present | 27,000 | eligible |
| 42CB534 | H | trash dump | 1920s-1960s | 12,000 | eligible ? |
| 42CB535 | H | construction camp | 1900s-1950s | 2,200 | not eligible |
| 42CB933 | H | masonry (sandstone) cabin | 1900s-1950s | 150 | not eligible |
| 42CB946 | H | cultural material scatter | 1900s-1980s | (no form) | not eligible |
| 42CB947 | H | cultural material scatter | 1904-1917 | 20 | not eligible |
| 42CB948 | H | cultural material scatter | 1900s-1960s | 300 | not eligible |
| 42CB949 | H | cultural material scatter | 1911-1917 | 400 | not eligible |
| 42CB950 | H | cultural material scatter | 1903-1917 | 130 | not eligible |
| 42CB951 | H | cultural material scatter | 1905-1916 | 470 | not eligible |
| 42CB1029 | P | lithic scatter | unk | 294 | not eligible |
| 42EM631 | P | lithic scatter - deflated | unk | 400 | unevaluated |
| 42EM632 | P | lithic scatter | unk | 110 | unevaluated |
| 42EM691 | P | lithic scatter; limited activity | unk | 40 | unevaluated |
| 42EM692 | P | lithic scatter; limited activity | unk | 10 | unevaluated |
| 42EM705 | P/H | lithic scatter; crockery | unk | 50 | unevaluated |
| 42EM706 | P/H | lithics; glass and metal | unk | 65 | unevaluated |
| 42EM763 | P | lithic scatter | Fremont; Archaic | 650 | unevaluated |
| 42EM764 | P | lithic scatter | unk | 500 | not eligible |
| 42EM765 | P | lithic scatter | unk | 900 | unevaluated |
| 42EM766 | P | lithic scatter | Archaic | 1,000 | unevaluated |
| 42EM767 | P | lithic workshop | unk | 1 | not eligible |
| 42EM768 | P | rock shelter with lithics | unk | 950 | unevaluated |
| 42EM959 | P | rock shelter | unk | 80 | eligible |
| 42EM960 | P | rock shelter | unk | 80 | eligible |
| 42EM1092 | P | sandstone slab structure | Fremont | 315 | eligible |
| 42EM1093 | P/H | camp; dump | unk | 15,700 | eligible |
| 42EM1101 | P | buried hearth | unk | 2 | not eligible |
| 42EM1123 | P | lithic scatter | unk | 15 | not eligible |
| 42EM1124 | P | chipping station | unk | 80 | not eligible |
| 42EM1125 | ? | masonry enclosure or structure | unk | 15 | not eligible |
| 42EM1181 | P | lithic scatter | unk | 95 | not eligible |
| 42EM1182 | P | small camp | Fremont | 590 | eligible |

**Table 3–21 (continued)**
**Cultural Resource Sites within the Ferron Natural Gas Project Area**

| SITS No. | H/P | Site Type | Period | Size (m²) | Evaluation |
|---|---|---|---|---|---|
| 42EM1327 | H | cabin | unk | 25 | not eligible |
| 42EM1527 | H | dump | 1900s-1950s | 400 | eligible |
| 42EM1638 | P | camp | unk | 61,820 | eligible |
| 42EM1643 | P | camp | unk | 30 | eligible |
| 42EM1645 | P | lithic scatter | unk | 1,770 | eligible |
| 42EM1646 | H | rock shelter | unk | 40 | eligible |
| 42EM1647 | H | debris scatter; hearth | unk | 4,415 | not eligible |
| 42EM1648 | P | lithic scatter | unk | 470 | eligible |
| 42EM1649 | P | lithic scatter (dunes) | unk | 7 | eligible |
| 42EM1650 | P | lithic scatter (dunes) | unk | 705 | eligible |
| 42EM1651 | P | lithic scatter (terrace) | unk | 470 | not eligible |
| 42EM1652 | P | lithic scatter (dunes) | unk | 160 | eligible |
| 42EM1653 | H | log and pole corral | unk | 400 | not eligible |
| 42EM1654 | P | lithic scatter | Late Archaic? | 120 | eligible |
| 42EM1658 | H | pole corral | 1950s - present | 1,200 | not eligible |
| 42EM1659 | P | lithic scatter | unk | 15,000 | eligible |
| 42EM1660 | P | lithic scatter | unk | 20 | not eligible |
| 42EM1661 | P | lithic scatter | unk | 60 | not eligible |
| 42EM1662 | P | lithic scatter | unk | 80 | not eligible |
| 42EM1866 | P | lithic scatter | Fremont | 5,400 | not eligible |
| 42EM1950 | P | camp | unk | 315 | eligible |
| 42EM2084 | P | lithic scatter | unk | 3,925 | not eligible |
| 42EM2086 | P | lithic scatter | Fremont? | 4,400 | not eligible |
| 42EM2095 | P | camp; processing locality; pit houses | Fremont | 1,295 | eligible |
| 42EM2102 | P | quarry; workshop | unk | 5,275 | not eligible |
| 42EM2103 | H | farmstead | 1900s | 6,000 | not eligible |
| 42EM2104 | P | camp | unk | 30 | not eligible |
| 42EM2108 | P | lithic scatter | unk | 20 | not eligible |
| 42EM2109 | P | see 42EM2095 and report | Fremont | not available | not eligible |
| 42EM2112 | P | cultural material scatter | Fremont | 1,250 | not eligible |
| 42EM2113 | P | camp | unk | 195 | eligible |
| 42EM2130 | P | masonry habitations | Fremont | 1,450 | eligible |
| 42EM2199 | H | dump | 1880s-1930s | 690 | not eligible |
| 42EM2214 | H | ranch complex | 1890s-1950 | 2,400 | eligible |
| 42EM2215 | H | bridge | 1900-present | 360 | not eligible |
| 42EM2216 | H | homestead | 1890-present | 2,650 | not eligible |
| 42EM2248 | H | coal mine | 1920-1960 | 40,000 | unevaluated |
| 42EM2249 | H | coal mine | 1930-1966 | 40,000 | unevaluated |

**Table 3–21 (continued)**
**Cultural Resource Sites within the Ferron Natural Gas Project Area**

| SITS No. | H/P | Site Type | Period | Size ($m^2$) | Evaluation |
|---|---|---|---|---|---|
| 42EM2250 | H | coal mine | 1932-1958 | 1,200 | unevaluated |
| 42EM2284 | H | coal mine | 1922-? | 550 | unevaluated |
| 42EM2285 | H | coal mine | 1922-? | 100 | unevaluated |
| 42EM2317 | P | lithic scatter | unk | 60 | not eligible |
| 42EM2402 | P/H | lithic scatter; mining camp | unk | 180 | not eligible |
| 42EM2403 | P | lithic scatter | unk | 4,700 | not eligible |
| 42EM2421 | P | lithic scatter | unk | 690 | not eligible |
| 42EM2422 | P/H | camp; inscription | Early Archaic; Fremont | 865 | eligible |
| 42EM2423 | H | road | 1876-1949 | not applicable | eligible |
| 42EM2431 | H | homestead | 1910s-1920s | 227,500 | not eligible |
| 42EM2433 | H | canal system | 1884-present | 4,830 | eligible |
| 42EM2445 | H | canal | 1884-present | 380 | eligible |

SITS: Smithsonian Institution Trinomial System official site number

The records search for the Project Area also included a search of the Historic Index and an inspection of General Land Office plat maps at the BLM State Office. Homestead entries, Desert Land Act entries, Enlarged Homestead entries, Stock Raising Homestead entries, cash entries, and patents were tabulated for the Project Area. Public sales, mineral entries, ditch and canal easements, and railroads easements or grants were also noted but not tabulated in detail. The general location of former entries and patents were plotted on Project Area maps, patterns were noted for numbers of entries by five-year periods, and the proportion of the entries that were canceled or relinquished.

As would be expected, entries and patents were strongly clustered around principal drainages and nearby irrigation benches. Early homestead entries in the late 1870s and the early 1880s are sparse with most lands being claimed by Mormon settlements. In the mid 1880s, entries became increasingly common, and continue at a moderate rate in most of the principal drainage valleys until the 1920s. However, except for the period from 1900 to 1905, the vast majority of entries are canceled or relinquished and fail to obtain land patents.

A significant proportion of the various homestead entries in the Historic Index are listed as canceled or relinquished within ten years. Many of these brief and unsuccessful homesteads would have left little in the way of cultural remains or landscape modifications, but nonetheless reflect a focus of settlement and land use along the principal drainages. Beginning in the 1920s in several areas and increasing in frequency in the 1950s throughout much of the Project Area, mineral entries, oil and gas leases, and coal leases come to dominate the records in the Historic Index.

# 3.10 LAND USE

The principal land uses in the Project Area include range, agriculture, residential, coal mining, oil and gas development and utility corridors. Current land use and land ownership in the Project Area and vicinity were mapped and tabulated utilizing BLM 1:100,000 Surface Management Status maps, BLM Master Title Plats, BLM Oil and Gas Plats, BLM Coal and Potash Plats and aerial photos. In addition, current and proposed land management plans for the area and their constraints were identified.

## 3.10.1 Land Status/Ownership

Approximately 61 percent of Carbon County and 92 percent of Emery County is public land. Most of the public land is federal land administered by the BLM and U.S. Forest Service land in the Manti-La Sal National Forest. State-owned and private lands account for the remainder.

Land ownership within the Project Area is primarily BLM-administered federal land, interspersed with blocks of state-owned lands and private lands.

The Manti-La Sal National Forest adjoins the west side of the South Area and is also incorporated in the western edge of the South Area. State-owned lands consist of lands administered by the State Institutional Trust Lands Administration, the Utah Division of Sovereign Lands and Forestry, and the Utah Division of State Parks. Part of the Huntington Lake State Park is within the South Area. The distribution of land ownership in the North and South Areas is summarized in **Table 3–22** and shown on **Plate 2–1**. The pipeline corridor is located primarily on private lands and BLM in Emery County.

## 3.10.2 Land Use

Several primary land uses occur within the Project Area. The following sections identify and describe each use. **Plate 3–7** show the distribution of these land uses in the Project Area.

### 3.10.2.1 Agriculture/Range

Agriculture is second in importance to coal mining in Carbon and Emery Counties. Most agricultural lands in the counties are used for livestock operations. Grazing occurs in both the North and the South Areas, and along the pipeline corridor in Emery County. Irrigated croplands occur in the South Area.

**Table 3–22**
**Land Ownership in the Project Area**

| | Areal Extent (acres) | | | | |
|---|---|---|---|---|---|
| Area | BLM | Forest Service | State of Utah | Private | Total |
| North Area | 12,591 | 0 | 2,935 | 2,824 | 18,350 |
| South Area | 31,649 | 10,976 | 25,106 | 25,439 | 93,170 |
| Pipeline Corridor[1] | 58 | 0 | 2 | 201 | 262 |
| Total | 44,298 | 10,976 | 28,043 | 28,464 | 111,782 |

Note
1 The pipeline corridor is 27 miles long and 80 feet wide.

Livestock operations consist primarily of cattle raising. Cattle are grazed on private and BLM lands in the western Carbon and Emery Counties during the winter and spring months. Livestock are usually moved to higher elevations in the summer and early fall months. Grazing on BLM allotments in the North and South Areas is described in the Livestock Management Section 3.11 of this chapter.

In western Carbon and Emery Counties, croplands are located on flat-lying lands with irrigable soils (Office of Surface Mining 1985). These areas are irrigated by flood and by water diverted by a ditch from a stream. Croplands produce hay crops, silage, grains, vegetables and melons. Irrigated croplands occur along the Price River between the towns of Wellington and Helper. There are no irrigable agricultural lands in the North Area.

Huntington, Cottonwood and Ferron Creeks drain the central part of the Wasatch Plateau, and flow through the South Area to empty into the San Rafael River to the east. Irrigated croplands are located along the lower reaches of the creeks at the east side of the South Area. Canals lead to irrigated land north and south of each stream in the area.

There are three soil types in the North Area that meet the soil requirements for prime farmland when irrigated (Soil Conservation Service 1988). The soil types are Green River-Juva Variant complex, Haverdad loam, moist; and Ravola loam. The soils are described in the Soils section of Chapter 3. These soils are currently in use as grazing land. None of the land in the North Area is irrigated.

There are ten soil types in the South Area that meet the soil requirements for prime farmland when irrigated. The soil types are Billings silty clay loam, Green River-Juva Varient Complex, Haverdad loam, Hernandez, Hunting loam, Minchey loam, Penoyer Variant loam, and Ravola loam. These soils are described in **Section 3.4**. These soil types comprise 2,475 acres and occur sporadically along Huntington and Cottonwood Creeks, and in areas west of Orangeville and north and east of Clawson.

### 3.10.2.2 Oil and Gas Developments

Public lands administered by the BLM in the Price Field Office are available for oil and gas leasing, exploration and development. As of November 10, 1997, the number of applications for permit to drill in Carbon and Emery counties are 36 and 24 permits, respectively. Drilling activities in Carbon and Emery counties are summarized in **Table 3–23**.

The majority of permits (31) issued in Carbon County in 1997 as of November were issued to Price CBM and Anadarko in the Price CBM Project Area and the North Area. As of December 1997, there were 15 active wells in the North Area. Seven wells are located on BLM lands, and eight wells are on state-owned land. The wells were completed in the Ferron Sandstone in the years 1994 through 1998.

In Emery County, 21 of the 24 issued permits were to Texaco in the South Area. Coal bed methane well development in the Price CBM Project Area adjacent to the North and South Areas is described in the 1997 FEIS for the Price Coalbed Methane Project. Existing development in the South Area consists of 53 active wells as of December 31, 1997.

### 3.10.2.3 Mining

The location of active mining is discussed in **Section 3.1.5.4**.

**Table 3–23**
**Drilling Permits in Carbon and Emery Counties**

| Carbon County: | 1997 | 1996 | 1995 | 1994 |
|---|---|---|---|---|
| Application for Permit to Drill | 36 | 38 | 21 | 50 |
| Well Completions | 15 PGW<br>1 SERV | 5 PGW<br>4 SGW<br>2 SERV<br>1 TA | 18 PGW<br>1 PA | na |
| Emery County: | | | | |
| Application for Permit to Drill | 24 | 23 | 20 | 18 |
| Well Completions | 12 PGW<br>1 PA | 6 PGW<br>6 SGW<br>1 SERV<br>1 PA | 4 SGW<br>2 PA | na |

Note:
PGW = Producing Gas Well, SGW = Shut-in Gas Well, TA = Temporarily Abandoned, PA = Plugged and Abandoned, SERV = Service Well (water injection, gas injection, water disposal).
Source: UDOGM 1997

### 3.10.2.4 Residential

Rural residences within the North and South Areas are located near communities. Residences in the South Area are within the city limits of Clawson, Orangeville and Huntington. Other residences are rural residences located along roads in the South Area. The number of residences within the North and South Areas are shown in **Table 3–24**.

**Table 3–24**
**Residences within the North and South Areas, and the Pipeline Corridor**

| Study Area | Houses Within City Limits | Rural Houses | Total |
|---|---|---|---|
| North Area | 53 | 0 | 53 |
| South Area | 71 | 38 | 109 |

There are 53 residences in Kenilworth that are located within the North Area. All other residences in Kenilworth are within 0.14 miles of the North Area. There are no residences in Helper and Spring Glen within the North Area, but there are numerous homes in these communities that are within 0.5 miles of the North Area's boundary.

All residences within the pipeline corridor are located along the portion of the corridor following the existing Questar Pipeline. The section of the pipeline that will consist of new right-of-way is located on public lands. There are no residences along this portion of the corridor.

### 3.10.2.5 Utilities and Rights-of-Way

#### *3.10.2.5.1 North Area*

A powerline crosses through the North Area southeast from Kenilworth. A powerline is located adjacent to the southwest boundary of the North Area. Two powerlines cross through the North Area. A pipeline corridor extending from Price to Nine Mile Canyon crosses through the south end of the North Area.

#### *3.10.2.5.2 South Area*

Two power plants operated by Utah Power and Light Company are located in Castle Valley. The Hunter plant is located adjacent to the east boundary of the South Area about two miles south of Castle Dale. The Huntington plant is within the South Area in Huntington Canyon, accessed by State Route 31. Research farms at the Hunter and Huntington power plants use spent cooling water to produce grain crops and cattle.

A power line extends southeast across public and private lands in the South Area from a substation adjacent to the power plant. A power line extends from the same substation to tie in with power lines at Helper.

Right-of-way corridors that cross through BLM lands within the North and South areas include oil and gas facilities and water lines, are summarized in **Table 3–25**.

#### *3.10.2.5.3 Pipeline Corridor*

The proposed pipeline corridor would be located adjacent to the existing Questar Pipeline corridor. The Questar Pipeline is located in a right-of-way that extends from Price to Ferron, near the State Route 10 highway corridor. The existing pipeline is a 6-inch line that includes tap lines that serve each community along the pipeline corridor.

## 3.10.3 Land Use Planning and Management

BLM lands in the entire Project Area are now managed by the Price Field Office. Before the BLM restructured, the North Area was managed by the Price River Resource Area and the South Area was managed by the San Rafael Resource Area. Therefore, management plans for each area are still in effect and both the Price River Management Framework Plan and the San Rafael Resource Management Plan are referenced. In addition. the National Forest lands in the South Area are managed under the Manti-La Sal National Forest Plan. Private lands in the Project Area are covered by county master plans and zoning plans for Carbon and Emery Counties as well as the local municipalities.

### 3.10.3.1 BLM Land Management Direction

As stated above, the management direction for BLM lands in the Project Area varies between the North and South Areas. Both the RMP covering the South Area and the MFP covering the North Area provide BLM's direction for managing the resources in their respective areas.

The management objective for oil and gas development in the Price Field Office area is to lease public lands for oil and gas, to allow geophysical activity to occur only so long as management plans are met, and to administer operational aspects of federal oil and gas leases where BLM does not manage the surface. BLM-

**Table 3–25**
**Rights-of-Way in the Project Area**

| | Serial Number | Type | Legal Locations | Proprietor | Comments |
|---|---|---|---|---|---|
| North Area: | 74314 | oil & gas pipeline | T13S R10E sec. 23 | Anadarko Petro. Corp. | Expires 10/3/2006 |
| | 71854 | oil & gas facility site | T13S R10E, sec. 22, 23, 27, 34 | Anadarko Petro. Corp. | Expires 9/19/2004; 13.78 acres |
| | 067467 | oil & gas pipeline | T14S R10E sec. 11, 12 T14S R11E sec. 6, 7 | Questar Pipeline Co. | Expires 1/1/1999 |
| South Area: | 0146663 | oil & gas pipeline | T19S R8E, sec. 7, 18 T17S R9E, sec. 4 | Questar Pipeline Co. | Asgn approved for Mtn Fuel Supply 7/23/1984 |
| | 52401 | Trans-solid | 17S R7E, sec. 2 | Pacificorp DBA UPL | Expires 5/2/2013; 0.738 acres |
| | 57139 | oil & gas pipeline | T19S R7E, sec. 1, 3, 11, 12, 13 T19S R8E, sec. 18 | Chandler & Assoc. Inc. | Expires 10/15/2001 |
| | 71862 | water pipeline | T18S R7E, sec. 12 | Jim Peacock | Pending 12/5/1994; 1.0 acre; unauthorized use |
| | 74338 | water pipeline | T18S R7E, sec. 7 | Castle Valley Special Service District | Expires 12/29/2027 1.0 acre |

Source: BLM 1997c

administered public lands in the South Area are in Oil and Gas Leasing Category 2 – Open With Special Conditions (BLM 1991c). Category 2 prescriptions consists of seasonal restrictions that apply to desert bighorn sheep crucial habitat, antelope crucial habitat, and mule deer and elk crucial winter ranges. BLM management direction for the various other resources is discussed in the appropriate sections of this chapter.

### 3.10.3.2 Carbon County Land Use Planning

County land use controls in Carbon County include the Carbon County Master Plan (Carbon County 1997), adopted in October 1997 and a Zoning Ordinance (Carbon County 1995). The Master Plan focuses on six major issues identified by County residents, including 1) economic development, 2) human services and education, 3) infrastructure and resources, 4) private land use, 5) public lands and resources, and 6) recreation and tourism. The issues are developed through policy statements, objectives, strategies and action steps designed to accomplish County goals and objectives.

The Carbon County Zoning Ordinance is currently being updated by the Carbon County Planning and Zoning Department. The zoning ordinance and decisions of the Planning Commission will be reviewed for consistency with the County Plan. The current zoning ordinance will be in effect for land planning purposes until the new ordinance is developed and approved.

Under the current ordinance, all of the North Area is within the M&G–1 – Mining and Grazing zone with the exception of an R–1–8K – Residential zone that contains the unincorporated community of Kenilworth (**Plate 3–8**). The Glen Canal runs along part of the west side of the North Area, between Helper and Spring Glen. The lands on the west side of Glen Canal adjacent to the North Area are within Rural Residential zoning districts.

The M&G–1 zone consists of low rangeland areas of county that are used for the grazing of livestock, mining and mineral exploration. Production wells are Permitted Non-Conditional Use of the zone. The R–1–8K zone district in the North Area includes existing residential and associated infrastructure development in Kenilworth. Production wells are a Permitted Conditional Use of the zone.

### 3.10.3.3 Emery County Land Use Planning

The Zoning Resolution for Emery County adopted in 1970 includes amendments current through November of 1995 (Emery County 1995). The Zoning Resolution has established zoning districts to implement land-use controls that limit the uses to which land in an area may be put. There are the following four zoning districts within the South Area (shown on **Plate 3–8**): A–1 (Agricultural), M&G–1 (Mining and Grazing), I–1 (Industrial), and CE–2 (Critical Environmental).

Most of the South Area is in M&G–1 – Mining and Grazing. The zone consists of dry mountain and desert areas that generally contain economically significant mineral deposits. The area has been historically used for the grazing of livestock on the open range and as the location of numerous mining and mineral exploration sites. Production wells are a Permitted Conditional Use of the zoning district that is subject to the prior approval of the County Commission.

Agricultural lands along creeks that run through the South Area are in the A–1 – Agricultural zone. The zone was established as a district in which the primary use of the land is for agricultural and livestock raising operations. Exploratory, oil and gas wells are a Permitted Administrative (Planning Commission) Conditional Use requiring a Small Site Plan Approval.

Approximately ½ section north of Castle Dale is zoned with I–1 Industrial. The I–1 zone is characterized by a mixture of industrial, manufacturing and processing establishments. Production wells are a Permitted Conditional Use of the zoning district that is subject to the prior approval of the County Commission.

A small area of land in Huntington Canyon in the northwest part of the South Area is in the CE–1 Critical Environmental zoning district. The CE–1 district includes canyon, mountain, riparian and other lands of environmental concern. Land within the zone has historically functioned as a primary watershed for much of the irrigation and culinary water supply for the area. Uses that tend to degrade the quality of the environment are not permitted. Exploration and production wells are not covered under the Permitted Non-Conditional Uses or Permitted Conditional Uses in this zone.

### 3.10.3.4 Utah State Land Management

Approximately 2,935 acres in the North Area and 9,035 acres in the South Area are owned by the state of Utah. Most of the state lands are administered by SITLA (SITLA 1996). The SITLA was created to manage real estate trust funds granted to the state by the United States at statehood. The trust lands are managed for the financial benefit of beneficiaries that include common schools (grades K through 12), reservoirs, Utah State University and other institutional beneficiaries. Nearly 96 percent of state trust lands support common

schools. Sections 2, 16, 32 and 36 in every township were granted for the support of common schools. In Carbon County, approximately 94,637 acres of land are under trust land surface ownership. In Emery County, 299,015 acres of land are state trust lands.

Approximately 270 acres are Utah State Park/Recreation Area lands within the Huntington Lake State Park. Recreation opportunities in the park are described in **Section 3.12**.

Utah State Wildlife Reserve (SWR) lands are located along State Route 31 west of Huntington. There are two parcels of SWR lands. An 80-acre parcel is located on the north side of the town of Huntington. Another 80-acre parcel is accessed from State Route 31 about 1.5 miles from Huntington. There is currently no formal mechanism used to resolve land use conflicts (Utah State Legislature 1997). Land use planning for wildlife lands has been identified as a potential issue for the 1998 Utah General Session. It is anticipated that there will be legislation that will create a land use planning process for SWR lands.

#### 3.10.3.5 Manti-La Sal National Forest Management

Approximately 10,931 acres of land in the South Area is within the Manti-La Sal National Forest. There are four Forest management units on National Forest System lands within the South Area; General Big Game Winter Range (GWR), Leasable Mineral Development (MMA), Key Big Game Winter Range (KWR), and RNG, managed for timber and forage (Forest Service 1986). Most of the South Area National Forest lands are in GWR and RNG units. Lands along creeks, including Whetstone Creek, Grimes Wash, Killpack Canyon and Rock Canyon are in the MMA unit.

Forest-wide stipulations do not allow surface occupancy on slopes greater than 35 percent. With the exception of lands along some creeks, most of the National Forest lands in the South Area are on slopes greater than 35 percent. These lands are within the Huntington Canyon and Cottonwood oil and gas analysis areas. There are two oil and gas lease types with stipulations for surface occupancy as follows:

- TL1/TH1 — Lease with Timing Limitation Stipulation No. 1 and Threshold Stipulation No. 2. Surface occupancy for construction of facilities and drilling is not allowed from December 1 to April 15. Disturbance of the ground surface and disturbance (area avoided) of wintering big-game would be limited to 10 percent of the GWR Management Unit.

- STD — Lease with standard terms and forestwide stipulations only.

### 3.10.4 Transportation

The transportation network that serves the proposed project Area consists of federal and state highways, local roads, and BLM roads. The network would be used by workers and vehicles hauling equipment and supplies to the Project Area.

#### 3.10.4.1 Public Road Network

State Route 10 is the primary north-south transportation route through Carbon and Emery Counties and links the communities of Huntington, Castle Dale, Clawson and Ferron between Price and Interstate–70 to the south. U.S. Highway 6 connects Price with Salt Lake City 120 miles to the northwest. State Routes 29 and 31 connect State Route 10 with the Manti-La Sal National Forest to the west.

The primary access into the North Area is from county and BLM roads, and from State Route 157, which connects the community of Kenilworth with State Route 6. There are approximately 303 miles of roads in the North and South Areas. Local roads provide access to roads and trails on BLM lands from the neighboring communities of Price, Carbonville, Spring Glen, Helper, and Kenilworth. Access to the North Area is also available by four-wheel drive and graded roads that connect with the Nine Mile Canyon National Back Country Byway, located about five miles to the east.

State Route 10 provides access to the South Area by way of county roads, and state routes. The primary routes that connect with State Route 10 are State Route 31, State Route 29, and State Route 57. Most of State Routes 29, 31 and 57 are within the South Area. State Route 29 crosses through the South Area between the Manti-La Sal N.F. boundary and the north limit of Orangeville. State Route 31 is a scenic byway that crosses through Huntington Canyon in the South Area between the National Forest's boundary and the northwest limit of Huntington at State Route 10. State Route 57 connects State Route 10 with the Cottonwood/Wilberg Mine to the north of the South Area's boundary.

The pipeline corridor in Emery County parallels and overlaps an Questar Pipeline's existing right-of-way. This part of the corridor is accessed from State Route 10 and from other state and local routes that connect with State Route 10. The remainder of the pipeline corridor is in new right-of-way on public lands. The new pipeline right-of-way is located partially along existing county roads and is accessible from several county roads.

Annual Average Daily Traffic (AADT) counts for U.S. Highway 6, State Route 10, State Route 29 and State Route 31 were obtained from the Utah Department of Transportation (UDOT). AADTs consist of the annual average of traffic weekly traffic counts calculated from Sunday through Saturday. The AADTs were counted for the entire length of each State Route **Table 3–26** show the counts for each segment of U.S. Highway 6 and State Route 10 that are accessed from the North and South areas in Carbon and Emery counties.

**Table 3–26** shows each segment of State Route 6 between the northern incorporated limits of Helper and the Carbon-Emery County line, a distance of nearly 46 miles. Traffic levels are highest in the vicinity of Price, particularly on sections at the junctions of State Routes 244, 10 and 55. The levels are highest at the west incorporated limits of Wellington, located north of the North Area. Wellington is at the junction of several county roads.

State Route 10 section length AADTs are shown between the junction of Main Street and S.R 55 100 North Street in Price and the south incorporated limits of Ferron, a distance of nearly 41 miles. The AADTs show decreasing traffic levels heading south on State Route 10.

### 3.10.4.2 BLM Roads

Numerous improved and unimproved (four-wheel drive) roads are located in the North and South areas, as shown on **Plate 2–1** in Chapter 2. The transportation system on BLM lands within the management area consists of roads maintained under four road classes, consisting of temporary, resource, local and collector type roads. BLM road classes are described in Chapter 2. Prior to gas field development, roads on BLM lands were primarily maintenance Level 2 roads. Existing gas field development has resulted in the addition of new roads and the upgrading of existing roads. Currently, most roads are maintained as Level 3 roads. A description of the use of gas development roads on BLM lands follows:

**Table 3–26**
**Annual Average Daily Traffic Counts in Carbon and Emery Counties**

| County | Route Name | Description | 1995 | 1996 |
|---|---|---|---|---|
| Carbon | SR 157 | south incorporated limits of Helper | 2,150 | 2,510 |
| | SR 157 | junction SR 139 – Kenilworth | 555 | 555 |
| | US Hwy 6 | north incorporated limits of Helper | 6,385 | 6,095 |
| | US Hwy 6 | south incorporated limits of Helper | 13,590 | 12,975 |
| | US Hwy 6 | west incorporated limits of Price | 10,600 | 10,075 |
| | US Hwy 6 | junction SR 55 west of Price | 9,895 | 9,500 |
| | US Hwy 6 | junction SR 10 | 11,185 | 10,965 |
| | US Hwy 6 | junction SR 55 and south incorporated limits of Price | 14,900 | 14,610 |
| | US Hwy 6 | west incorporated limits of Wellington | 15,725 | 15,415 |
| | US Hwy 6 | Carbon – Emery county line | 3,390 | 3,410 |
| | SR 10 | junction SR 6 Price bypass | 8,895 | 8,730 |
| | SR 10 | south urbanized boundaries of Price | 7,035 | 6,780 |
| Emery | SR 10 | Emery – Carbon county line | 5,130 | 5,055 |
| | SR 10 | north incorporated limits of Huntington | 5,150 | 5,080 |
| | SR 10 | junction SR 31 | 6,810 | 6,730 |
| | SR 10 | junction SR 29 | 5,835 | 5,765 |
| | SR 10 | north incorporated limits of Castle Dale | 3,235 | 3,250 |
| | SR 10 | junction SR 57 | 4,050 | 4,000 |
| | SR 10 | north incorporated limits of Clawson | 3,310 | 3,835 |
| | SR 10 | north incorporated limits of Ferron | 3,310 | 3,835 |
| | SR 29 | Manti-La Sal N.F. boundary | 995 | 885 |
| | SR 29 | junction SR 57 | 2,380 | 2,245 |
| | SR 29 | north incorporated limits Orangeville | 2,750 | 2,590 |
| | SR 29 | east incorporated limits Castle Dale – junction SR 10 | 3,940 | 3,720 |
| | SR 31 | Manti-La Sal National Forest boundary | 1,400 | 1,320 |
| | SR 31 | road to Bear Creek Canyon | 1,825 | 1,720 |
| | SR 31 | road to Deer Creek Canyon Power Station | 3,655 | 3,445 |
| | SR 31 | northwest incorporated limits of Huntington | 4,375 | 4,125 |
| | SR 57 | junction SR 10 | 985 | 950 |
| | SR 57 | local road to Orangeville | 900 | 865 |
| | SR 57 | SR 29 – Cottonwood/Wilberg Mine | 900 | 865 |

Source: UDOT 1996, 1997

- Temporary roads are low volume, single-lane roads located, designed, and constructed for temporary use. They are constructed to be made impassable to vehicle travel and returned to a near natural condition upon completion.

- Resource roads are low volume, single-lane roads that may be reclaimed after a particular use terminates. These roads connect terminal facilities, such as a well site to collector, local, arterial, or other higher class

roads. They serve low average daily traffic. They may be developed for either long- or short-term use, and operated either closed or open to public use.

- Local roads are normally graded, drained, and surfaced and are capable of carrying highway loads. They collect traffic from resource or local roads or terminal facilities, and are connected to arterial roads or public highways.

- Collector roads serve large land areas and are the major access route into development areas with high average daily traffic rates. They usually connect with public highways or other arterials to form an integrated network of primary travel routes and are operated for long-term land and resource management purposes and constant service.

### 3.10.4.3 County Transportation Planning

The Emery County General Plan (Emery County 1995) anticipates that coal-bed methane extraction will require development roads that impact the unimproved native portions of the County road system. The Plan notes that the extracted product is transported by pipeline, causing the access roads to be incidental to the industry, and of little use to the local economy, and therefore not a worthwhile County investment. An objective of the Plan is to encourage roads to be constructed or improved by development interests and assure they meet acceptable standards for safety, structure and widths as determined by the County Engineer or Road Department Supervisor in compliance with the existing Road Encroachment Ordinance 8–7–85A.

The primary transportation issues identified in the Carbon County Comprehensive Plan is to improve safety on U.S. Highway 6 and State Route 10 and to increase County participation in transportation and highway planning decisions. Safety on State Route 10 has become a serious concern in recent years. The highway is a high-speed road, and can be dangerous to enter or exit from the narrow driveways and roads that connect to it. The County intends to explore possible zoning changes that could require safer entry points on the highway, and to examine issues that have been identified in the UDOT's feasibility study for improvements in the area.

### 3.10.4.4 Other Transportation

Rail service in Carbon County is provided by the Union Pacific Railroad. The railroad tracks connect Helper, Price and Wellington with the Provo area to the northwest, and continue east from Wellington. Utah Railway operates a spur line between Helper and Hiawatha in Emery County that connects coal mines in the area to the Union Pacific line.

The Carbon County Airport is located three miles east of Price partially within the North Area. The airport has three runways and two helipads (Air Nav 1997). Part of Runway 18/36 is within the North Area. The runway is 8,300 feet long, 100 feet wide, and oriented in a southwest-northeast direction. A TVOR (Very High Frequency Omnirange) site is on the field at the airport. A TVOR tower site radiates azimuth information for nonprecision instrument approach procedures.

# 3.11 LIVESTOCK MANAGEMENT

## 3.11.1 Regional Overview

Livestock grazing is a primary use for both public and private lands in the region. While livestock grazing has had a historic presence in the area, its economic success has been marginal due to the low carrying capacity of the land. This restrictive carrying capacity is due to the arid vegetation types within the area ranging from pinyon-juniper and sagebrush grassland to salt desert. Grazing patterns are typically managed to maximize what production does exist. The higher altitudes are utilized in the growing season, and the valley floor is grazed from spring to early summer, and during the fall and winter.

## 3.11.2 Allotments in Project Area

There are 22 BLM grazing allotments either completely or partially within the Project Area. **Plate 3–9** shows the extent of each allotment and **Table 3–27** summarizes allotment grazing information. As noted in this table, all of the livestock are domesticated varieties, and cattle and sheep are the primary livestock type grazed. **Table 3–27** also contains the management category of each allotment. The categories were defined by the BLM and established to provide priorities for distributing available funds and personnel in a manner that would achieve a cost-effective improvement in both rangeland condition and production. They are described in **Table 3–28**.

## 3.11.3 Carrying Capacity, Livestock Management and Facilities

The carrying capacity of an allotment is defined in terms of Animal Unit Months. This information, along with the livestock type, period of use, BLM management category, and ecological range condition, is provided in **Table 3–27** for each grazing allotment. Any reduction in the amount or quality of these factors can have a negative effect on the carrying capacity of the allotment.

Livestock operators use the existing road network to move cattle to the allotments and to access the allotment to check on their livestock, fix fences, inspect water tanks, distribute salt and other maintenance activities. Any restrictions in the ability of livestock operations to access the allotments would impact their ability to perform the necessary livestock management activities.

The grazing allotments contain various range improvements which are used to control animal movement and to provide water for livestock. Improvements include fences, cattle guards, corrals, developed springs and wells, detentions dams, reservoirs, and water pipelines. In some areas, pinyon-juniper has been chained to encourage herbaceous forage. Disruption of these range improvements could impact the control of livestock on the established grazing allotments.

# 3.12 RECREATION

## 3.12.1 Introduction

This section identifies existing recreation uses of lands in the North and South Areas, and along the Pipeline Corridor. A field reconnaissance of the Project Area was conducted with the BLM recreation specialist in

## Table 3–27
## Summary of BLM Grazing Allotments

| Allotment Name | Acres | | AUMs on Public Land | Acres/AUM[1] PublicLand | Livestock Type | Period of Use | Mgmt. Category | Ecological Range Condition | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Public | State/Pvt. | | | | | | PNC[1] | Late Seral | Mid Seral | Early Seral | Unsuitable |
| **SOUTH AREA** | | | | | | | | | | | | |
| Clawson Dairy | 1,830 | 85 | 65 | 28 | C | 5/1 – 5/31 | M | 0 | 0 | 77 | 0 | 0 |
| Cowley | 710 | 0 | 101 | 7 | C | 5/1 – 5/31 | C | 0 | 0 | 100 | 0 | 0 |
| Cox (Don) | 500 | 160 | 71 | 7 | C | 10/1 –11/30 | C | 78 | 0 | 18 | 4 | 0 |
| Cox (John) | 1,350 | 0 | 146 | 9 | C | 10/16–1/31 | M | 0 | 0 | 99 | 1 | 0 |
| Deep Wash | 2,540 | 1,190 | 7 | 148 | C | 4/1 – 6/10<br>11/1 – 11/30 | M | 0 | 0 | 100 | 0 | 0 |
| East Grimes | 3,761 | 960 | 146<br>129 | 14 | C<br>C | 4/1 – 4/30<br>5/1 – 6/15 | M | 0 | 0 | 15 | 85 | 0 |
| Humphrey | 80 | 0 | 20 | 4 | C | 6/1 – 6/20 | C | 0 | 0 | 100 | 0 | 0 |
| Jensen | 260 | 0 | 10 | 26 | C | 1/1–3/31 | C | 0 | 0 | 100 | 0 | 0 |
| N. Huntington | 1,335 | 17,185 | 46 | 12 | C | 11/1 –12/15 | I | 36 | 0 | 40 | 10 | 14 |
| Northwest Ferron | 1,980 | 840 | 110<br>8 | 17 | C<br>C | 5/1 – 5/31<br>4/1 – 6/15 | M | 0 | 27 | 73 | 0 | 0 |
| North Wolf Hollow | 90 | 30 | 8 | 11 | C | 5/1 – 10/31 | C | 0 | 0 | 100 | 0 | 0 |
| Peacock | 3,140 | 0 | 56 | 56 | C | 4/1 – 6/10 | I | 29 | 0 | 30 | 41 | 0 |
| Reid | 200 | 0 | 12 | 17 | C | 10/16–12/31 | C | 0 | 0 | 100 | 0 | 0 |
| Rock Canyon | 2,770 | 610 | 156<br>80 | 12 | S<br>C | 4/16–5/31<br>4/16 – 5/31 | I | 0 | 0 | 100 | 0 | 0 |
| South Wolf Hollow | 740 | 160 | 30 | 25 | S | 4/21–6/20 | C | 78 | 0 | 100 | 0 | 0 |
| West Grimes | 4,440 | 530 | 295 | 15 | C | 4/1 – 6/10 | M | 0 | 30 | 54 | 16 | 0 |
| West Huntington | 11,960 | 5,540 | 138 | 87 | C<br>C | 5/1 – 6/26<br>11/1– 12/15 | I | 34 | 1 | 28 | 37 | 0 |
| West Orangeville | 4,700 | 510 | 208<br>20 | 21 | C | 4/20 –6/10<br>10/16–12/31 | C | 68 | 0 | 26 | 6 | 0 |
| Wilberg | 2,562 | 2,875 | 46<br>62 | 16 | C<br>C | 11/1–12/15<br>4/16–6/15 | C | 0 | 5 | 77 | 18 | 0 |

## Table 3–27 (continued)
## Summary of BLM Grazing Allotments

| Allotment Name | Acres | | AUMs on | Acres/AUM[1] | Livestock | | Mgmt. | Ecological Range Condition | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Public | State/Pvt. | Public Land | PublicLand | Type | Period of Use | Category | PNC[1] | Late Seral | Mid Seral | Early Seral | Unsuitable |
| **NORTH AREA** | | | | | | | | | | | | |
| Coal Creek | 15,351 | 1,965 | 851 | 18 | C<br>C | 4/16–5/31<br>10/16–10/31 | I | 0 | 6,140 | 7,983 | 1,228 | 0 |
| Hayes Wash | 6,135 | 3,460 | 342 | 18 | C | 10/15–5/31 | M | 0 | 1,396 | 3,405 | 1,334 | 0 |
| Wood Hill | 2,769 | 1,680 | 205 | 16 | C | 3/1–5/31 | M | 0 | 0 | 1,523 | 1,246 | 0 |
| **FOREST SERVICE ALLOTMENTS — SOUTH AREA ONLY** | | | | | | | | | | | | |
| East Mountain | 11,221 | 8,107 | 1,230 | 9 | C | 6/21 – 9/10 | I[2] | | 38 | 48 | 14 | 71 |
| Horn Mountain | 70,309 | 1,607 | 4,371 | 16 | C | 6/9 – 9/30 | I[2] | | 17 | 69 | 14 | 59 |
| Gentry Mountain | 37,754 | 5,062 | 6,083 | 6 | C | 6/27 – 9/30 | I[2] | | 17 | 30 | 53 | 79 |
| Trail Mountain | 20,139 | 1,188 | 3,646 | 6 | C | 6/21 – 9/20 | I[2] | | 14 | 74 | 12 | 65 |

NoteS:

1. AUM = Animal Unit Month, PNC = Potential Natural Community
2. High priority allotment with big-game winter range an/or watershed improvements.

**Table 3–28**
**BLM Range Management Category Types**

| Management Category | Range Condition | Production Levels | Resource Use | Livestock Management | Potential for Economic Return |
|---|---|---|---|---|---|
| Maintain | satisfactory | near potential | no serious conflicts | appears to be satisfactory | |
| Improve | not satisfactory | below potential | serious conflicts | appears to be unsatisfactory | high |
| Custodial | not a factor | near potential | no serious conflicts | appears to be satisfactory | low |

October 1997. Existing recreation and land uses were identified. Public access to recreation opportunities on public lands and lands adjacent to the Project Area was discussed.

Carbon and Emery counties offer varied scenic terrain ranging from desert to mountains, which provide a setting for many forms of outdoor recreation. Major attractions include the San Rafael Swell, the Book Cliffs-Westwater Area, Ninemile Canyon, and the Manti-La Sal National Forest (BLM 1994a). Recreation areas within or adjacent to the North and South areas are Huntington Lake State Park and Millsite State Park.

Approximately 61 percent of Carbon County lands and 92 percent of Emery County are public land. Public lands provide open space for a variety of dispersed outdoor recreation opportunities, as well as developed facilities to help meet the demand for site-oriented recreation. Recreation opportunities offered by the private sector consist of community facilities in urban areas and the infrastructure of tourist services and facilities.

The primary users of recreation resources within the Project Area are local residents. The western half of Emery and Carbon Counties have not been a significant destination for recreation and tourism visitations, except the San Rafael Swell and the Green River. However, there is traffic through both counties from the Wasatch Front to other outdoor recreation areas that represent a potential market in part because of the opportunities offered by public lands. Carbon County has indicated that there is an increasing interest in local recreation opportunities in recent years.

## 3.12.2 Recreation Use

Public lands in Carbon and Emery Counties provide diverse recreational opportunities, including camping, backpacking, hiking, mountain biking, fishing, picnicking, hunting, whitewater rafting, horseback riding, all-terrain vehicle (ATV) and motorcycle riding, and winter sports.

### 3.12.2.1 Trails

The area around Price has an informal network of trails, routes and open space used for various motorized and non-motorized recreational pursuits. These include hiking, walking, running, horse riding, mountain biking, cross-country skiing, tubing, sledding, snowmobiling, dog walking, ATV use, dirt biking, 4-wheeling, birding and wildlife watching. The North Area contains about 80 miles of roads and trails that can be used as recreation trails. Other recreation activities include archery, shooting and hunting. Price's open space

attracts many of the newer residents to this area and is a valued asset to long time residents. However, no statistics on Recreation Visitor Days have been compiled for public lands in the Project Area. The BLM outdoor recreation planner estimates the North Area received 10,000 user days per year before the development of gas wells and road improvements.

There are numerous four-wheel drive roads and informal trails on public lands in the South Area, and along the pipeline corridor on lands west of Price. These lands that are used for a variety of trail related activities. Many roads and trails in the North and South areas provide easy access to public lands from local communities, and are popular with local recreationists.

Carbon County has prepared the 1995 Carbon County Trails Plan (Carbon County 1995) as an appendix to the Carbon County Comprehensive Plan. The plan identifies existing trail use and potential trail projects in Carbon County. The overall goal of the Trails Plan is to establish trail corridors that will enhance community development and the quality of life for local residents, and to possibly generate opportunities for economic development.

The Plan identified several different trail user groups in the Carbon County area. The most popular outdoor recreation trail related activities identified by the Plan are ATV riding, motorcycling, horseback riding, cross country skiing, 4WD vehicles, snowmobiling, bicycling, hiking and dog walking. Additionally, several organized groups, including the Rocky Mountain Elk and Deer Foundation, Utah Sportsman Association, and other recreational clubs, regularly use the public lands.

There are no designated trail systems within the North and South areas and the Pipeline Corridor. The existing state of trail use is mostly informal, unmarked routes. With the exception of organized and group events, users tend to be local residents who have developed knowledge of suitable trails by use type over time, through self-exploration, and word of mouth (Keleher 1995). Under the direction of the Carbon County Trails Plan, Carbon County is developing a system of trails in Carbon County and within the North Area. Neither a formal designation of trails nor land owner's permission to use these trails has been finalized. The proposed trails plan is shown on **Plate 3–10**.

The nearest trail system is the Helper Parkway, which runs along the banks of Price River in Helper. Long-term plans for the parkway are to extend it through Price Canyon to Wellington, located south of the North Area. Other designated trail systems in the area are the Castle Valley Ridge Trail System, located on National Forest lands west of the South Area and the Ninemile Canyon Back Country Byway.

A mountain biking guide was developed by the Castle Country Travel Council to describe biking and hiking routes in the Castle County region, including trails on the Wasatch Plateau, San Rafael Swell, the Green River area, and Carbon and Emery counties. There is one route described in the guide that is within the North Area. The 14-mile Kenilworth Loop (**Plate 3–10**) begins in Price, and heads north through the North Area to Kenilworth. The route continues east along the base of the Bookcliffs to connect with a road that loops to the south back to Price, paralleling the northward road. Several informal trails and 4-wheel drive roads connect with the route, providing recreation access into most of the North Area.

In addition to the Kenilworth Loop, there is an informal network of trails using existing roads, also shown on **Plate 3–10**, in the North Area used for various motorized and non-motorized recreational activities. These include trail-related activities such as hiking, running, horseback riding, mountain biking, cross-country skiing, tubing, sledding, snowmobiling, dog walking, strolling, ATV use, dirt biking, birding and wildlife watching. Other recreational activities include archery, shooting and hunting. These trails are planned to be signed at some time in the future to accommodate increasing levels of use. The existing trail network has

been recently altered by natural gas development. The existing roads and trails have been improved to accommodate access to wells. The improvements have altered the characteristics of trails and 4-wheel drive roads (width, surface characteristics, roughness, winding curves) that results in a different experience for some recreationists depending upon their point of view.

### 3.12.2.2 Hunting and Fishing

Hunting is a major recreation use of public lands in the North and South Areas. Various big game and upland game bird species are hunted in the region. Big game species include deer, elk, and pronghorn. Big game populations are managed by the UDWR in herd management units. The South Area is within two deer management units and the North Area is within one big game management unit. **Table 3–29** summarizes the number of participating hunters and total hunter days for the big game management units that include the North and South areas.

Fishing is a popular year-round activity with residents of Carbon and Emery counties at Huntington Lake and Huntington Creek. Camping and picnicking along the creek within the South Area is currently informal and unmanaged and has resulted in some degradation of the riparian zone. It is likely that these types of uses will be regulated in the future.

**Table 3–29**
**Big Game Hunting in North and South Study Areas**

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|
| **NORTH AREA** | | | | | | |
| Deer Herd Unit 32 – Range Creek | | | | | | |
| Hunters Afield | 2,891 | 1,868 | 1,019 | 749 | 1,103 | 934 |
| Total Harvest | 918 | 704 | 282 | 316 | 383 | 355 |
| Success Rate (%) | 32 | 38 | 28 | 42 | na | 38 |
| Elk Herd Unit 24 – Range Creek | | | | | | |
| Hunters Afield | 22 | 22 | 30 | 31 | na | 46 |
| Total Harvest[1] | 18 | 19 | 28 | 28 | na | 46 |
| Success Rate (%) | 80 | 86 | 93 | 90 | na | 100 |
| Pronghorn Herd Unit 11 Icelander Wash | | | | | | |
| Hunters Afield | 37 | 37 | 27 | 33 | 31 | 39 |
| Total Harvest[1] | 33 | 34 | 25 | 30 | 26 | 37 |
| Success Rate (%) | 89 | 92 | 91 | 91 | 84 | 95 |
| **SOUTH AREA** | | | | | | |
| Deer Herd Unit 31 Southeast Manti | | | | | | |
| Hunters Afield | 5,864 | 4,222 | 1,609 | 1,258 | 1,454 | 1,402 |
| Total Harvest | 1,311 | 750 | 188 | 443 | 308 | 411 |
| Success Rate (%) | 22 | 18 | 12 | 12 | 35 | 29 |

Source: Utah Department of Natural Resources 1996

### 3.12.2.3 Other Recreation Use

Portions of Huntington and Cottonwood creeks within the South Area are used for whitewater kayaking. The stretch of Huntington Creek between the Huntington plant and the west boundary of the South Area is part of a 12.5-mile long reach that provides Class I to II whitewater rafting (American Whitewater Affiliation 1995b). An 8-mile long segment of Cottonwood Creek from Joe's Valley Reservoir (about 4 miles west of the South Area) to the east provides Class III to IV waters (American Whitewater Affiliation 1995a). Approximately 4 miles of this reach of Cottonwood Creek is in the South Area.

Cottonwood and Huntington Creeks flow through the South Area and merge to form the San Rafael River approximately 15 miles downstream of the South Area. The 65-mile long segment of San Rafael River between the junction of Ferron, Cottonwood and Huntington Creeks and the bridge at San Rafael Campground provides Class I to II whitewater kayaking and is very popular in season for floating trips (American Whitewater Affiliation 1995c).

There are several special events that are held on an annual basis within or near the North and South areas. The Castle Valley Pageant site is located seven miles west of Castle Dale within the South Area. The pageant is presented annually over a period of eight nights in late July and early August. More than 20,000 people attend the pageant to view a portrayal of the Mormon settlement of Castle Valley.

The Butch Cassidy Blow Out Mountain Bike Race occurred northeast of Price partially within the North Area. The race was part of the National Off-Road Bicycle Association sanctioned Cannondale Cup Mountain Bike Racing Series, which is an annual racing series based in Salt Lake City. The most recent Butch Cassidy Blowout occurred in June 1996.

The Team Wild Bunch Bike Race is held in the Wood Hill–North Price area in June. The race area is west and outside of the North Area.

According to the Bicycle Utah Vacation Guide (Bicycle Utah Inc. 1993), a popular tour for road cyclists is the scenic, 19-mile stretch of State Route 29 between Orangeville and Joe's Valley Reservoir.

State Route 10 is the primary north-south transportation route through Carbon and Emery counties. The highway connects with State Routes 29 and 31, which cross through the South Area and provide access to nearby recreation areas in the Manti-La Sal National Forest, including the Castle Ridge Trail System, Joes Valley Reservoir, and the Left Fork of Huntington Canyon Trail, which is a National Recreation Trail. Recreation areas to the east that are accessed from State Route 10 include Nine Mile Canyon to the northeast of the North Area, the San Rafael Swell (east of State Route 10), and the Book Cliffs (north of U.S. Highway 10).

## 3.12.3 Developed Recreation Areas and Recreation Use Sites

Carbon and Emery counties include several special recreation management areas on public lands. Part of the Huntington Lake State Park, located north of Huntington in Emery County, is within the South Area. Huntington Lake State Park consists of Huntington Lake and the immediate surroundings, which include facilities for recreational uses. There are 237 acres in the park that include 22 camping units, numerous picnic sites, boat launching, and a covered group-use pavilion.

Recreational activities available in the park include boating, water-skiing, sailing, windsurfing, swimming, camping, fishing, hiking, bird watching, picnicking, archaeological exploration, and photographic opportunities.

Millsite State Park is located adjacent to the south side of the South Area, near Ferron. Visits to Huntington and Millsite State Parks in the years between 1986 and 1996 are characterized by annual increases and decreases, as shown in **Table 3–30**. These fluctuations are not related to population changes in the counties (see **Section 3.15.1**). Declines in visits to the parks probably result from ongoing renovation and construction.

The Bear Canyon Campground, owned and operated by Emery County, is located in Huntington Canyon within the South Area. The campground includes camp sites, two pavilions, and picnic areas. The campground is popular with visitors to the annual Castle Valley Pageant in late July through early August (Cox 1998). The campground is used primarily on weekends, and weekday use is light. The heaviest use occurs on Memorial Day weekend and weekends in June and July. An estimated 2,000 visitors used the campground in 1996 (Funk 1997).

An informal sledding hill is located within the North Area on a north-facing slope overlooking Kenilworth. The sledding hill is use primarily by local residents of communities adjacent to the North Area. A roadside park, used primarily as a parking area, is accessed from State Route 10 approximately two miles northeast of Clawson.

## 3.12.4 Recreation Planning

Recreation on lands in Carbon and Emery Counties is administered by various government agencies through planning documents.

**Table 3–30**
**Annual Visitation in State Parks In Carbon and Emery Counties, Utah; 1986–1996**

| Year | State Park Huntington Lake | Percent Change (Year to Year) | Millsite | Percent Change (Year to Year) |
|---|---|---|---|---|
| 1986 | 78,489 | - | 53,043 | - |
| 1987 | 69,702 | -11.2 | 34,674 | -34.6 |
| 1988 | 63,505 | -8.9 | 28,985 | -16.4 |
| 1989 | 43,227 | -31.9 | 32,713 | 12.9 |
| 1990 | 67,089 | 55.2 | 42,528 | 30.0 |
| 1991 | 78,936 | 17.7 | 43,659 | 2.7 |
| 1992 | 85,740 | 8.6 | 47,780 | 9.4 |
| 1993 | 70,621 | -17.6 | 54,492 | 14.0 |
| 1994 | 75,543 | 6.7 | 45,751 | -16.0 |
| 1995 | 58,264 | -22.9 | 38,285 | -16.3 |
| 1996 | 60,852 | 4.4 | 40,465 | 5.7 |

Source: UDNR 1997b

### 3.12.4.1 BLM

All lands in the North and South areas have been inventoried for Recreation Opportunity Spectrum (ROS) system to identify and evaluate recreation opportunities on public lands. The ROS system categorizes BLM lands in six classes, each of which is defined by its setting and by the possible recreation experiences and activities it offers.

The ROS inventory identified four ROS classes in the North and South areas as shown on **Plates 3–10** ranging from primitive to developed experience opportunities. Three ROS classes were identified in the North Area: Roaded Natural, Urban and Semiprimitive Motorized classes (BLM 1994b). Most of the North Area is Roaded Natural. North Area lands adjacent to the communities of Helper and Spring Glen are in the Urban class. A small area of lands in the northwest part of the North Area at the base of the Bookcliffs is in the Semiprimitive Motorized class. There are four ROS classes that have been mapped and inventoried in the South Area. These are urban, rural, roaded natural, and semi-primitive motorized. The management objectives for ROS classes in the North and South areas are defined below.

Urban — The Urban class is characterized by a highly modified environment, although the background has natural elements. Sights and sounds of man predominate, and large numbers of users can be expected.

Rural — The Rural class characterizes a substantially modified natural environment. Sights and sounds of people are evident, and the interaction between users is often moderate to high. The area is characterized by the sights and sounds of rural residential and agricultural land uses.

Roaded Natural — This class characterizes a predominantly natural environment with evidence of moderate permanent alternate resources and resource utilization. Evidence of the sights and sounds of people is moderate, but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from sights and sounds of man. These lands are crossed by numerous four-wheel drive roads and trails. The area has historically been used for grazing.

Semi-Primitive Motorized — This class is characterized by a predominantly unmodified natural environment. There are some opportunities for isolation from the sights and sounds of man, and a high degree of interaction with the natural environment. The interaction between users is low, but often there is evidence of other area users.

Off-highway vehicle (OHV) use designations have been applied to BLM lands in the Project Area. BLM lands in the North Area are open to OHV use. OHV use on BLM lands in the South Area is open but limited by the RMP to existing roads and trails (BLM 1991b). Specific road and trail designations have not been completed. Seasonal restrictions occur in deer and elk crucial winter ranges from December 1 to April 15. These seasonal restrictions do not apply to state, county, or BLM system roads or to private or state lands.

Existing roads and trails on State trust lands are open to OHV use unless signed closed or previously designated closed, and as long as the use is otherwise consistent with state law and not in conflict with current leases or permits.

### 3.12.4.2 Manti-La Sal National Forest

National Forest Sytem lands are inventoried and mapped by Recreation Opportunity Spectrum (ROS) class to identify the opportunities for recreation activities that occur on National Forest System lands. The ROS

system is a continuum divided into six classes ranging from Primitive to Urban. All of the National Forest System lands in the South Area have been inventoried as the Semi-primitive Motorized class (Forest Service 1986).

The Semi-primitive Motorized class is characterized by a predominantly unmodified natural environment in a location that provides good to moderate isolation from sights and sounds of man except for facilities and travel routes sufficient to support motorized recreational travel opportunities that present at least moderate challenge, risk, and a high degree of skill testing.

### 3.12.4.3 County Recreation Planning

Emery County has prepared the Emery County General Plan (Emery County 1996), which has been updated through Autumn of 1996. The region is beginning to attract tourists, and a primary objective of the county for recreation and tourism is to develop a tourism industry that will bring maximum economic benefits with a minimum of negative effects on local resources and culture.

The county intends to conduct a tourism assessment to determine the costs and benefits of tourism in Emery County, and would identify the infrastructure developments that are needed to increase the benefits of tourism to the County.

The Carbon County Comprehensive Plan (Carbon County 1997) has identified recreation and tourism as one of the primary issues for the development of policies, objectives, and strategies. The Plan states that recreation and tourism is an essential element of Carbon County's continued economic vitality, and proposes to provide additional recreation opportunities for county residents while simultaneously improving community attractiveness in order to promote tourism.

### 3.12.4.4 State Recreation Planning

The 1992 Utah State Comprehensive Outdoor Recreation Plan (SCORP) (UDNR 1992) was developed by the Division of Parks and Recreation to help with state and local decision-making regarding outdoor recreation. The plan provides generalized guidelines for allocating federal Land and Conservation Fund monies to the state of Utah. The plan also provides information on the study of supply and demand; the identification of goals and objectives; estimated funds needed to achieve the objectives; analysis of critical issues; implementation of programs to solve identified issues; and development of special studies. Data on recreation uses and preferences of the public for recreation activities have been compiled for public lands in Utah.

The 1990 SCORP Household Recreation Survey includes preferences for recreation activities in the Southwestern Multiple County District (MCD), which includes Carbon and Emery counties. Results indicate that the five favorite activities are fishing, hunting and sightseeing by individuals and families, camping (developed and primitive), and picnicking.

# 3.13 VISUAL RESOURCES

## 3.13.1 Visual Resource Management

### 3.13.1.1 BLM

The BLM has inventoried visual resources for all BLM, state and private land in the Price Field Office area according to the Visual Resource Management (BLM 1986b) and established VRM classes. The VRM system is the basic tool used by the BLM to inventory and manage visual resources on public lands. The VRM classes are objectives that outline the amount of disturbance an area can tolerate before it no longer meets the objectives of the class. There are four VRM classes, each of which combines and evaluates visual quality, visual sensitivity of the area, and view distances. The inventory includes state and private lands as well as BLM lands, however the BLM manages visual resources only on BLM lands. Many private and public lands in the area have increased in sensitivity since the last inventory conducted in the 1970s as a result of increases in population and lifestyle shifts that emphasize outdoor recreation. Three VRM classes have been inventoried within the North and South Areas, as shown on **Plate 3–11**. The objectives of VRM classes in the North and South areas are:

- Class II — Class II provides for activities that would not be evident in the characteristic landscape. Contrasts are seen, but must not attract attention. Lands along the Huntington Canyon Scenic Byway are managed with Class II objectives. These lands are sensitive to public view.

- Class III — The objective is to provide for management activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character. Activities may be visually evident, but should not be dominant.

- Class IV — The objective is to provide for management activities that may require major modifications to the existing landscape. The level of change to the landscape can be high and may be visually dominant.

### 3.13.1.2 Forest Service

The Forest Service has inventoried and mapped National Forest System lands that are adjacent to BLM lands with the BLM's VRM classes (Forest Service 1986). Most National Forest lands within the South Area are inventoried with BLM VRM Class III. National Forest lands in Rock Canyon, located northwest of the town of Clawson, are inventoried with BLM Class IV.

### 3.13.1.3 County Visual Resource Management

The Carbon County Comprehensive Plan (Carbon County 1997) has identified community attractiveness as a one of the primary strategies for developing recreation and tourism in the county. Plan goals related to enhancing the visual quality of Carbon County are:

1. Promote and improve the attractiveness of the entryways to Carbon County's communities. Develop a long-range plan for entryway beautification.

2. Help communities to work with UDOT in roadway beautification projects.

3. Develop an inventory of areas that need aesthetic improvements and rate them according to need.

4. Identify the owners of areas that need aesthetic improvements and form a committee to pursue beautification efforts in those areas.

The Emery County General Plan (Emery County 1996) identifies the existing rural character and scenic environment as an important aspect of the rural quality of life in the county. The County desires to preserve agricultural lands for both its economic and aesthetic benefits, and is interested in exploring open space/ agricultural land preservation techniques and alternatives.

## 3.13.2 General Visual Characteristics

The Project Area consists of public, state and private lands in Carbon and Emery counties in Utah. The Project Area includes the North Area, approximately 18,000 acres in Carbon County, and the South Area, approximately 93,000 acres in Emery County. The detailed study area for direct and indirect impacts consists of public lands in the North and South areas. The general study area for direct and indirect impacts consists of all private and state lands in the Project Area. The cumulative effects area includes that area potentially impacted by existing and proposed gas development in Carbon and Emery counties.

The Project Area lies in the Colorado Plateau physiographic province within the Castle Valley and is bordered by the Wasatch Plateau to the west and the San Rafael Swell to the east. The area is typified by rugged canyon and mesa terrain and an arid climate. Primary access to the Project area is State Route 10, the primary north-south transportation route through Carbon and Emery counties.

The eastern rim of the Wasatch Plateau is the dominant feature of the Project Area. The valley is rural and agricultural in character. Rangeland and cropland in the basin are interspersed with tree belts along perennial streams. Higher elevations in the Project Area, at the base of the Wasatch Plateau, consist of rolling terrain that is vegetated with pinyon, juniper, oak brush, sagebrush and grasses. The Wasatch Plateau on the west side of the Project Area provides a scenic backdrop to many views from within the Project Area. The diversity of topography, vegetation and geologic formations characteristic of the region provide a variety of scenic experiences to those who utilize the area.

### 3.13.2.1 North Area

The North Area is located at the base of the Book Cliffs east of U.S. Highway 6. Communities along the highway near the North Area include Price, Carbonville, Spring Glen, Helper, and Martin. Kenilworth is located on the north side of the North Area, and is partially within the North Area. The landscape is characterized by rolling terrain and flat-topped mesas vegetated with pinyon-juniper. As seen from a distance, the background views of the area presents a landscape of a uniform light brownish grey coloration interspersed with contrasting dark and light zones. When viewed in the middleground, the landscape exhibits a stippled appearance with light and dark contrasts between the vegetation, soil and rock. Closer foreground views reveal sparse shrubby vegetation interspersed with grassy openings and rock outcrops that create a mosaic of texture, forms and color. The general area is essentially natural and undeveloped in character. The landscape is composed primarily of scenery that is common for the region.

Existing development in the North Area consists of natural gas pumping units and associated well pads and access roads. The wells are intrusive (defined as readily visible) in foreground views from roads and trails. Roads and trails in the North Area are used for recreation by the local residents. In middleground and

background views, the well pad is the most obvious feature of the development. Clearings are visible as a light brownish gray, geometric clearing with straight, linear edges that provide a contrast with the surrounding vegetation.

### 3.13.2.2 South Area

Existing visual modification to the South Area consists primarily of agricultural uses. Residential and commercial developments are located along State Route 10, which crosses north-south through the area. The communities of Huntington, Orangeville, and Ferron are accessed from State Route 10 on the east side of the South Area.

There is also modification to the landscape in the South Area from existing drilling activity. Other existing cultural modifications in the predominantly rural landscape in the North and South Area viewsheds include roads and highways, residences, two power plants, powerlines, and grazing improvements such as fences. Grazing is the primary land use north of Huntington. Croplands south of Huntington include haycrops and corn. The primary land uses of the region fall into the categories of ranching, farming, hunting, fishing, mountain biking, hiking and camping.

Most of the South Area is on flat to rolling terrain. Background views are dominated by the steep rim of the Wasatch Plateau. Horizontal layers of light tan to reddish brown shales and sandstones provide a dramatic backdrop to the rural landscape of the foreground and middleground views.

## 3.13.3 Key Observation Points (KOPs)

The primary views of the Project Area are from travel routes and recreation-use areas within the area. Travel routes include State Route 10 through the Project Area, county roads and BLM roads that access the area from the highway. Recreationists use public lands located throughout the area, including the Huntington Lake State Park and roads and trails throughout the North and South Areas. KOPs were selected to represent sensitive views of both areas. The location of each KOP is shown on **Plate 3–11** and are described below.

### 3.13.3.1 North Area

- KOP N1. The KOP is on a road at the south end of the town of Kenilworth, which is located at the mouth of a canyon that leads into the Book Cliffs. Views to the east are up a steep-sided valley, and includes a four-wheel drive road that provides access to roads and trails throughout the North Area. The view to the south is obstructed by a steep ridge. An existing well that is skylined near the top of the ridge is visible and other proposed wells would be seen in the foreground and middleground zones. Most of the North Area is obstructed from view by the topography.

- KOP N2. The viewpoint is on an improved, dirt-surfaced road along a drainage that accesses the North Area from Price. The road is used by mountain bicyclists and hikers, and it also provides access to the numerous four-wheel drive roads and trails that are also used for recreational activities. The views from this KOP are of the rugged terrain typical of the North Area. The views are of hilly to rugged terrain in the foreground and middleground zones. Background views are obscured by the terrain to the north, west and south of the KOP. An existing power line is visible in the background views to the east of the KOP.

- KOP N3. This viewpoint is located on a BLM road 2 miles southeast of Kenilworth. The views are of flat to rugged, sparsely vegetated terrain. An existing well and wellpad dominate the middleground views. The sharp line between the vegetation and the lighter gray-brown of the well pad is obvious.

### 3.13.3.2 South Area

- KOP S4. The Huntington Lake State Park is located less than one mile north of the town of Huntington adjacent to State Route 10. The park setting consists of a lake surrounded by landscaped lands that include facilities such as camping and picnic sites, a covered group-use pavilion, and a boat launch. Views of the Project Area on the south and west sides of the park consist of the lake and surrounding parklands in the foreground zones, the flat to rolling terrain of the Project Area in the middleground, and the steep rim of the dramatic Wasatch Plateau in the background.

- KOP S5. The KOP is on Huntington Canyon Scenic Byway (S.R. 31), which is part of a statewide system of scenic routes. The byway is a 48-mile scenic route between Huntington and Fairview, and provides access to scenic and recreational opportunities in the Manti-La Sal National Forest and to cultural and geologic points of interest. The KOP is located approximately 4.3 miles west of Huntington on the road, and provides a view to the north along Fish Creek, a tributary of Huntington Creek.

- KOP S6. This KOP is located on Huntington Canyon Scenic Byway (S.R. 31) approximately 0.3 miles east of the Bear Creek Campground, which approximately 10 miles west of Huntington. The view to the southeast is of dense stands of trees along Huntington Creek.

- KOP S7. The KOP is located on State Route 10 approximately 4.5 miles north of Castle Dale. The view is representative of views seen by travelers along the length of the highway through the South Area. The viewshed includes the flat to rolling terrain of lands in the foreground of the South Area to the west of the highway. Cultural features include a power line that consists of wood H-frame structures and conductors that are obvious in the foreground views.

- KOP S8. The Castle Valley Pageant site is located seven miles west of Castle Dale. The pageant is presented annually over a period of eight nights in late July and early August. Over 20,000 people attend the pageant to view a portrayal of the Mormon settlement of Castle Valley. The Pageant site is located on a ridge that provides panoramic views in all directions. The view to the southeast includes the ridgeline that provides a setting for the pageant. The west side of the ridge slopes down to rolling, hummocky terrain in a scenic protected bowl that is visible to the Pageant audience in the seating area. The Hunter Power Plant can also be seen to the southeast of the Pageant site. Views to the north and west are of steep terrain rising up to the Wasatch Plateau, and the dramatic cliffs of the Plateau in the middleground. The scenic setting is an essential element of the Pageant.

- KOP S9. This viewpoint is on State Route 29 on the north side of Orangeville. The views of the South Area are to the west along Cottonwood Creek, and to the north and south of agricultural lands.

- KOP S10. This viewpoint is at a radio tower on a Wasatch Plateau escarpment within the Manti-LaSal National Forest. The site provides a vista of the Castle Valley, including the South Area, and is representative of the views seen by users of the four-wheel drive roads and trails along the rim of the plateau.

## 3.14 NOISE

Noise is generally described as unwanted sound and discussions of environmental noise do not focus on pure tones. Commonly heard sounds have complex frequency and pressure characteristics. Accordingly, sound measurement equipment has been designed to account for the sensitivity of human hearing to different frequencies. Correction factors for adjusting actual sound pressure levels to correspond with human hearing have been determined experimentally. For measuring noise in ordinary environments, A-Weighted correction factors are employed. The filter de-emphasizes the very low and very high frequencies of sound in a manner similar to the response of the human ear. Therefore, the A-weighted decibel (dBA) is a good correlation to a human's subjective reaction to noise.

The following discussion sets a basis of familiarity with known and common noise levels. A quiet whisper at five feet is 20 dBA; a residential area at night is 40 dBA; a residential area during the day is 50 dBA; a large and busy department store is 60 dBA; rush hour traffic at 100 feet from the road is 60-65 dBA; a heavy truck at 50 feet is 75 dBA; and a typical construction site is 80 dBA. At the upper end of the noise spectrum, a jet takeoff at 200 feet is 120 dBA (Harris 1991).

The dBA measurement is on a logarithmic scale. The apparent increase in "loudness" doubles for every 10 dBA increase in noise (Bell 1982). Taking a baseline noise level of 50 dBA in a daytime residential area, noise of 60 dBA would be twice as loud, 70 dBA would be four times as loud, and 80 dBA would be eight times as loud.

Because of the variability of individual's reaction to noise and attitudes toward noise sources, it is impossible to accurately predict how an individual will react to a particular noise. However, when entire communities are considered, community reaction to noise may be represented with a high degree of confidence. A standard unit for measuring noise that affects communities is the Day-Night Average Sound Level ($L_{dn}$) that averages sound levels over a 24-hour period and adds a 10 dBA "penalty" at night from 10 p.m. to 7 a.m. to represent the intrusiveness of sound that occurs during normal sleeping hours. The $L_{dn}$ is represented as:

$$L_{dn} = 10 * \log \{1/24 [15 * (10^{Ld/10}) + 9 * (10^{(Ln+10)/10})]\}$$

where: Ld is the average daytime noise level $L_{eq}$ dBA.
Ln is the average nighttime noise level $L_{eq}$ dBA.

This formulation results in adding 6.4 to the average daytime noise to obtain the $L_{dn}$.

Community noise can be predicted by assuming that motor vehicle traffic is the most important single contributor to the noise environment for a community not located near major highways or airports (EPA 1974). This relationship assumes the number of vehicles and types of vehicles is almost constant, and that the vehicle usage is directly proportional to population density. The $L_{dn}$ can then be calculated using the relationship:

$$L_{dn} (dBA) = 10*\text{Log} (p) + 22$$

where: p = the population density of people with vehicles per square mile.

The Project Area has land uses that vary from sparsely populated rural areas to more densely populated small urban areas. Generally, noise levels would be about 35 dBA in rural areas away from communities and

roads. In the communities, the noise should range from about 45 dBA to 52 dBA $L_{dn}$ at locations away from the main highways and County roads in and near the communities. **Table 3–31** shows the average noise levels that can be expected based on population and size.

## 3.15 SOCIAL AND ECONOMIC ENVIRONMENT

The Ferron Natural Gas Project represents the second phase of a leasing program which encompasses three geographic areas centered around Price, Utah including the North and South Areas (this project) and the Central area covered in the recent Price CBM EIS (BLM 1997c). The information and analysis in this section is founded upon the information contained in the Price CBM EIS, tiering to, and building upon the previous EIS. The following paragraphs summarize relevant information contained in the Price CBM EIS while providing additional baseline information specific to this project.

### 3.15.1 Population

The population levels in both Carbon and Emery counties have fluctuated considerably from 1980 through the present. In 1983, the population levels peaked at 24,100 in Carbon County and 12,700 in Emery County. However, the population of both counties declined from 1984 through 1990. In 1990, Carbon County's population leveled at 20,200 residents while Emery County had 10,300 residents, equating to a 16 percent and 19 percent decline, respectively since 1983. A decline in local mining and energy industry activities was thought to be the primary cause for the fluctuation in population levels.

Since the 1990 census, both counties have experienced small increases and decreases in population, equating to small net increases in population in both counties. The Governor's Office of Planning and Budget (GOPB) estimates that 20,437 people live in Carbon County and 10,402 people live in Emery County (GOPB 1997a). Population estimates for both Carbon and Emery counties and local cities for the last seven years are presented on **Table 3–32**. **Figure 3–14** graphically presents population trends over the last seven years for Carbon County, Emery County, and two major cities within the counties. The population levels are shown to be stable with little change.

**Table 3–31**
**Estimated Noise Levels in Towns Near Ferron Natural Gas Project**

| Town | Population | Size (square miles) | Population Density[1] (people with vehicles per square mile) | Noise (dBA $L_{dn}$) |
|---|---|---|---|---|
| Ferron | 1,629 | 1.93 | 422 | 48.2 |
| Clawson | 156 | 0.4 | 195 | 44.9 |
| Orangeville | 1,447 | 1.27 | 569 | 49.5 |
| Castle Dale | 1,704 | 1.91 | 446 | 48.5 |
| Huntington | 1,893 | 2.01 | 471 | 48.7 |
| Price | 8,711 | 4.11 | 1,060 | 52.2 |
| Helper | 2,078 | 1.78 | 583 | 49.7 |
| Kenilworth | 200 | 0.16 | 625 | 49.9 |

Note:
1. Population density based on assumption that half of population drives a vehicle. This considers noise in neighborhoods and residential areas and does not consider background noise from major highways.

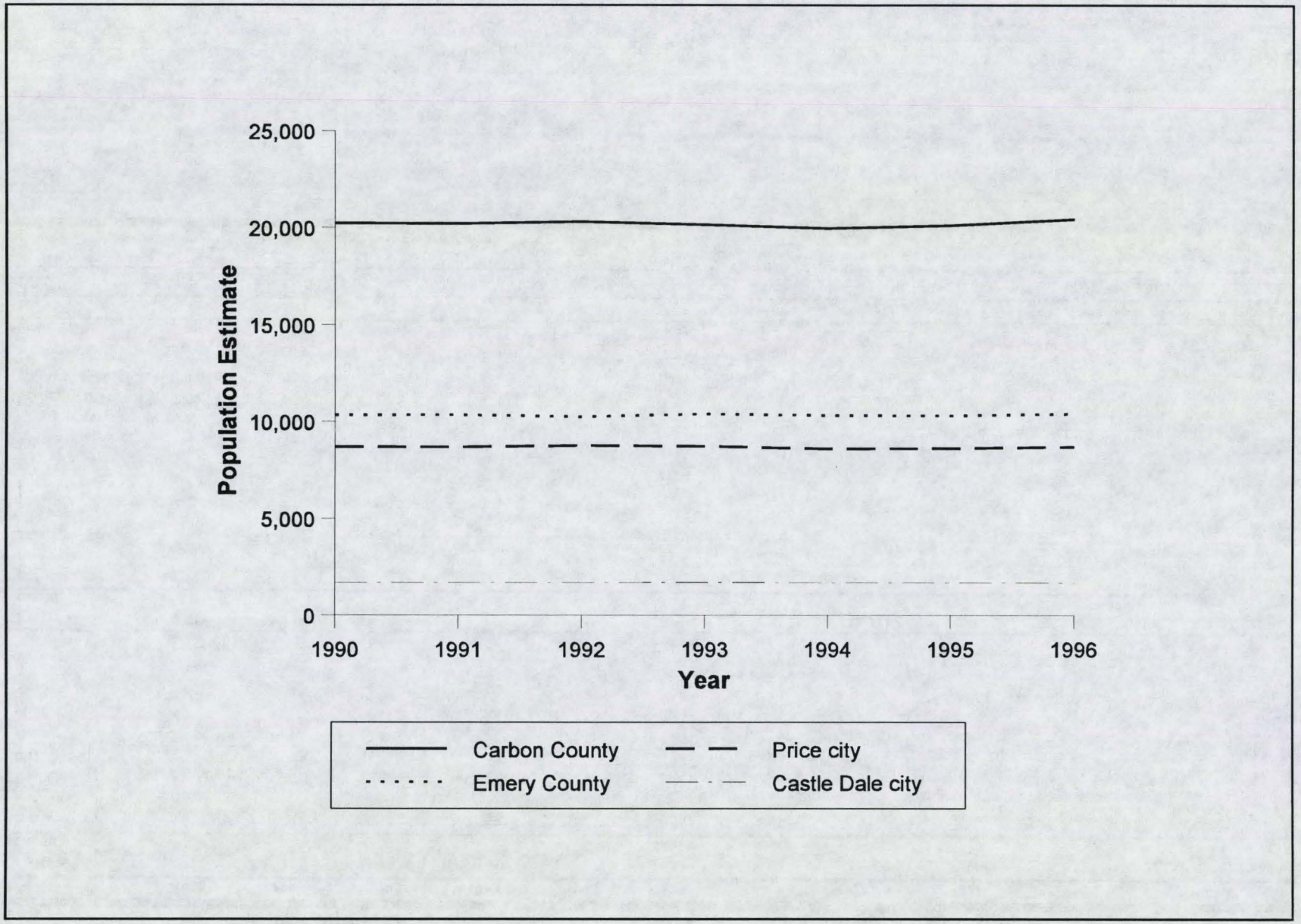



**Figure 3–14 Population Estimates**

## Table 3–32
## City Population Estimates for Carbon and Emery Counties, Utah, and U.S.A.

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Carbon County** | **20,228** | **20,212** | **20,297** | **20,145** | **19,967** | **20,115** | **20,437** | **22,699** | **24,328** | **26,031** | **27536** | **28,683** |
| Balance of Carbon Co. | 6,084 | 6,092 | 6,118 | 6,081 | 6,075 | 6,193 | 6,362 | | | | | |
| East Carbon city | 1,270 | 1,268 | 1,266 | 1,247 | 1,229 | 1,229 | 1,239 | | | | | |
| Helper | 2,148 | 2,135 | 2,128 | 2,091 | 2,061 | 2,057 | 2,078 | | | | | |
| Price | 8,712 | 8,699 | 8,764 | 8,726 | 8,610 | 8,626 | 8,711 | | | | | |
| Scofield town | 43 | 43 | 42 | 42 | 41 | 41 | 42 | | | | | |
| Sunnyside | 339 | 339 | 338 | 335 | 336 | 338 | 345 | | | | | |
| Wellington | 1,632 | 1,636 | 1,641 | 1,623 | 1,615 | 1,631 | 1,660 | | | | | |
| **Emery County** | **10,332** | **10,348** | **10,247** | **10,397** | **10,318** | **10,308** | **10,402** | **11,211** | **12,060** | **12,888** | **13,140** | **13,343** |
| Balance of Emery Co. | 1,728 | 1,730 | 1,712 | 1,741 | 1,729 | 1,725 | 1,733 | | | | | |
| Castle Dale | 1,704 | 1,707 | 1,695 | 1,721 | 1,705 | 1,699 | 1,704 | | | | | |
| Clawson town | 151 | 152 | 150 | 152 | 149 | 153 | 156 | | | | | |
| Cleveland town | 498 | 497 | 492 | 498 | 493 | 497 | 502 | | | | | |
| Elmo town | 267 | 274 | 276 | 286 | 289 | 298 | 311 | | | | | |
| Emery town | 300 | 299 | 294 | 298 | 295 | 294 | 295 | | | | | |
| Ferron | 1,606 | 1,606 | 1,588 | 1,613 | 1,599 | 1,599 | 1,629 | | | | | |
| Green River | 744 | 745 | 735 | 744 | 737 | 731 | 732 | | | | | |
| Huntington | 1,875 | 1,874 | 1,856 | 1,879 | 1,875 | 1,873 | 1,893 | | | | | |
| Orangeville | 1,459 | 1,464 | 1,448 | 1,465 | 1,447 | 1,439 | 1,447 | | | | | |
| Utah | 1,722,850 | 1,767,139 | 1,811,673 | 1,860,807 | 1,909,521 | 1,958,313 | 2,000,494 | 2,207,000 | 2,411,000 | 2,520,000 | 2,670,000 | 2,775,000 |
| USA | 249,398,000 | 252,124,000 | 255,002,000 | 257,795,000 | 260,295,000 | 262,890,000 | 265,284,000 | 274,634,000 | 285,981,000 | 297,716,000 | 310,134,000 | 322,742,000 |

Source: GOPB 1997a, U.S. Bureau of the Census 1996, Utah Foundation 1997

For comparison purposes, recent (last 6 years) population estimates and growth rates for Carbon and Emery Counties, as well as the State of Utah and the United States are provided in **Table 3–32.** Approximately 43 percent of Carbon County's total population resides in the city of Price (the county seat), while only 16 percent of Emery County's total population resides in its county seat, Castle Dale. Carbon and Emery counties' populations make up only 1 and 0.5 percent, respectively, of the total population in the state of Utah. The rate of growth for Carbon and Emery counties are well below the state and national averages. These comparisons are also presented graphically on **Figure 3–15**. During the 1990s, Carbon County's population has increased at an average annual rate of 0.84 percent, the fifth lowest rate in the State of Utah. During the same period, Emery County's population increased at an average annual rate of 0.69 percent. The reader should note that the GOPB population estimates are somewhat higher than official Census estimates.

In 1996, Price, the Carbon County seat and largest city in the County, had an estimated population of 8,711. Additionally, Carbon County's average household size of 2.8 people is among the lowest in the state. The median age in Carbon County is 29 years. This is older than the State average of 25.9 years (GOPB 1997b). The GOPB projects the population of Carbon County to rise to 28,683 by the year 2020 as indicated on **Table 3–32**. In addition to the cities listed on the table, Kenilworth, a small residential community located north east of Price, is located within the Project Area. It is estimated that approximate 200 persons reside in this former mining company town.

As of 1996, the population of Castle Dale, the Emery County seat, was 1,704 people. Huntington, Emery County's largest city, had a population of about 1,893 (1996). Emery County's average household size of 3.2 people is the forth largest in the State of Utah. Its median age of 25.2 is slightly younger than the state average of 25.9. The GOPB projects the population of Emery County to reach 13,343 by the year 2020. Population projections for both Carbon and Emery Counties through the year 2020 are presented in **Table 3–32** and shown graphically in **Figure 3–16.**

The GOPB 1996 data describes the Carbon County population as approximately 49 percent male and 51 percent female, and a median age of 29 years. The Emery County population is given as 51 percent male and 49 percent female, and a median age of 25 years. A breakdown of the percentage of total population by selected age groups for Carbon and Emery Counties is shown in **Table 3–33**.

**Table 3–33**
**Percentage of Total Population by Selected Age Groups, 1995**

| Age Group | Carbon County (percent) | Emery County (percent) |
|---|---|---|
| 0–4 years | 8 | 7.8 |
| 5–17 years | 23.9 | 30.3 |
| 18–29 years | 17.8 | 15.2 |
| 30–39 years | 13.1 | 13.9 |
| 40–64 years | 23.8 | 24.4 |
| 65+ years | 13.4 | 8.4 |

Source: GOPB 1997b

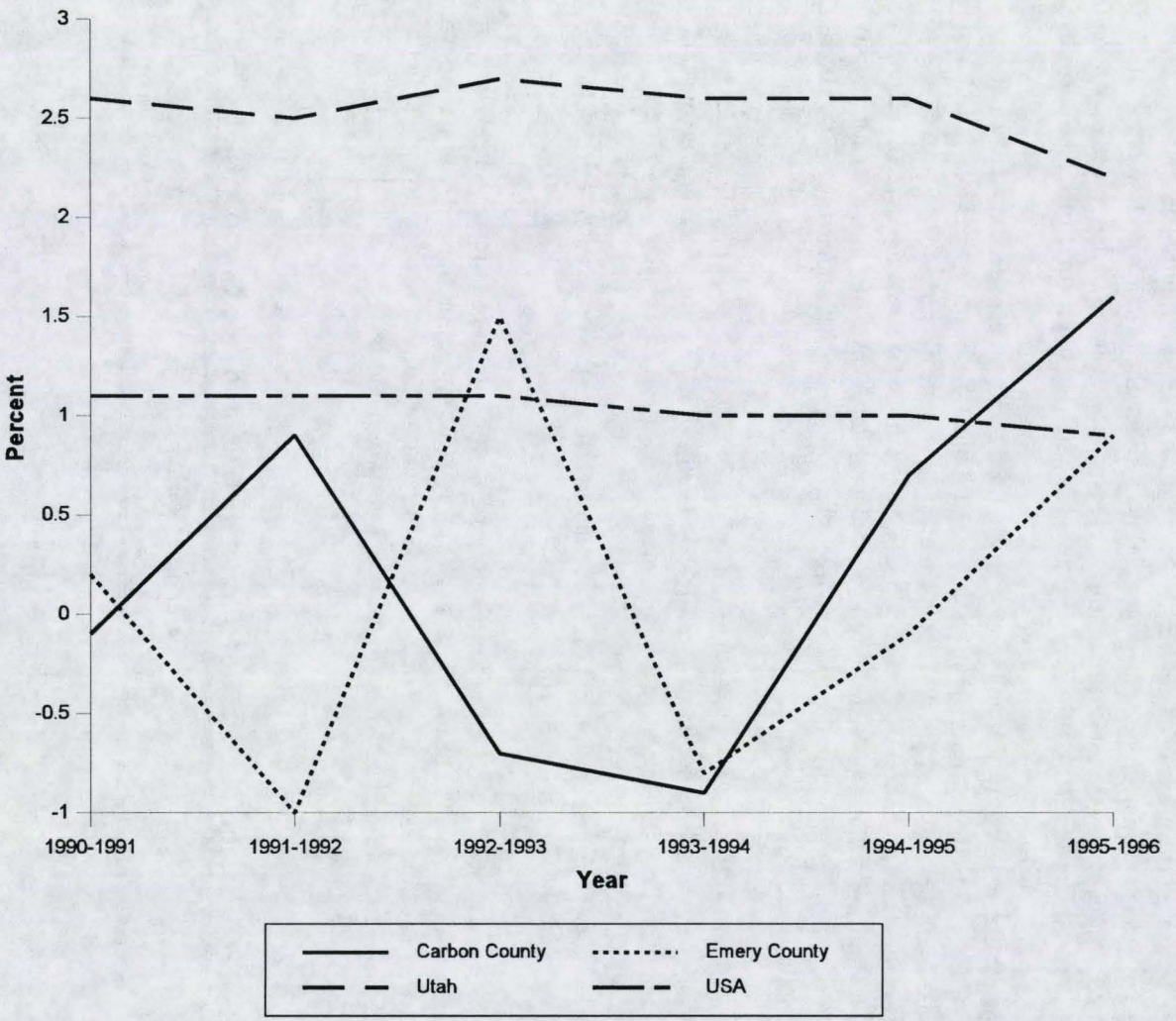



**Figure 3–15 Population Growth**

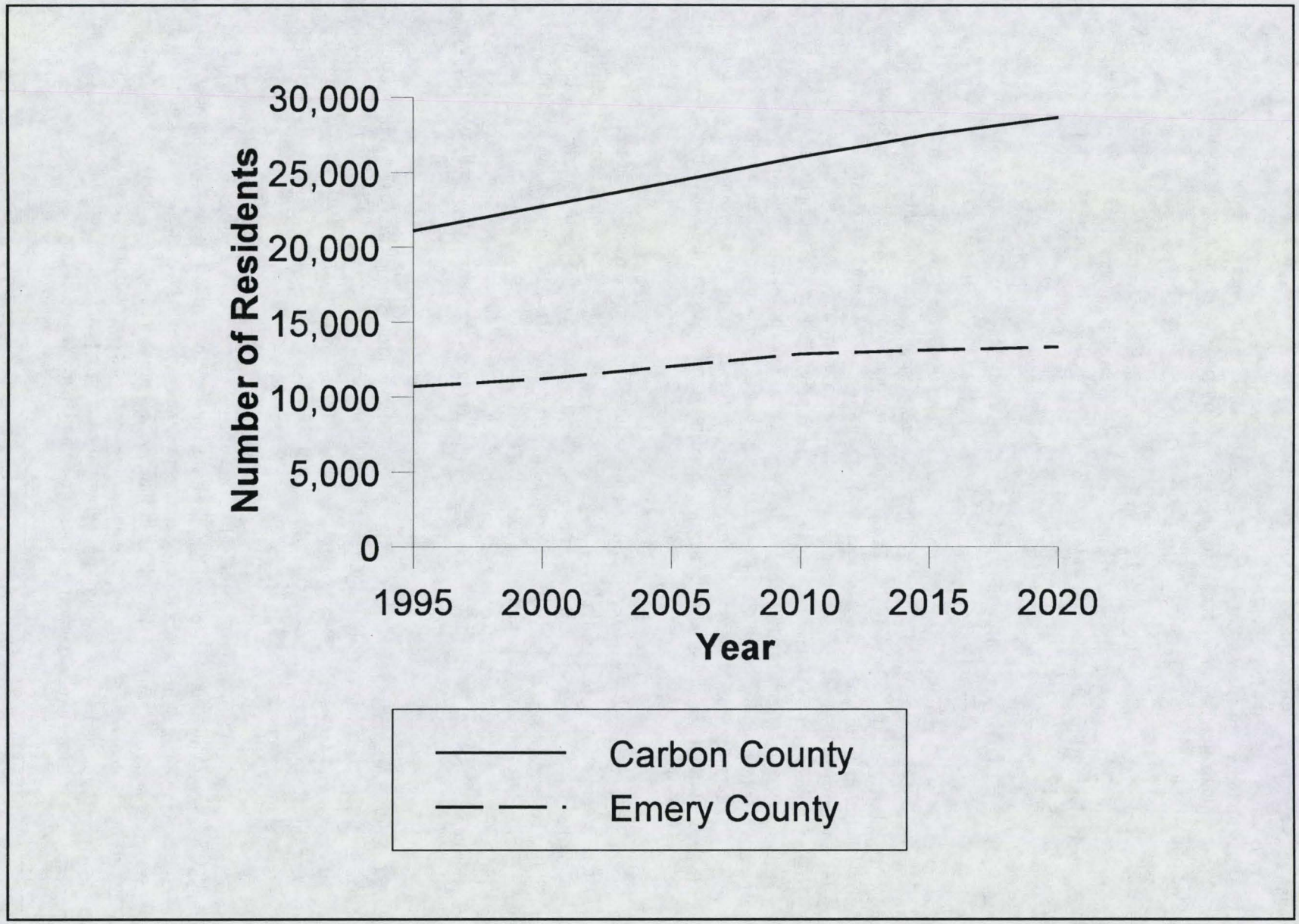



**Figure 3–16 Population Projections**

The racial composition of Emery and Carbon Counties, compared with the state of Utah is shown on **Table 3–34**. The majority of the population (96 percent) in Emery County is white, with smaller percentages of black, American Indian, and persons of Hispanic dissent comprise the balance of the population. Carbon County's racial composition is somewhat more diverse, with white persons accounting for about 88 percent of the total population in 1994.

The Church of Latter Day Saints (LDS) membership has dropped in Emery County from 8,403 in 1991 to 5,877 in 1996. The LDS membership in Carbon County rose slightly in the same period from 10,196 to 10,245 members. During this period from 1991 to 1996, LDS membership in Utah increased from 1,236,244 to 1,398,170 (LDS 1996).

## 3.15.2 Local Economy, Employment, and Wages

The economies of Carbon and Emery County are different in composition. Emery County's retail trade and service sectors are relatively small while mining and utilities comprise a more significant employment sector. Generally, the opposite is true in Carbon County with a substantial percentage of employment in government, trade and services. In recent years, employment opportunities in Carbon County have steadily increased. By the third quarter of 1994, employment in Carbon County increased by about 2.8 percent. Recent growth has been steady in nearly all employment sectors except the mining industry. The manufacturing, service, and retail trade employment sectors experienced the strongest growth. The majority of commercial activity is centered in Price located in Carbon County. Commercial business activity has been strong in Price in recent years. There is also relatively minor commercial business activity in towns within Emery County, however in general terms, Emery County has experienced more modest growth in the service and retail sectors (BLM, 1997a).

Currently, the government, trade, services, and mining industries comprise over 70 percent of Carbon County's total employment. Since 1980, the services and manufacturing industries have grown the fastest, while mining has lost the greatest percentage of jobs. The Carbon County School District, Castleview Hospital (medical services), The City of Price (local government), Utah Power and Light, Utah Fuel Company, and Cyprus Plateau (coal mining), and Koret of California (textile manufacturing) are among the largest employers in Carbon County. Current and projected employment distribution by industry for Carbon County is shown on **Table 3–35**. Employment distribution percentages are shown graphically on **Figure 3–17**.

In Emery County, Energy West (coal mining) is Emery County's largest employer. The Emery County School District, the Castledale and Huntington units of Utah Power and Light (electric utility) the County local government, and Genwal Resources (mining) are also major employers. Historical and projected employment distribution for Emery County is shown on **Table 3–36**. Emery County's employment distribution is shown graphically on **Figure 3–18**.

Local economic trends in Carbon and Emery Counties have been described previously in the Price CBM EIS. In summary, the economy of these two counties has historically been founded on resource extraction, and have been subject to changes in the coal mining and energy markets which have had a substantial effect on the local economy and employment. Throughout the late 1970s and early 1980s when the energy market was relatively strong, the economy and employment opportunities in Carbon and Emery Counties grew steadily. Beginning in 1982, the national recession coupled with the declining energy market and mechanized coal mining resulted in a substantial reduction in employment and increased unemployment.

## Table 3–34
## Racial Composition By County and State, 1980 and 1994

| | Total Population | | Percent White | | Percent Black | | Percent American Indian, Eskimo, or Aleut | | Percent Asian or Pacific Islander | | Percent Hispanic Origin | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | 1980 | 1994 | 1980 | 1994 | 1980 | 1994 | 1980 | 1994 | 1980 | 1994 | 1980 | 1994 |
| Carbon Co. | 22,179 | 21,099 | 0.88 | 0.88 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.11 | 0.10 |
| Emery Co. | 11,451 | 10,600 | 0.96 | 0.96 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.03 |
| Utah State | 1,461,037 | 1,915,988 | 0.93 | 0.93 | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | 0.02 | 0.04 | 0.06 |

## Table 3–35
## Historical and Projected Employment by Industry — Carbon County

| Industry | 1990 Number Employed | 1990 Portion of Total Employment (percent) | 1995 Number Employed | 1995 Portion of Total Employment (percent) | 2000 Number Employed | 2000 Portion of Total Employment (percent) | 2005 Number Employed | 2005 Portion of Total Employment (percent) |
|---|---|---|---|---|---|---|---|---|
| Agriculture | 240 | 2.62 | 236 | 2.42 | 241 | 202 | 235 | 1.96 |
| Mining | 1,349 | 14.86 | 1,000 | 10.25 | 1,223 | 11.17 | 1,397 | 11.67 |
| Construction | 142 | 1.55 | 241 | 2.47 | 301 | 2.75 | 358 | 2.99 |
| Manufacturing | 288 | 3.15 | 393 | 4.03 | 539 | 4.92 | 619 | 5.17 |
| T.C.P.U.[1] | 467 | 5.11 | 489 | 5.01 | 535 | 4.89 | 573 | 4.79 |
| Trade | 1,764 | 19.29 | 1,957 | 20.06 | 2,129 | 19.44 | 2,244 | 18.75 |
| F.I.R.E.[2] | 164 | 1.79 | 176 | 1.80 | 191 | 1.74 | 202 | 1.69 |
| Services | 1,459 | 15.96 | 1,692 | 17.34 | 1,989 | 18.17 | 2,237 | 18.69 |
| Government | 2,201 | 22.10 | 2,207 | 22.62 | 2,319 | 21.18 | 2,516 | 21.02 |
| Non-farm Proprietors | 1,240 | 13.56 | 1,367 | 14.01 | 1,482 | 13.54 | 1,588 | 13.27 |
| Total | 9,144 | 100.00 | 9,758 | 100.00 | 10,949 | 100.00 | 11,969 | 100.00 |

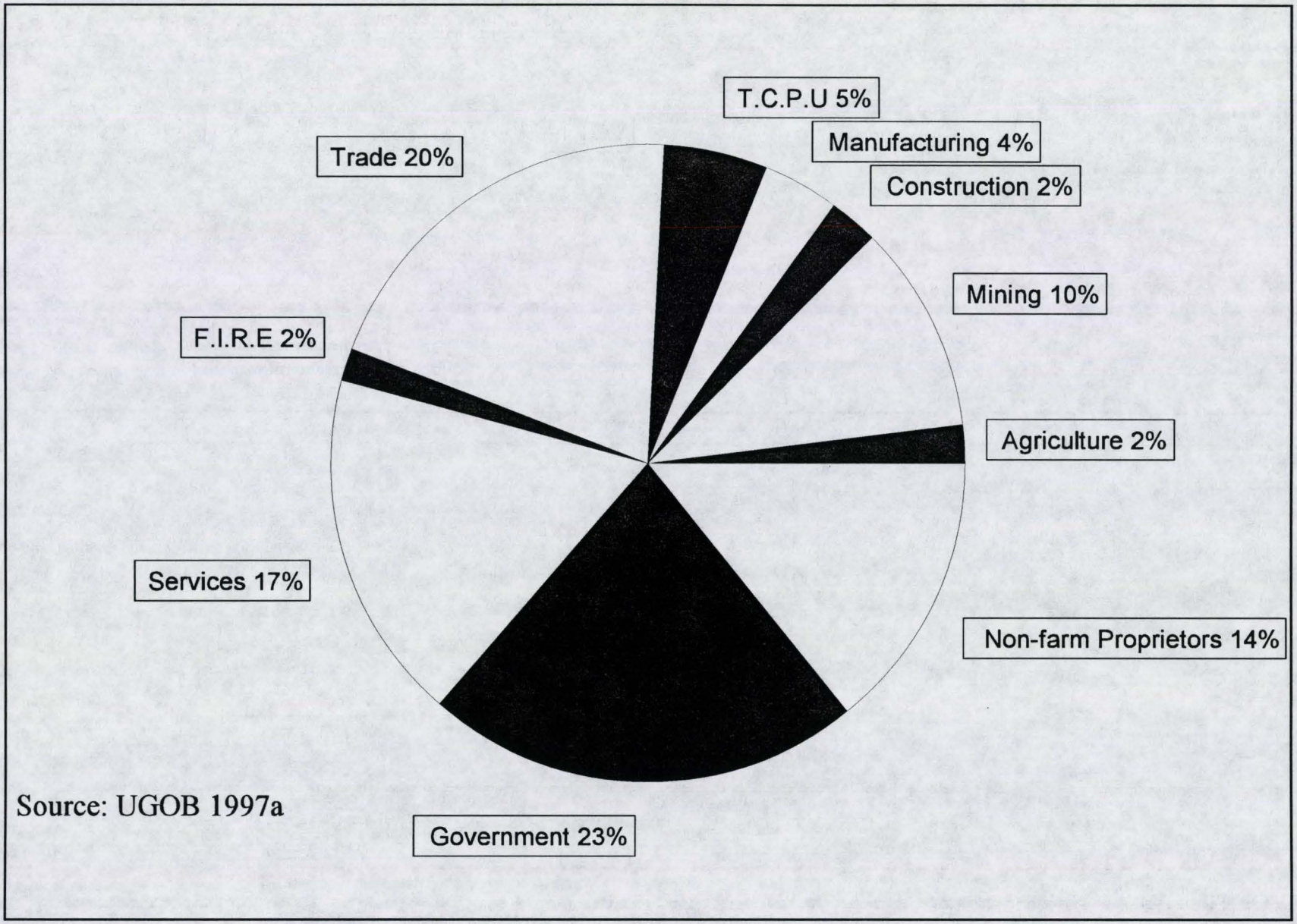
Notes:
1. T.C.P.U. = Transportation, Communication, and Public Utilities
2. F.I.R.E. = Finance, Insurance, and Real Estate
Source: GOPB 1997b

## Table 3–36
## Historical and Projected Employment by Industry — Emery County

| Industry | 1990 Number Employed | 1990 Portion of Total Employment (percent) | 1995 Number Employed | 1995 Portion of Total Employment (percent) | 2000 Number Employed | 2000 Portion of Total Employment (percent) | 2005 Number Employed | 2005 Portion of Total Employment (percent) |
|---|---|---|---|---|---|---|---|---|
| Agriculture | 500 | 10.25 | 491 | 9.91 | 502 | 9.29 | 489 | 8.23 |
| Mining | 1,002 | 20.55 | 867 | 17.5 | 980 | 18.13 | 1,158 | 19.49 |
| Construction | 267 | 5.47 | 250 | 5.05 | 383 | 7.08 | 560 | 9.43 |
| Manufacturing | 13 | 0.27 | 40 | 0.81 | 98 | 1.81 | 133 | 2.24 |
| T.C.P.U.[1] | 766 | 15.71 | 757 | 15.28 | 773 | 14.3 | 781 | 13.15 |
| Trade | 437 | 8.96 | 423 | 8.54 | 448 | 8.29 | 465 | 7.83 |
| F.I.R.E.[2] | 42 | 0.86 | 42 | 0.85 | 45 | 0.83 | 47 | 0.79 |
| Services | 286 | 5.86 | 405 | 8.18 | 475 | 8.79 | 537 | 9.04 |
| Government | 819 | 16.79 | 894 | 18.05 | 875 | 16.19 | 898 | 15.12 |
| Non-farm Proprietors | 745 | 15.28 | 784 | 15.83 | 827 | 15.3 | 873 | 14.69 |
| Total | 4,877 | 100.00 | 4,953 | 100.00 | 5,406 | 100.00 | 5,941 | 100.00 |

Notes:
1. T.C.P.U. = Transporation, Communication, and Public Utilities
2. F.I.R.E. = Finance, Insurance, and Real Estate

Source: GOPB 1997b




Source: UGOB 1997a

**Figure 3–17 Carbon County Employment by Industry**

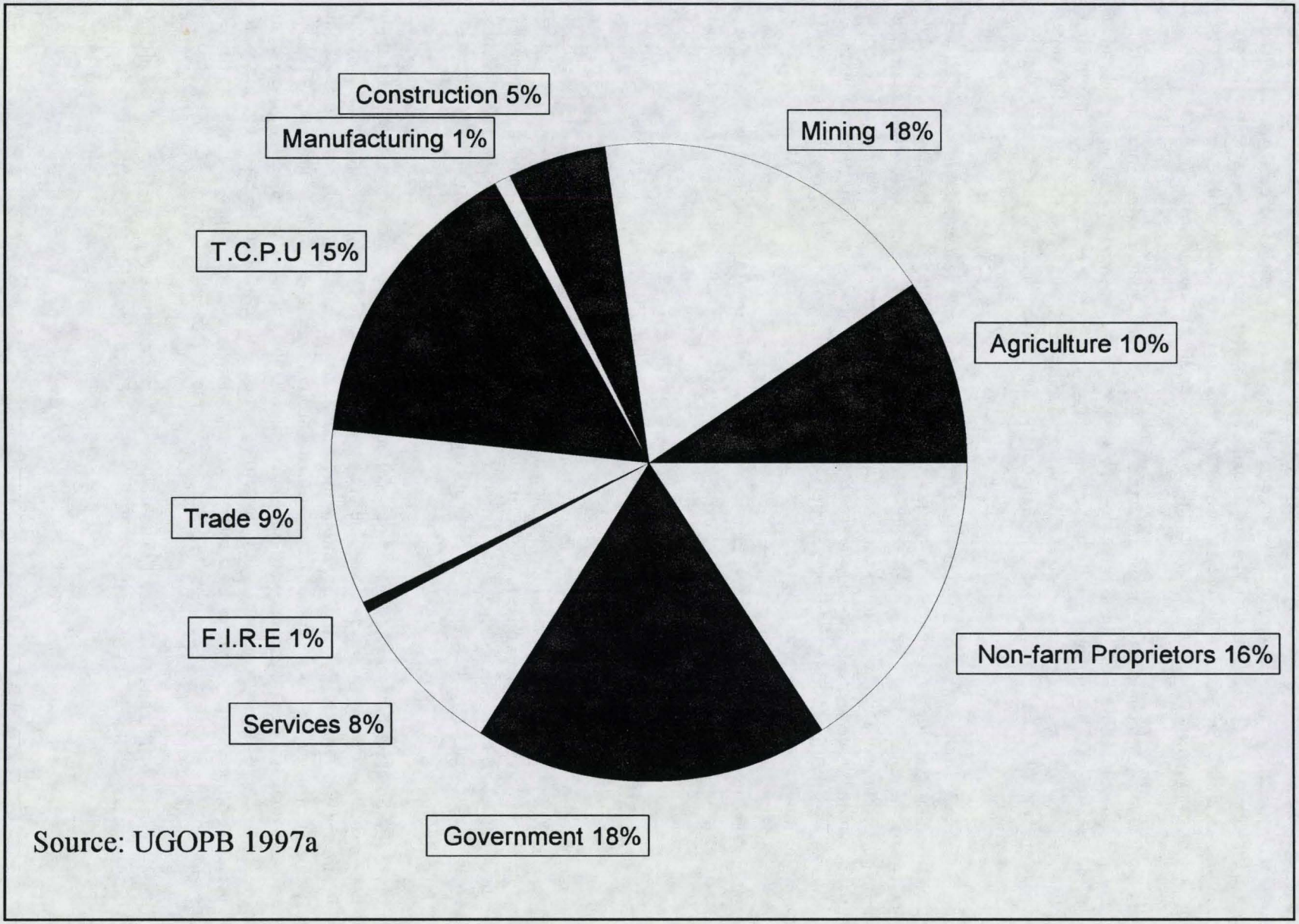



**Figure 3–18 Emery County Employment by Industry**

Statewide employment distribution is provided on **Table 3–37**, and shown on **Figure 3–19**. Compared to Carbon County, the mining industry provides a larger percentage of employment (17 percent), while the trade sector (9 percent) and government sector (18 percent) make up a smaller percentage of total employment in the county. Agriculture provides a larger percentage of employment in Emery County (10 percent). A relative comparison of employment by sector for each county is shown on **Figure 3–20**.

The distribution of labor income among major industries provides some insight into the structure of a local economy. As shown in **Table 3–38**, the average annual wages in the mining industry both statewide and in Carbon and Emery Counties are significantly higher than many other industries. In addition, the mining industry accounted for about 27 percent of total labor income in Carbon County and 36 percent of the total in Emery County in 1995. Mining wages are also higher on average in Carbon and Emery Counties than the statewide average.

In general, **Table 3–38** shows that the average wages for all other industries are lower in Carbon and Emery Counties than the statewide average. Statewide, labor income in the mining industry accounts for only 1.6 percent of the total. In Emery County, about 33 percent of labor income is distributed to the transportation, communication, and utilities sector. Approximately 26 percent of labor income in Carbon County falls within the services category, accounting for regional retail activity occurring primarily in Price. **Table 3–39** shows that the Carbon and Emery County contribution to the statewide payroll is very small, except for the mining payrolls, accounting for 14 and 11 percent, respectively.

Per capita income in Carbon County is lower than both the Utah and national average as shown on **Figure 3–21** and **Table 3–40**. In Emery County the average annual wage is higher than both the state and national average.

## 3.15.3 Housing

A housing inventory for 1994 limited to the major communities within the central study area identifies about 6,700 total units in Carbon County and includes single family homes, duplexes, apartments and mobile homes. About 75 percent of these units are single family dwellings. At the time of this inventory, vacancy rates ranged between 0-6 percent within the study area. For Emery County, the inventory found 2,094 units of all types, with vacancy rates between 0-14 percent. Approximately 70 percent of these units are single family dwellings.

According to the Southeastern Utah Association of Local Governments (SUALG), there were approximately 8,364 housing units in Carbon County in 1996. The same source indicates that Emery County had 3,557 total housing units. Unfortunately, housing inventory information for the study area is fairly limited and inconsistent. Construction reports issued by the Bureau of Economic and Business Research (BEBR) indicate that about 646 building permits were issued in Carbon County in 1996, while 206 were issued in Emery County. These reports conclude that of the permits issued, a total of about 93 dwelling units were constructed in Carbon County, of which 28 percent were single family units. In Emery County, the BEBR reports a total of 15 units constructed in 1996, of which 53 percent were single family.

The Utah Association of Realtors reported 178 home sales in Carbon and Emery County in 1995, and 188 in 1996. The average value in 1996 was about $72,000, up from an average of $60,898 in 1995.

## Table 3–37
## Historical and Projected Employment by Industry — State of Utah

| Industry | 1990 Number Employed | 1990 Portion of Total Employment (percent) | 1995 Number Employed | 1995 Portion of Total Employment (percent) | 2000 Number Employed | 2000 Portion of Total Employment (percent) | 2005 Number Employed | 2005 Portion of Total Employment (percent) |
|---|---|---|---|---|---|---|---|---|
| Agriculture | 18,918 | 2.13 | 18,690 | 1.70 | 19,991 | 1.54 | 19,549 | 1.34 |
| Mining | 8,603 | 0.97 | 8,114 | 1.74 | 8,616 | 0.67 | 8,903 | 0.61 |
| Construction | 27,926 | 3.14 | 54,793 | 4.98 | 64,267 | 4.96 | 65,505 | 4.50 |
| Manufacturing | 107,100 | 12.04 | 123,867 | 11.26 | 144,504 | 11.15 | 152,448 | 10.48 |
| T.C.P.U.[1] | 42,283 | 4.75 | 51,493 | 4.68 | 61,179 | 4.72 | 63,319 | 4.35 |
| Trade | 172,399 | 19.38 | 220,025 | 20.00 | 259,364 | 20.02 | 293,519 | 20.19 |
| F.I.R.E.[2] | 34,134 | 3.84 | 47,678 | 4.33 | 55,759 | 4.30 | 62,238 | 4.28 |
| Services | 185,896 | 20.90 | 244,054 | 22.18 | 302,873 | 23.38 | 355,550 | 24.45 |
| Government | 150,556 | 16.92 | 163,666 | 14.88 | 179,098 | 13.82 | 200,937 | 13.82 |
| Non-farm Proprictors | 141,766 | 15.94 | 167,839 | 15.22 | 199,889 | 15.43 | 232,134 | 15.96 |
| Total | 889,581 | 100.00 | 1,100,219 | 100.00 | 1,295,540 | 100.00 | 1,454,102 | 100.00 |

Notes:
1. T.C.P.U. = Transporation, Communication, and Public Utilities
2. F.I.R.E. = Finance, Insurance, and Real Estate

Source: GOPB 1997b

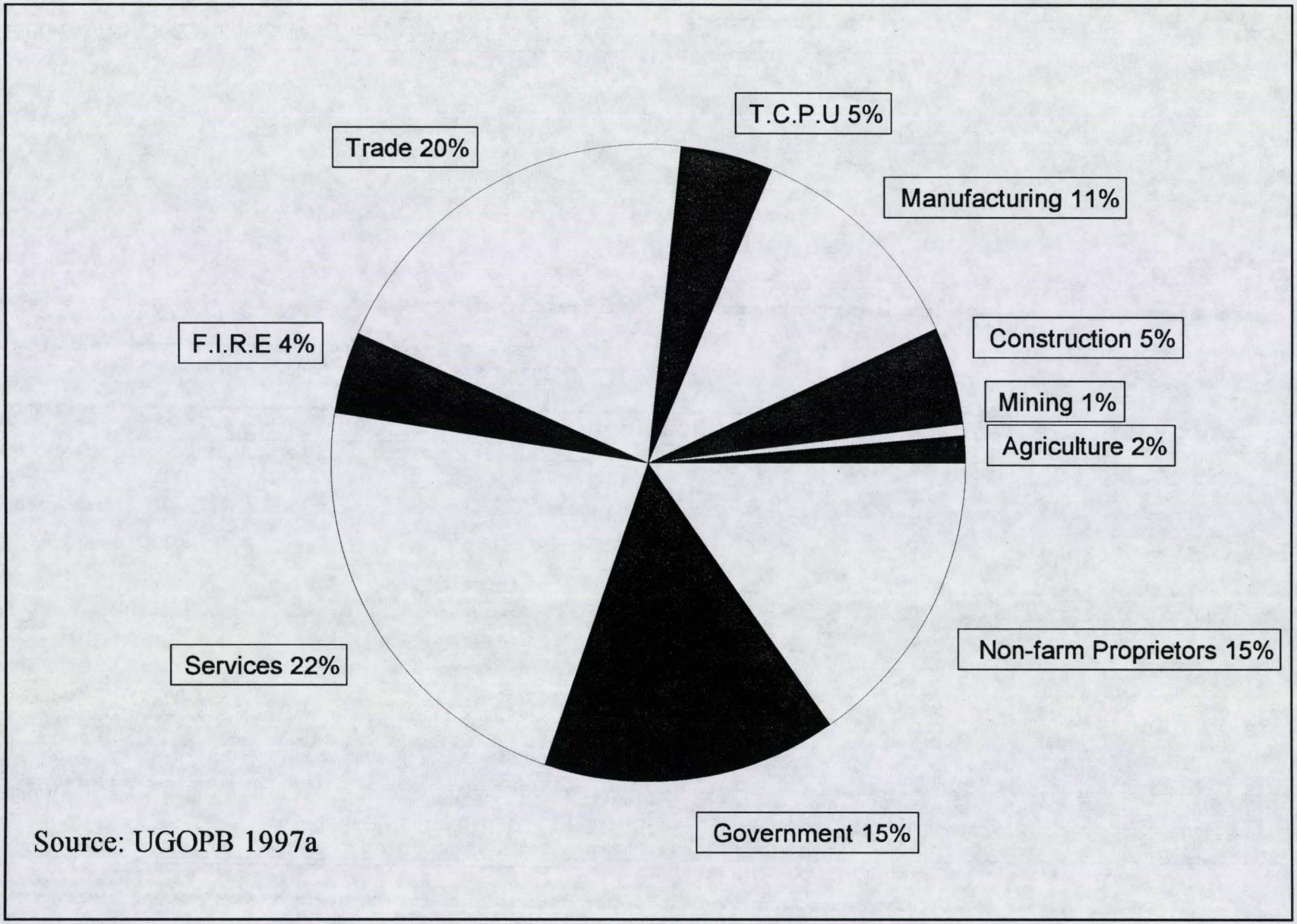



**Figure 3–19 Utah Employment by Industry**

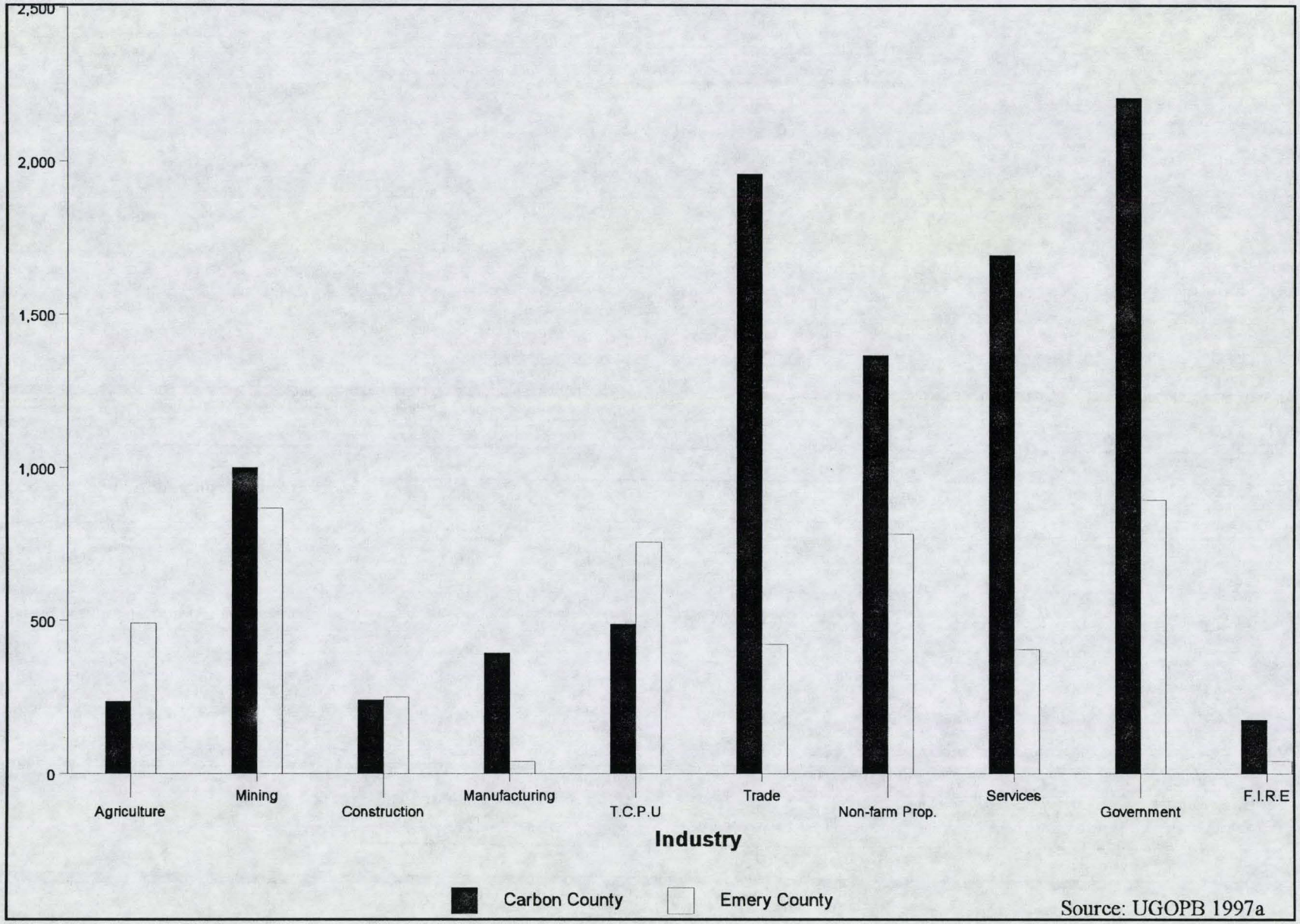



**Figure 3–20 Employment by Industry — 1995**

## Table 3–38
## Labor Income by Industry, 1995
## Average Annual Wage and Annual Payroll

| Industry | Utah | | Carbon County | | Emery County | |
|---|---|---|---|---|---|---|
| | Average Annual Wage ($) | Annual Payroll (million $) | Average Annual Wage ($) | Annual Payroll (million $) | Average Annual Wage ($) | Annual Payroll (million $) |
| Construction | 24,500 | 1342.9 | 22,600 | 5.4 | 24,300 | 6.1 |
| Finance, Insurance, Real Estate | 27,600 | 1328.2 | 18,200 | 3.3 | 13,800 | 0.6 |
| Manufacturing | 28,600 | 3545.2 | 20,000 | 7.8 | 18,600 | 0.7 |
| Mining | 41,800 | 339.6 | 48,000 | 48.0 | 44,400 | 38.5 |
| Public Administration (Government) | 28,900 | 1851.6 | 21,700 | 19.9 | 20,900 | 7 |
| Trade - Retail | 13,400 | 2344.9 | 10,500 | 16.1 | 7,600 | 3.1 |
| Trade - Wholesale | 29,900 | 1368.4 | 28,100 | 11.9 | 26,000 | 0.5 |
| Services & Misc. | 21,500 | 6987.7 | 16,300 | 46.5 | 17,500 | 15.4 |
| Transportation, Communication & Utilities | 32,000 | 1912.7 | 34,400 | 20.1 | 42,800 | 35.4 |
| Total | 23,200 | 21118.0 | 22,000 | 179.3 | 29,200 | 107.4 |

Source: Utah Department of Community and Economic Development 1997

## Table 3–39
## 1995 Annual Payroll by Industry by State and County

| Industry | Utah | Carbon County | | Emery County | |
|---|---|---|---|---|---|
| | Annual Payroll (million $) | Annual Payroll (million $) | Portion of Utah State Payroll (percent) | Annual Payroll (million $) | Portion of Utah State Payroll (percent) |
| Construction | 1,342.9 | 5.4 | 0.4 | 6.1 | 0.5 |
| Finance, Insurance, Real Estate | 1,328.2 | 3.3 | 0.2 | 0.6 | <0.1 |
| Manufacturing | 3,545.2 | 7.8 | 0.2 | 0.7 | <0.1 |
| Mining | 339.6 | 48.0 | 14.1 | 38.5 | 11.3 |
| Public Administration (Government) | 1,851.6 | 19.9 | 1.1 | 7.0 | 0.4 |
| Trade - Retail | 2,344.9 | 16.1 | 0.7 | 3.1 | 0.1 |
| Trade - Wholesale | 1,368.4 | 11.9 | 0.9 | 0.5 | <0.1 |
| Services & Misc. | 6,987.7 | 46.5 | 0.7 | 15.4 | 0.2 |
| Transportation, Communication & Utilities | 1,912.7 | 20.1 | 1.1 | 35.4 | 1.9 |
| Total | 21,118.0 | 179.3 | 0.8 | 107.4 | 0.5 |

Source: Utah Department of Community and Economic Development 1997

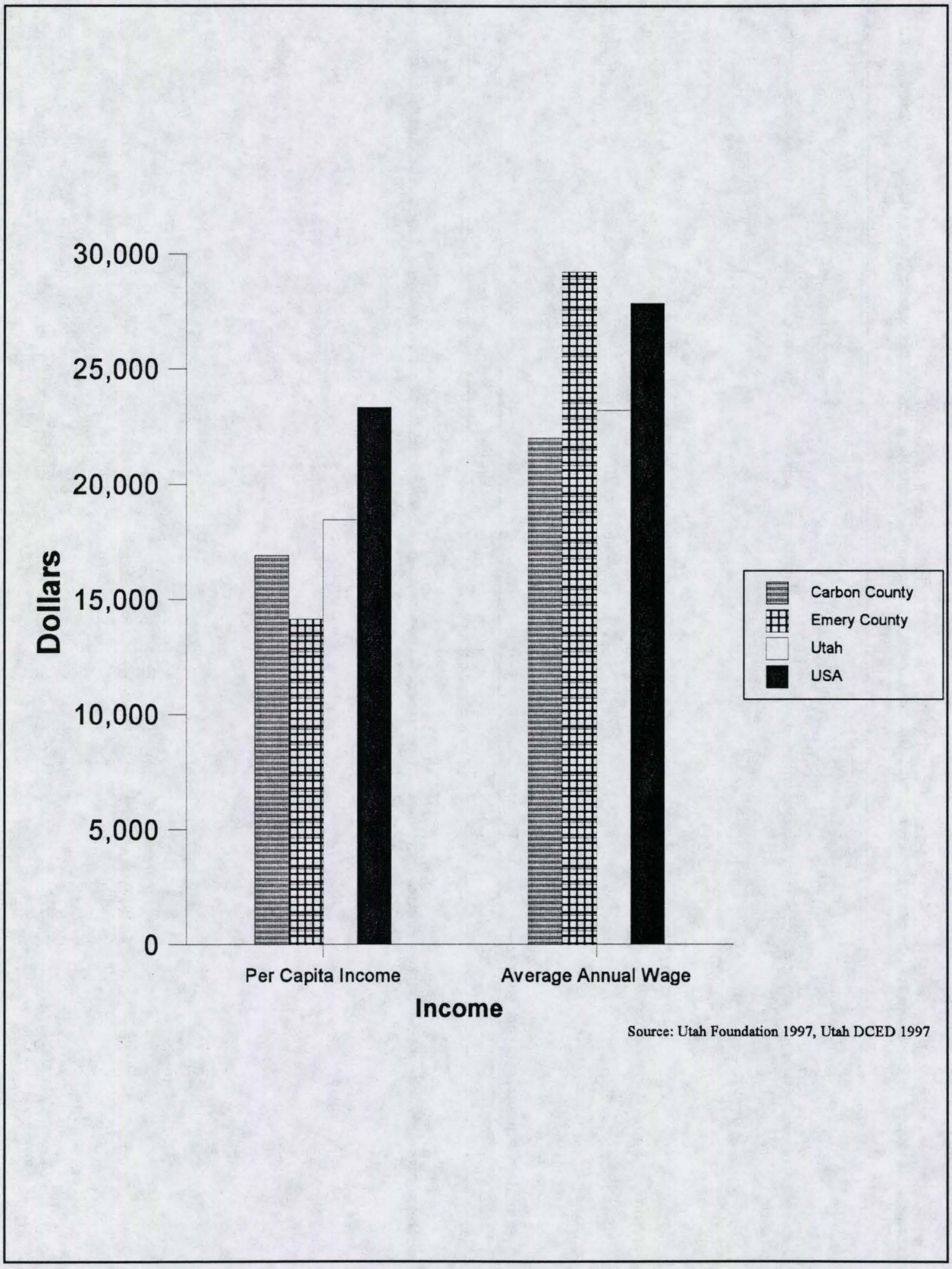



**Figure 3–21 Per Capita Income and Average Income, 1995**

**Table 3–40**
**Per Capita Personal Income and Average Annual Wage, 1995**

| Location | Per Capita Personal Income ($)[1] | Average Annual Wage ($)[2] |
|---|---|---|
| Carbon County | 16,909 | 22,000 |
| Emery County | 14,134 | 29,200 |
| Utah | 18,468 | 23,200 |
| USA | 23,345 | 27,846 |

Sources: Utah Foundation 1997, Utah Department of Community and Economic Development 1997

There is an abundance of temporary housing accommodations in the study area, which would be available to project contractors. Numerous mobile homes parks, motels, and campgrounds are present. In 1994, there were 570 motel rooms in Price, Wellington, and Helper. Five mobile home parks with a capacity of 30 spaces are located in Carbon County. Only a modest number of temporary accommodations are available in Emery County.

## 3.15.4 Community Facilities and Services

Natural gas exploration and resource development activities have the potential to effect existing community facilities and infrastructure. The use of, or connection to, existing infrastructure including roads with project activities may affect service agencies capacity or conveyance systems, or may require the installation of new facilities. In addition, natural gas activities in the two-county area may also impact employment and population, which subsequently can effect local community services such as schools, law enforcement, or medical facilities. The following paragraphs present a baseline description of these facilities and services as the pertain to project activities.

### 3.15.4.1 Roads, Water and Wastewater Systems, and Solid Waste Disposal

Federal and State highways, county roads, and roads and trails on federal lands would be utilized for the movement of equipment required for gas exploration and development activities. The North Area lies just to the east of U.S. Highway 6. The northwest corner of the North Area is accessed via road 157 south of the City of Helper. Several other local roads and trails extending north and northwest of the City of Price allow access to the North Area.

The South Area is bordered by U.S. Highway 10. In the north portion of the South Area, road 31 extends northwest from the city of Huntington. The center of the South Area is accessed via road 29 and 57 near the cities of Castle Dale and Orangeville. Various other local roads and jeep and pack trails are found throughout the South Area. Construction and maintenance of these roads is accomplished by a variety of entities.

Domestic water is provided to various communities within Carbon County by the PRWID and several local water districts. The PRWID provides all domestic water to the City of Wellington and unincorporated communities within the County, such as Spring Glen and Carbonville. The cities of Price and Helper have their own water systems, which is occasionally supplemented with water from the PRWID. The PRWID's

water treatment plant has recently been expanded and currently has capacity to treat 6 million gallons per day (Mgd). PRWID also provides wastewater treatment services for all of Carbon county. Typical flows at the plant are in the range of 2.1 to 2.2 Mgd.

In Emery County, water and wastewater treatment services are provided by the Castle Valley Special Service District, which is currently operating below capacity.

### 3.15.4.2 Public Schools, Law Enforcement and Fire Protection, and Medical Facilities

In Carbon County, there are four elementary schools, three secondary/junior high schools, and one high school. In the Fall of 1997, enrollment in these schools was about 4,771, increasing by about 6.1 percent from the previous year. However, over a five year period between 1991 and 1995, enrollment was down about four percent in the Carbon County district. The Price CBM EIS reported that each of the schools in the district is generally nearing or currently at capacity levels; however, after a four-year trend of declining enrollments, some additional capacity may be available. In Emery County, there are four elementary schools, one secondary school, and one high school. Total enrollment the fall of 1997 in the schools was about 3,228, representing a decline from the previous year of about 2.6 percent. Each of these schools except for Canyon View Secondary School and Emery County High School has capacity for additional students. Similar to Carbon County, enrollment in the district has generally shown small decreases annually for the last five years. (Utah State Office of Education 1997)

Established in 1937, the College of Eastern Utah (CEU) provides higher education to the region. CEU is located in Price and includes a campus of 15 buildings. Student enrollment is more than 3,000. CEU offers associate degree programs, vocational-technical programs, developmental programs, and other adult programs that are transferable to four year universities.

Law enforcement services within unincorporated Carbon County are provided by the Carbon County Sheriff's Department and the Utah Highway Patrol. The Carbon County Sheriff's Department maintain 15 sworn officers (Robertson 1998). The cities of Price, Helper, and Wellington maintain their own police departments. Fire protection is provided by the City of Price or local volunteer fire departments in Helper and Wellington. The Emery County Sheriff's Department and the Utah Highway Patrol provide law enforcement services to all areas of Emery County. The Sheriff's Department maintains 26 sworn officers (Jensen 1998). The Highway Patrol generally maintains six patrol vehicles in the county. Fire protection services are provided by the Special Service District, staffed by approximately 87 volunteer firemen, equipped with 30 fire trucks. **Table 3–41** provides the number of reported criminal offenses occurring in Carbon and Emery counties in 1996.

Castleview Hospital in Price is the largest medical facility in the Project Area. This is a full service hospital providing 24-hour emergency service, specialized physicians, ground and air transportation services. Several other clinics, nursing homes and the Southeastern Utah Health Department are provide medical services in both Carbon and Emery counties.

## 3.15.5 Public Finance

Utah state mineral lease royalties are collected for gas wells located on state lands. Royalty payments are based on the volume of gas produced. Depending on the type of lands, royalties are either deposited into the

**Table 3–41**
**Number of Offenses Reported — 1996**

| Type of Offense | Emery County[1] | Carbon County[2] |
|---|---|---|
| Drug/Narcotics | 76 | 161 |
| Destruction/Vandalism | 178 | 356 |
| Murder | 0 | 1 |
| Sexual Offenses (Rape) | 0 | 30 |
| Robbery | 1 | 2 |
| Aggravated Assault | 11 | 245 |
| Stolen Property Violation | 38 | 12 |
| Fraud | 1 | 7 |
| Burglary | 84 | 103 |
| Counterfeit/Forgery | 10 | 26 |
| Larceny/Theft | 428 | 589 |
| Motor Vehicle Violation | 5,223 | 40 |
| Arson | 1 | 14 |
| Kidnaping | 2 | 5 |
| Extortion/Blackmail | 0 | 2 |
| Gambling | 0 | 0 |
| Pornography | 2 | 0 |
| Prostitution | 0 | 2 |
| Weapon Law Violation | 22 | 140 |
| Total | 6,077 | 1,735 |

Source: Jensen 1998, Robertson1998

state's school trust or the general fund. Federal mineral lease royalties are collected for gas wells located on public lands based on the volume of gas produced. Fifty percent of this revenue is returned to the State. The state allocates one third of the revenue collected from gas royalties to the Permanent Community Impact Fund which is available to cities within Carbon and Emery counties to obtain funding for infrastructure related projects. Another 25 percent of the revenue is allocated back to the county from which the natural gas originated.

Within the Project Area, the local share of federal mineral royalties is paid to the Carbon and Emery County Road Special Service Districts to cover the cost of road maintenance and improvements.

Ad valorem tax is levied by Carbon and Emery Counties on facilities and/or improvements constructed by companies. Sales and use tax is also collected on purchases of materials and supplies including gravel, pipe, and motor fuel. Transient occupancy and restaurant taxes are collected from lodging facilities and restaurants.

## 3.15.6 Quality of Life

Quality of life is a subjective measure of an individuals happiness with a particular geographic location based on a composition of self-defined variables. These variables typically vary by geographic region and can include both rural and urban components. Frequently, measures of a particular "quality of life" include traffic conditions and congestion levels, parks and recreational opportunities, affordability of housing and/or commercial facilities, climate, employment opportunities, the quality of regional air and water, and many others.

Previous studies within the Carbon and Emery County region (BLM 1997c) have indicated a quality of life perception which includes the abundance of open space, wildlife hunting and viewing, a substantial network of roads and trails supporting activities such as mountain biking, hiking, horseback riding, and off-road vehicle use.

Current traffic and transportation conditions are described in **Section 3.10**. Existing air quality and noise conditions are discussed in **Sections 3.3** and **3.14**. Other quality of life factors, such as crime and community values and religion, are not anticipated to be impacted by the proposed project and therefore are not detailed in this report. Furthermore, prediction of how these parameters would be affected by project implementation over the lifespan of the project would be nearly impossible to predict.

### 3.15.6.1 Tourism

Recently, tourism has become a more important part of the economy in Carbon and Emery counties. As described in **Section 3.12**, there are a variety of tourist attractions and recreational opportunities available within the two-county region. Ninemile Canyon, the San Rafael Swell, and the use of public lands for hunting, off-road vehicles, wildlife observation, Indian Rock art viewing, hiking, and mountain biking are some of the recreational activities offered in the region. Price is generally thought to be the central hub for accommodations and goods and services from which visitors can disburse throughout the counties. Tourism in the region contributes to a diversified economy and quality of life as perceived by residents.

# CHAPTER 4

# ENVIRONMENTAL CONSEQUENCES

# CHAPTER 4
# ENVIRONMENTAL CONSEQUENCES

This chapter of the EIS provides an analysis of the impacts (environmental consequences) that would result from implementation of the proposed Ferron Natural Gas Project and alternatives. Certain measures that would avoid or reduce impacts have been included in the action alternatives as discussed in Chapter 2. The environmental impact analysis documented in this chapter took these measures into consideration.

An environmental impact or consequence is defined as a modification or change in the existing environment brought about by the action taken. Impacts can be direct or indirect in nature and can be temporary (short term) or permanent (long term). Impacts can vary in degree ranging from only a slight discernable change to a drastic change in the environment. For the purpose of this EIS, short-term impacts are defined as those that would occur during the construction and drilling/completion phases. Long-term impacts are impacts caused by construction and operations that would remain longer.

The impact analysis evaluated the effects that would occur in the Project Area, regardless of land ownership. However, the BLM and Forest Service's decisions on this project would only apply to federal lands. The impacts reported for non-federal lands may occur regardless of BLM's decision. Impacts on non-federal lands are included to provide a full disclosure of effects for the complete project and to support other environmental revisions and permitting associated with the project.

The basic environmental impacts identified from production of natural gas are premised on the use of gas-fired equipment (compressors and pumps). However, as described in Chapter 2, options were developed for Alternatives 1 and 2 where electric compressors, electric pumps, or both would be used instead of gas-fired equipment. The effects of implementing these options for electrical equipment instead of gas-fired equipment are discussed for Alternatives 1 and 2 separately for each resource.

Because the alternatives are conceptual in nature and final locations for project facilities are unknown, three primary assumptions were made to facilitate the analysis of the electric utilities options for Alternatives 1 and 2. First, the average disturbance for aboveground and underground power lines would be 10 feet. This assumption is based on the width of ROW the BLM commonly grants for power lines. Second, 50 percent of the total overall length of proposed aboveground power lines would not coincide with the access roads' disturbance. Aboveground power lines commonly follow relatively straight lines. They would not follow every curve in the access roads closely. Thus, parts of these aboveground power lines would extend away from the access roads' disturbance. A review of the proposed layouts of access roads for Alternatives 1 and 2 suggested as much as 50 percent of the ROW for the power lines could be could be away from the access roads' disturbance. Finally, power lines buried along access roads would be installed within the access road's disturbance along their entire length (unlike the situation with aboveground power lines). Thus, no additional disturbance would occur outside the access road's disturbance during burial of the underground power lines.

## 4.1 GEOLOGY AND MINERALS

The purpose of the Proposed Action is to remove all recoverable coalbed methane from the Companies' leases. The recovery of the methane is considered the only significant consequence to geological resources. Other potential impacts, such as precluding development of other mineral resources or disturbing paleontological resources, were considered, but not analyzed in detail by alternative.

## 4.1.1 Direct and Indirect Effects

### 4.1.1.1 Alternative 1 — Proposed Action

#### *4.1.1.1.1 Irreversible Commitment of Natural Gas*

Under the Proposed Action, for the new and existing wells, peak gas production is estimated to be 60 bcf per year and total production would be 680 bcf for the 25-year (1999 through 2024) project life (Cox 1998). This estimate is based on a zero-time plot analysis using production history from the existing Ferron wells. Natural gas production should increase initially (1999 through 2005), level off, then gradually decline (2008 through 2024).

The Energy Information Administration (EIA) (1996a) estimates proved reserves of coalbed methane in the United States in 1996 were about 10,566 bcf and production of coalbed methane reached 1,003 bcf. Additionally, proved reserves of natural gas in the United States in 1996 were about 166,474 bcf and overall production was 18,861 bcf (EIA 1996a). Thus, coalbed methane accounts for about 6 percent of the United States' proved reserves of natural gas and 5 percent of natural gas production. At peak production, the Ferron Natural Gas Project would add about 60 bcf of coalbed methane to the nation's total natural gas production, which would be an increase of about 6 percent (based on the 1996 level of 18,861 bcf). In Utah however, the increase would be more substantial. Production of CBM in Utah was 12.2 bcf in 1995 (Petzet 1996) and overall production of natural gas in Utah during 1996 was 180 bcf (EIA 1996a). The Ferron Natural Gas Project would add 680 bcf to Utah's proved reserves of natural gas, which the EIA (1996a) identified as 1,633 bcf.

#### *4.1.1.1.2 Conflicts Between Natural Gas Drilling and Coal Mining*

As shown on **Plate 3-1**, active coal leases and known coal reserve areas (KCRA) occur within the South Area. No active coal leases or KCRAs occur in the North Area or along the corridor for the transmission pipeline. Although about 3,250 acres of active coal leases and almost 9,700 acres of KCRA exist within the South Area, a conflict would exist with only one well. A well on State land in Section 36, Township 17 South, Range 6 East would be drilled into the KCRA. However, the well would be near the eastern boundary of the KCRA. No other wells or facilities would conflict with the active coal leases or KCRAs.

#### *4.1.1.1.3 Geologic Hazards*

The potential effects of seismic activity on project facilities, such as wells and pipelines, and the risks to public safety were identified as issues to be addressed in the impact analysis. General and site-specific reviews of the potential effect of seismic activity on the pipelines associated with this project have been conducted (McDonough 1998).

In general, modern transmission pipelines are constructed of high-strength carbon steel and butt-welded joints. Because of the high pressures common in gas transmission pipelines, the wall thickness is sufficient to consider transmission pipelines rigid in terms of their interaction with the soil. Standard practice assumes 100 percent x-ray inspection of welded transmission pipeline joints ensuring that the joints are as strong as the pipe itself. In addition, gas transmission pipelines are protected from corrosion by protective coatings or wrapping, sacrificial anodes, or impressed DC current.

It is common to monitor and control the flow of product in gas transmission pipelines electronically around the clock through a central control office. Information from remote sites is telemetered to control centers over telephone, radio, cellular, or microwave transmissions. Remote valves, compressors, and regulators can be operated from the control center by the same process. Irregularities in line pressure, product flow rate, or other operating conditions are evaluated as they occur. Control-center personnel are trained to respond rapidly in emergency situations in accordance with standard operating procedures and operator-specific emergency plans.

In the absence of corrosion, it is rare that welded steel pipelines would exhibit damage as a result of ground shaking. Exceptions may be found at transitions between vastly different soil deposits, connections to rigid structures (such as tanks), and branch connections to other piping. These exceptions are normally limited to natural gas LDC piping, refinery facilities, and product handling terminals.

Permanent ground deformation is the most severe earthquake-related condition affecting buried pipelines. Surface faulting is an obvious example. Other sources of permanent ground deformation include lateral spreading, liquefaction-related settlement, and earthquake-activated landslides. Continuous welded steel pipelines may be designed to withstand several feet of permanent ground deformation.

The performance of gas transmission pipelines in past earthquakes has demonstrated that they are inherently rugged because of the large service loads for which they are designed. Damage typically is limited to locations where permanent ground deformation has occurred or where corrosion or joining techniques have reduced strength.

Relationships exist between gas pipeline damage and the Modified Mercalli Intensity scale (McDonough 1998). These relationships have been developed based on review of numerous historic earthquakes and their effects on facilities. No damage to meter sets or associated equipment are predicted below intensity VI with probable damage to the steel pipe occurring only with an intensity IX or greater event.

McDonough (1998) used historical earthquake data for the east-central Utah region to predict the probability of the occurrence of an intensity IX earthquake in the Project Area. The historic data, reported in Richter Scale magnitudes, has been converted to Modified Mercalli intensities using a formula that factors distance from the earthquake's epicenter, soil type, and magnitude. McDonough's calculations show that no historic earthquakes have occurred along the proposed transmission pipeline route with magnitudes greater than VI. McDonough then estimated that a magnitude IX earthquake will occur once in 10,000 years. Based on this estimate, he calculated that there is a 0.5 percent probability of one earthquake-caused failure along the proposed 27-mile long pipeline during its 50-year life. Standard installation measures can reduce the probability of a pipeline failure during a seismic event (McDonough 1998).

$H_2S$ has not been encountered to date during drilling in any of the more than 100 CBM wells in the Price area. However, $H_2S$ has been detected in produced water from some of the CBM wells in small amounts (80 to 90 ppm below the minimum level of 100 ppm at which it is regulated under Onshore Order No. 6). Dissolved $H_2S$ also was recently encountered in the drilling of a disposal well to a depth of approximately 6,000 feet into the Navajo Formation. As a result, the Companies would prepare an $H_2S$ contingency plan in accordance with UDOGM's requirements (see **Section 4.16**).

#### 4.1.1.1.4 Electric Power Option

No additional impacts to geology and minerals would occur with the installation and operation of electrically-powered facilities.

### 4.1.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Under Alternative 2, some wells were moved to other locations within a lease to afford protection to certain resources and about 18 wells would not be drilled due to restrictions for natural resources. Therefore, the total production over the life of the 335 wells would be 645 bcf instead of 680 bcf under the Proposed Action. Similar to the Proposed Action, there would be no conflict with coal leases and only the one well in conflict with the KCRA. Therefore, the impacts for Alternative 2 would be similar to Alternative 1.

#### 4.1.1.2.1 Electric Power Option

No additional impacts to geology and minerals would occur with the installation and operation of electrically-powered facilities.

### 4.1.1.3 Alternative 3 — No Action

A maximum of 155 new wells could be drilled on private and state lands under the No Action Alternative. Therefore, the total production over the life of the wells would be 430 bcf instead of 680 bcf under the Proposed Action. There would be no conflict with coal leases and only the one well in conflict with the KCRA. However, with no wells on federal estates, federal leases could be drained from the state and private leases. Seismic risk to wells and pipelines would be similar to the Proposed Action, although fewer wells would be drilled and the total length of pipelines would be considerably shorter under the this alternative.

## 4.1.2 Impacts Summary

Implementation of any of the three alternatives would result in no more than minor effects to geology and minerals. Only one well would under each alternative would be in conflict with KCRAs. No conflicts would exist with active coal leases. Seismic and geologic hazards would be minimal. Installation and operation of electrically-powered facilities under the two electric power options would not effect geology and mineral resources under Alternatives 1 or 2.

## 4.1.3 Mitigation

In accordance with Onshore Order No. 2, if usable quality water and/or prospectively-valuable minerals are encountered by the well bore, those formations shall be isolated and/or protected by the cement program for the production casing. Based upon cement log results, remedial cementing action shall be required as necessary.

Any potential conflicts with coal operations should be coordinated with the coal companies and the authorizing agencies.

## 4.1.4 Unavoidable Adverse Effects

The only unavoidable adverse effect identified is the conflict of one well with KCRAs. This well could prevent the extraction of coal from the part of Section 36 in which it is located. No other unavoidable adverse effects were identified.

# 4.2 WATER RESOURCES

## 4.2.1 Direct and Indirect Effects

### 4.2.1.1 Alternative 1 — Proposed Action

#### *4.2.1.1.1 Ground Water*

Extraction of the gas would require dewatering of the productive formation. Water from the Ferron Sandstone is not usable for domestic or irrigation purposes in the Project Area. It is a saline, sodium chloride water with TDS concentrations ranging from 6,000 to more than 15,000 mg/L. It would be disposed of into wells competed in the Navajo-Nugget aquifer. Some disposal wells also may be completed in the overlying Entrada-Preuss aquifer, but for simplicity sake, all discussion of disposal refers to the Navajo-Nugget aquifer. The produced water disposal wells would be completed approximately 6,000 feet deep. Maximum disposal would occur when all wells are on line in year five of the project.

Removal of water from the production zone would not substantially change the steady state discharges from the Ferron at the outcrop. Rather, it would accelerate the flow of water from the west to the east (Applied Hydrology Associates, Inc. 1998). More water would come from the area of greatest head, the west. Any effects to the outcrop discharge would be more pronounced in the North Area, where the western head is lower. Water levels would decrease in the Ferron Sandstone formation.

Most water users utilize ground waters derived from alluvial aquifers and water from shallow, saturated sandstone aquifers, which are potable and inexpensive to access. In the South Area, the State Engineer's Office has permitted three wells in the Ferron Sandstone, south of Huntington. The depths of these wells are not known, but, if they are completed in the Ferron, the wells could be affected by reduction of water levels.

For analysis purposes, conservative assumptions were made that a gas well would produce approximately 350 barrels of water per day (BWPD) during its first year of operation, dropping steadily to 100 BWPD in Year 6, and tapering off throughout the lifetime of the well. There are 80 wells in the North Area that would produce a maximum of 17,750 BWPD (2.3 acre-feet/day). Three disposal wells are proposed for the North Area and each could dispose 10,000 BWPD. Thus, a capability to handle 30,000 BWPD provides a surplus of disposal capacity. Currently 53 wells have been constructed in the South Area and an additional 220 would be constructed. Maximum production would be 60,300 BWPD (7.78 acre-feet/day). Nine disposal wells, two in use and six proposed, that could each dispose of 8,500 BWPD would be used in the South Area. The total capacity for disposing of produced water in the South Area would be 68,000 BWPD.

Where sampled in the Project Area, the Navajo-Nugget aquifer has TDS concentrations ranging from 13,100 to 217,264 mg/L, with the average concentrations of 101,142 mg/L. This water is a brine and is unacceptable for any traditional beneficial use. Disposal of produced waters from the Ferron Sandstone would marginally dilute Navajo-Nugget waters, but the water would remain unusable. There are three orders of magnitude

difference of volume between the water injected into the Navajo and its storage. The Ferron Project would inject a maximum of 45,513 (0.045 million) acre feet into the Navajo over the life of the project. The Navajo-Nugget aquifer in the San Rafael Swell area has 94 million acre feet in transient storage across 2,300 square miles (Hood and Patterson 1984). Even if one looks at mixing within a six-mile radius of influence, the Navajo has 4.62 million acre feet of storage, or a difference of two orders of magnitude from the quantity of injected water. There is an order of magnitude of difference in the water quality between the Ferron and Navajo, as the average TDS concentrations are 16,525 and 101,142 mg/L respectively.

Disposal of the produced water would temporarily increase the pressures within the Navajo-Nugget immediately adjacent to the disposal wells, but should not affect fresh water contained in the formation outside the Project Area. Modeling of water disposal of 100 gpm (3,428 BWPD) at the existing disposal wells, SWD #1 and SWD #2 near Castle Dale, using a hydraulic conductivity of 0.03 ft/day (Stevens and Garr 1997). Over a 30-year period, this would result in a radius of influence of approximately six miles and a maximum head of 6,360 feet. At 500 gpm (17,143 BWPD) after 30 years, the maximum hydrologic head would be 10,390 feet and the radius of influence would be approximately 8 miles. This is double the expected disposal rate of the proposed disposal wells in the South Area and does not consider a produced water decline from the peak production. Assuming fresh water flow patterns in the Navajo-Nugget aquifer are constant (see **Section 3.2.2.1.4**) on a long-term basis, produced water disposal would not affect these flow patterns.

A regional groundwater modeling study for the Navajo aquifer was not included as part of the analysis for this EIS. The ongoing regulatory responsibility for controlling underground injection through wells, such as those proposed in the Ferron Natural Gas Project, resides with EPA and the delegated State or Indian agency, in this case the UDOGM.

Impacts to springs are not likely to occur as it is not operationally viable to construct in a wet area. However, any blasting near springs could affect flows. Modifications to the permeability of the recharge area or a spring's flow may change the resource for preexisting uses, such as domestic, irrigation, or stock/wildlife watering. In addition, the springs or seeps may sustain riparian areas or wetlands and vegetative productivity could vary due to a change in flow.

#### *4.2.1.1.2 Surface Water Quantity*

As noted in Chapter 3, the Ferron Natural Gas Project would occur in an arid area overlain by poor soils and limited vegetative cover. Precipitation from intense rainfall events runs rapidly off steep slopes in channel flow, infiltrates in more gently sloping areas or basins, or evaporates. The Project Area is an erosional landscape etched by dry channels. The surface disturbance that would be associated with the Proposed Action encompasses about 0.7 percent of the total Project Area. The primary impact from the Ferron Natural Gas Project to surface water quantity would consist of slight changes in the timing and amounts of runoff that may occur following the increase in disturbance.

If roads, well pads, pipelines, or compressor sites would be constructed over or compact springs and seeps or their recharge areas, a reduction, cessation, or relocation of the spring's flow could occur. The proposed locations for three wells in the South Area and one proposed and one existing CPF in the North Area would be within 800 feet of identified springs. These locations may diminish the utility of the springs for preexisting uses, such as domestic, irrigation or stock/wildlife watering. In addition, the springs or seeps may support riparian or wetland vegetation, which could be affected by a reduction in flow. However, these facilities would likely be realigned during the APD stage either to avoid construction in moist areas or to install a drain to direct the flow away from the fill, thus promoting stabilization of the facility structure.

Blasting associated with construction has the potential to modify or discontinue spring flow. It also may damage the embankments of water storage reservoirs.

During the scoping process, the public raised a concern about changes in drainage density from the project. Although minor, localized realignment of flows associated with the roads may occur, the distribution of channels on the landscape would remain the same.

The dewatering and degasification of the Ferron Sandstone would not impact surface waters through subsidence or dewatering. The Ferron ranges in depth from 1,000 to 6,000 feet below the ground surface within the Project Area. There are several layers of confining shales between the surface and the coal seams. Water and gas are found in the cleats and fractures, and coal bed methane extraction does not result in collapse or subsidence of the formation. There is no direct hydrologic connection between the Ferron and surface waters within the Project Area (see **Section 3.2.2.1.2**).

#### *4.2.1.1.3 Surface Water Quality*

##### 4.2.1.1.3.1 Sedimentation

Temporary increases in sediment loss would occur where the construction of facilities or wells occur in channels and at sites where pipelines or utilities cross perennial streams. Moderate sediment loss also would occur with other aspects of this project. Sedimentation impacts would generally occur in close proximity to the disturbances. Removal of vegetation typically increases sedimentation. Sediment loss already is very high in this area due to low vegetative cover and the high percentage of fine-grained soils. In the North Area, portions of nine soil complexes out of a total of 21 have a critical soil classification based on water erosion hazard. In the South Area, portions of 27 soil complexes out of 87 identified soils have a critical soil classification based on water erosion hazard.

Standard operating procedures for sediment control, as proposed by the Companies, include surfacing of roads and well pads, installing drainage controls, reseeding, and installing water bars across reclaimed areas. Site-specific reclamation would be tailored to the landowner's or authorizing officer's specifications. All sediment control work would be required to comply with the UPDES stormwater permit program and the Utah Nonpoint Source Management Plan (State of Utah 1995).

Specific sediment loss calculations for the Ferron Natural Gas Project are shown in **Appendix E**. The maximum rate of sediment loss from the 763 acres of long-term disturbance would be 11.2 tons per acre per year. Actual sediment delivery (i.e., the amount of sediment loss that would be transported to flowing streams) would be 4.5 tons per acre per year. Similar calculations for undisturbed, natural conditions in this area yielded a sediment loss of 0.64 tons per acre per year and a sediment delivery rate of 0.28 tons per acre per year. Natural conditions of sediment loss have been reported to range from 2 to 12 tons per acre per year in the Project Area (BLM 1997c). The range of natural sediment delivery is 0.8 to 4.8 tons per acre per year. Therefore, projected sediment loss (11.2 tons per acre per year) and delivery (4.5 tons per acre per year) from the Proposed Action should be within the naturally occurring range.

The Proposed Action includes twelve wells in the South Area that would be constructed in floodplains adjacent to perennial streams. No facilities have been identified adjacent to perennial streams or floodplains in the North Area. Seventeen proposed wells would be in intermittent or ephemeral channel beds in the South Area and five wells in the North Area would be located in intermittent or ephemeral channel beds.

Most precipitation events would result in runoff through facilities. In floodplains or channel beds, this would result in substantial sediment loss and increased pollution potential.

Typically, well pad and facility site construction results in a cut slope, flat pad, and fill slope. Cut slopes would be steeper than the surrounding slope, increasing sediment loss. The gently-sloping pad would counteract this effect in an area of high relief providing a break in slope length and a depositional surface for disturbed area runoff. Well pads may be surfaced with coarse-grained sands and gravels. The fill slope would show an increase in sediment loss immediately down gradient for the operating life of the well of approximately 20 years. All portions of the well pad not needed for production would be reclaimed and seeded following drilling in accordance with the authorizing agency or landowner's specifications. Increases in sediment loss would occur until sites and roads are abandoned and reclaimed.

A slight increase in sediment loss would be expected along pipeline routes and the transmission pipeline right-of-way. Even with sediment control reclamation techniques, reestablishing vegetation would be necessary to return to pre construction levels.

The transmission pipeline would cross three perennial streams: Ferron, Cottonwood Canyon, and Huntington Canyon creeks. A GP40 Stream Alteration Permit would be administered by the Utah Division of Water Rights, Price Office (Page 1998). Questar proposes to trench across these live steams and bury the pipeline at depths of six to eight feet. Short-term sedimentation would occur for about a week after construction. No long-term impacts would occur for the following reasons. Questar would submit pre-construction plans to include site drawings, depth of burial, placement of rip-rap, and reclamation plans. After construction, the Water Rights Division would conduct an on-site inspection of stream crossings to ensure that all construction and reclamation techniques have been implemented correctly. In addition, the pipeline would be constructed immediately adjacent to the existing Questar 6-inch pipeline.

#### 4.2.1.1.3.2 Salinity

Water runoff across disturbed areas, particularly those with saline soils, results in an elevation of total dissolved solids (TDS). The significance of this impact depends on the size of the disturbed area, the period of disturbance, the salinity of the sediment involved, the amount of runoff affected, the proximity of the area to running water, and the effectiveness of erosion control measures. Also, characteristics of soils vary widely. The Ferron Natural Gas Project proposed permanent disturbance would be 763 acres, or 0.7 percent of the Project Area. The Project Area includes some particularly saline soils on the lower elevations overlying the Mancos shale. Two soils within the North Area have been identified as critical soils due to average conductivities that exceed 8 mmhos/cm: the Persayo-Chipeta Complex and the Ravola-Slickspots Complex. Eighteen soils within the South Area have been identified as critical soils due to their salinity. These soils are found in 53 percent of the proposed disturbance areas.

Salinity was calculated for the Ferron Natural Gas Project (**Appendix E**). Long-term salt delivery to flowing water would be 0.319 tons per acre per year. This value is within the natural range of 0.005 to 0.51 tons per acre per year for the region (BLM 1997c).

As noted earlier, there is very little running water within the Project Area, but in those places where roads or pipeline construction cross perennial streams, or areas where runoff readily enters streams, there would be an increase in the salinity. Regionally, this should not result in an adverse consequence to the salinity standard adopted by the Colorado River Basin Salinity Control Forum.

Salinity increases may have a deleterious impact to an irrigator whose headgate is located within the reach between the disturbed area and the point at which dilution decreases TDS concentrations. Elevated salinity can diminish the productivity of agricultural crops. Irrigation of saline soils results both in increased levels of TDS in the return flows as well as lower vegetative productivity for the irrigated fields.

#### 4.2.1.1.4 Spill Impacts to Surface and Groundwaters

The Proposed Action could result in accidental spills of fuels, lubricants, hydraulic fluids, drilling fluids, assorted chemicals required for standard well field operations, and produced water. Project proponents would prudently manage their facilities to minimize spills and would employ practices described in Onshore Oil and Gas Order No. 1, Notice to Lessees 3a, and UDOGM rules, which identify strategies to reduce accidental spills and leaks.

All vehicles involved in the project would run a slight risk for spills of fuel and hydraulic fluids. This risk is equivalent to the risk assumed by communities for any agricultural or recreational uses within their borders. Reasonable care would be employed in fueling and servicing vehicles to ensure spills do not occur and that a spill does not impinge on surface or ground waters.

Drilling operators use pits to contain drilling fluids. In the event of an accidental release of drilling fluids due to failure or overflow of the pit, drilling fluids could traverse the well pad, descend the fill slope and migrate downhill until the fluid infiltrates. In this dry Project Area, infiltration would probably occur off the well pad before the fluids mix with surface waters. Should the ground have a high permeability and be a source of recharge, the fluids would commingle with the ground water. Drilling fluids consist primarily of fine-grained earthen materials, water, a surfactant similar to soap, and light lubricating oils. The hydrocarbons would either volatilize or bind with the soils and degrade slowly over time.

**Appendix B** identifies chemicals that may be used for operation and maintenance of the wells, compressors, and pipelines. These materials arrive in shipping containers and would be stored within other structures, which would amount to secondary containment. Reasonable care would be used in the use and transfer of these materials to minimize spills and used containers would be disposed of responsibly. Random vandalism could result in unplanned spills. However, the operators would only maintain a minimum inventory on site, to reduce the total quantity that could spill. Spills could infiltrate and migrate into shallow ground waters, if they exist. Remediation and treatment of such a spill would depend on the chemical and the quantity of the spill. It is unlikely that these spills would discharge directly into surface waters.

Each compressor station would produce an oil waste product through the bypass system consisting of 90 percent water and 10 percent hydrocarbons. This material would be piped to 50-barrel sump tanks, which would be periodically pumped by an off-site disposal contractor with a vacuum pump. The volume of this material would be limited and breach of the tank would infiltrate into the soil and shallow ground waters before intersecting surface waters. A spill of this nature easily could be remediated with no long-term impacts to ground water through excavation and biotreatment.

Produced water could accidentally spill due to a breach in the pipelines at the well sites or along the gathering pipeline network. This is most likely to occur from heavy equipment accidentally striking the pipeline. Warning signs placed along the pipeline would minimize this potential. Pressure ruptures are unlikely because pipelines are designed with a factor of safety to handle the expected maximum flows and they are leak tested under pressurized conditions during installation.

Nevertheless, a breach could occur due to a severe washout at a pipeline crossing or fault displacement during an earthquake. The Companies would perform daily monitoring to assess pressures in the line and would immediately shut off sections that could be affected by a breach. The produced water contains a sodium chloride water with concentrations of TDS ranging from 6,000 to more than 23,100 mg/L. Spilled produced water would initially saturate the unconsolidated materials around the pipelines and may mix with any existing shallow ground waters. Should produced water intersect alluvial waters, the concentrations of salts would be elevated. Some of this water may discharge into surface water channels. Should a spill of produced water reach a perennial waterway, concentrations of salts and chloride would be elevated until the fluids are effectively mixed to achieve dilution. Prior to dilution, the spilled produced water is unsuitable for domestic consumption, and may diminish the productivity of any crops irrigated by this water due to the elevated salt concentrations.

Produced water also could accidentally spill at the CPF due to a breach in the pipeline on the CPF. However, impacts would be less because the water could be diverted into the emergency pits. These pits would be designed to accept, at a minimum, a 24-hour volume of produced water.

#### *4.2.1.1.5 Water Uses*

At scoping, individuals expressed concerns that water use by the Companies would negatively influence the water supply and increase costs. As noted in Chapter 3, the Utah Division of Water Resources had estimated that 42,925 acre-feet of the surface water depletion in the North Area goes into wetlands, 27,551 acre-feet is used for irrigation, and 7,283 acre-feet is utilized for domestic and industrial purposes, on an annual basis. Annually, in the South Area, 47,478 acre-feet of the surface water is applied for irrigation, 29,322 acre-feet is employed for domestic and industrial uses, and 8,250 acre-feet is consumed by wetlands. Public water supplies are derived from surface waters in all communities, but Helper. Calculations show that about 84 acre-feet would be consumed in the Project Area over the life of the project. The Companies would purchase water from a variety of users, resulting in very minor shifts in water consumption from existing uses to this project. No change in costs to consumers should occur as a result of this project.

Many springs and seeps have been adjudicated to water users who have filed to protect the flow for dedicated uses. Injury to a water user could occur in the event that spring flow would decrease, halt, or relocate.

#### *4.2.1.1.6 Electric Power Option*

Implementation of the electric power option of Alternative 1 would result in minimal additional effects to water resources. Disturbance associated with construction of the 94 miles of aboveground power lines located away from access roads would contribute minor amounts of sediment and salinity to local surface waters. However, this contribution would be short-term because any disturbance associated with this construction would be reclaimed immediately after the power lines' construction is completed.

### 4.2.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

#### *4.2.1.2.1 Ground Water*

The impacts associated with Alternative 2 would be the same as described for Alternative 1 in the Ferron and Navajo-Nugget aquifers within the Project Area. The number of disposal wells would be the same, but 18 fewer production wells would be drilled. The result would be approximately 3.5 percent less water

transferred from the Ferron Sandstone aquifer to the Navajo-Nugget than under the Proposed Action. The water quality within the Navajo-Nugget would be diluted slightly, although probably immeasurably.

On Federal leases, construction of nonlinear facilities would be limited to areas outside the designated 100-year floodplain for perennial streams or for 330 feet on either side of a perennial stream centerline under Alternative 2. This would reduce changes to the hydrogeologic properties of the alluvium along perennial streams.

Springs and seeps are afforded greater protection under Alternative 2. No construction activities could occur within a 660-foot radius of a spring or seep. The blasting buffer around springs would be 0.25 mile. This would protect the discharge point of all springs and seeps and reduce the potential for damage to recharge zones that are immediately adjacent to the spring.

#### *4.2.1.2.2 Surface Water Quantity*

Effects to surface water quantity from Alternative 2 would be similar to the impacts projected for Alternative 1. The long-term surface disturbance for Alternative 2 would be about 85 less acres than the Proposed Action. These acreages are each less than 1 percent of the Project Area.

Similar to Alternative 1, no dewatering of surface streams due to gas and water production from the Ferron sandstone aquifer would occur.

Alternative 2 varies from Alternative 1 in the protection of spring discharge sites. Construction of roads, well pads, pipelines, and compressor stations would not occur within 660 feet of springs. The Proposed Action indicates that three wells in the South Area and a CPF in the North Area would be within 660 feet of springs, but these facilities would be located beyond 660 feet of springs under Alternative 2. Blasting would be restricted to distances greater than 0.25 miles from a spring. While this may not protect the recharge area of a spring, it would afford more protection for domestic, irrigation, or stock/wildlife watering uses than Alternative 1. Furthermore, Alternative 2 provides protection for riparian zones potentially supported by springs with a 220-foot buffer for right-of-way construction of linear facilities, unless an exemption is granted.

#### *4.2.1.2.3 Water Quality*

##### **4.2.1.2.3.1 Sedimentation**

Implementation of Alternative 2's Environmental Protection Measures and the long-term disturbance of 85 fewer acres would result in a sediment loss of 9.9 tons per acre per year, or 1.3 tons per acre per year less than the Proposed Action. Sedimentation delivery to streams would be reduced to 4.0 tons per acre per year.

Water quality immediately adjacent to disturbed areas may exhibit increased sediment loading, as noted in Alternative 1. Natural sediment loss is high in this area due to low vegetative cover and the high percentage of clay soils. Disturbances within the 100-year floodplain of perennial streams would be avoided. Surface disturbances also would be avoided 330 feet from the centerline of perennial streams. These environmental protection measures should limit the sediment loss associated with large storm events.

Slightly fewer disturbances of critical soils and disturbances within steeper slopes would occur under Alternative 2, compared with Alternative 1. Environmental protection measures for soils have been

incorporated into this alternative for activities on Federal lands (See **Section 4.4**). New road construction would avoid soils classified as critical, but, considering the prevalence of critical soils in the Project Area, complete avoidance would be difficult. Road grades on critical soils would never exceed 15 percent and would only exceed 10 percent with approval from an Authorizing Officer. Construction of well sites and facilities on critical soils with slopes greater than 6 percent would be avoided where possible. However, since all occupancy could not be avoided, erosion and sediment control measures should be employed. Sediment control measures include surfacing of roads and well pads, drainage control, reseeding, and installation of water bars across reclaimed sites and roads. Additionally, construction of well pads, roads, would be prohibited on slopes greater than 25 percent. Pipeline on slopes exceeding 25 percent could only be installed with approval of the Authorized Officer. Siting of facilities to avoid steeper slopes would reduce the overall disturbance by limiting the cut and fill disturbances. Reclamation of portions of the well pads not needed for operations would be performed following drilling.

Sediment losses from installation of the gas transmission line would be similar to Alternative 1.

#### 4.2.1.2.3.2 Salinity

Implementation of Alternative 2's Environmental Protection Measures and a 85-acre reduction in long-term disturbance would result in a salinity of 0.239 tons per acre per year (**Appendix E**), or almost 0.1 tons per acre less than the Proposed Action. This value is within the natural range of 0.005 to 0.51 tons per acre per year for the region of the Project Area. Water runoff across disturbed areas results in an increase in salinity. Disturbance acreage between Alternatives 1 and 2 would be the similar, although the exact location of some well pads may be different due the use of buffer zones around perennial streams, springs, and riparian zones under Alternative 2. The environmental protection measures would limit construction on saline soils where possible, which not only limits the runoff of water with elevated salinity during operations, but would result in the better reestablishment of vegetative cover following reclamation. This, in turn, could further reduce runoff of water. Regionally, Alternative 2 should not result in any adverse consequence to the salinity standard adopted by the Colorado River Basin Salinity Control Forum.

### *4.2.1.2.4 Spill Impacts to Surface and Groundwaters*

Spill effects from Alternative 2 would be similar to the Proposed Action. Alternative 2 differs from Alternative 1 in three aspects that have implications for accidental spills. One, there would be 330-foot no-occupancy zones for nonlinear facilities on either side of the centerline of perennial streams. This would reduce the potential for spills at a well pad or compressor station to migrate into a waterway and then into the alluvium. Two, no construction would occur within 660 feet of springs and, three, no blasting or geophysical drilling would occur with 0.25 miles of a spring or water well. This would minimize the risk of contaminating the immediate area of a spring or well with an accidental spill.

### *4.2.1.2.5 Water Uses*

Water consumption and impacts to water users would be about the same for Alternatives 1 and 2 (84 and 77 acre-feet, respectively) with one exception. The no occupancy protection afforded within 660 feet of springs, coupled with the blasting restriction within 0.25 miles of springs, should protect adjudicated springs.

#### 4.2.1.2.6 Electric Power Option

Implementation of the electric power option of Alternative 2 would result in minimal additional effects to water resources. Disturbance associated with construction of about 49 miles of aboveground power lines located away from access roads would contribute minor amounts of sediment and salinity to local surface waters. However, this contribution would be short-term because any disturbance associated with this construction would be reclaimed immediately after the power lines' construction is completed. Construction of the underground power lines would not contribute any additional effects because they would be installed within the ROWs for access roads. These ROWs would be disturbed with or without the installation of the underground power lines.

### 4.2.1.3 Alternative 3 — No Action Alternative

#### 4.2.1.3.1 Ground Water

Natural gas development within the Project Area has already occurred at 68 wells. Additional development could occur on state and private lands within the area if the gas could be efficiently processed and transported off-site. Construction of an additional 136 wells and four CPFs in the South Area could occur. Similar development within the North Area could result in construction of another 19 wells. Hypothetically, additional development would take another five years at the Proposed Action's construction rate. Maximum annual production of produced water from the North and South areas would be 6,250 BWPD (0.8 acre-feet/day) and 39,050 BWPD (5.04 acre-feet/day), respectively. There is currently capacity to handle 10,000 BWPD in the North Area and 8,500 BWPD in the South Area. Alternative 3 would result in 42 percent less water transferred from the Ferron Sandstone aquifer to the Navajo-Nugget aquifer. The water quality within the Navajo-Nugget would improve slightly, although immeasurably.

#### 4.2.1.3.2 Surface Water Quantity and Quality

Additional development could occur on state and private lands within the area in the event that the gas could be efficiently processed and transported off-site. This would involve the construction of an additional 136 wells and four CPFs in the South Area, disturbing an additional 331 acres over the long term. Similar development within the North Area could result in 19 wells disturbing an additional 36 acres over the long term. Construction of facilities in floodplains would increase sediment loss and spill potential to surface waters.

Water quantity and quality impacts from gas production are similar to those described for the Proposed Action and Alternative 2, but at a proportionally lower rate.

Sediment loss was evaluated for the No Action Alternative and the results are shown in **Appendix E**. Sediment loss was estimated to average 10.9 tons per acre per year on 367 acres and sediment delivery was estimated to be 4.4 tons per acre per year. Sediment losses from installation of the gas transmission line would be similar to Alternative 1.

Estimates of salt delivery suggest that the disturbance under the No Action Alternative would generate 0.31 tons per acre per year on 367 acres of disturbance. Additional details concerning these projections are shown in **Appendix E**.

#### 4.2.1.3.3 Spill Impacts to Surface and Groundwaters

The impacts from accidental spills would be similar to the Proposed Action, but proportionally lower because of the fewer wells.

#### 4.2.1.3.4 Water Uses

The No Action Alternative would result in some natural gas development on state and private lands. Construction and drilling is predicted to use 42 acre-feet in the Project Area. This work would be performed over two years and would shift water from existing irrigation and domestic uses to industrial uses. As noted under the Proposed Action, this is a minute percentage of the available water supply and this consumption should not impact costs to existing users.

### 4.2.2 Impacts Summary

Implementation of any of the three alternatives would not directly or indirectly result in deleterious effects to ground waters at depth. Pumping of water associated with all three alternatives would cause a transfer of water from the Ferron Sandstone to the Navajo-Nugget aquifer. Neither of these aquifers is used in the Project Area due to their depths and high salinities. Dewatering would not affect water quantity in bedrock aquifers overlying the Ferron within the Project Area or along its boundaries.

There may be impacts to springs or shallow alluvial waters from construction activities or spills. Spills of fuels, hydraulic fluids, drilling fluids, treatment fluids, and produced water may occur during construction, drilling or production. In the event of a water pipeline rupture, saline produced water could infiltrate into any nearby shallow alluvial aquifers, decreasing water quality. The probabilities of the occurrence of these impacts to ground waters would be less under Alternative 2 as 18 fewer wells would be drilled and environmental protection measures would be employed to provide protective buffers near water courses and springs. Effects under Alternative 3 would be similar to the Proposed Action, but proportionately less as 130 fewer wells would be drilled.

The most critical impacts to surface water quantity from the Proposed Action and Alternative 3 would occur if springs and seeps are damaged by blasting. Under Alternative 2, blasting would be prevented within 0.25 mile of known springs or seeps to reduce the potential for damage.

No communication exists between surface waters and the Ferron or Navajo aquifers in the Project Area. Surface waters would not be dewatered from any of the three alternatives. A comparatively small quantity of surface water would be redirected from irrigation or domestic uses during construction, but the quantities would be less than 0.02 percent of annual consumption.

Increased, short-term sediment loading would occur during construction of pipelines or roads across perennial streams or flowing intermittent or ephemeral channels. Increased sediment generation also would occur during heavy storm events when surface facilities have been constructed in or near dry channels or floodplains.

Other surface water impacts from the three alternatives would consist of increases in water runoff and sediment production from the removal of vegetation and increased compaction at disturbed sites. These increases would occur throughout the operating life of the project and for the first few years following reclamation. Sediment delivery to streams from the Proposed Action was calculated at 4.5 tons per acre per

year from 763 acres that would be disturbed over the long term. Sediment delivery from alternatives 2 and 3 were estimated at 4.0 and 4.3 tons per acre per year from 678 acres and 367 acres disturbed over the long term, respectively (**Appendix E**). These levels are within the range of the naturally occurring rate of 0.8 to 4.8 tons per acre per year (BLM 1997c). Salinity delivery to flowing water from disturbed area runoff would be 0.3 tons per acre per year for alternatives 1 and 3 and 0.2 tons per acre per year for Alternative 2 (**Appendix E**). These levels are within the range of the naturally occurring rate of 0.005 to 0.51 tons per acre per year (BLM 1997c). Regionally, none of the alternatives should result in adverse consequences to the salinity standard adopted by the Colorado River Basin Salinity Control Forum.

### 4.2.3 Mitigation

Drill pads and facility sites should be designed and constructed to prevent overland flow of water from entering or leaving the sites. This could be accomplished through the use of berms, terraces and grading to form depressions. Stormwater would be diverted around sites. Any stormwater on disturbed sites would be prevented from flowing off the site, thereby reducing pollution potential.

Roads should be designed to divert stormwater runoff and reduce erosion. Proper design and installation of erosion control structures, such as water bars and diversion channels should be completed. Road ditch turnouts should be equipped with energy dissipators. Where roads interrupt overland sheet-flow of water and convert this runoff to channel flow, ditch turnouts should be designed to reconvert channel flow to sheet flow, by using rock energy dissipators and gravel dispersion fans or other designs. As necessary, cut banks, road drainages and road crossings should be armored or otherwise designed to prevent headcutting.

To maintain stream channel stability, road crossings on channels having 10 year flows that would require a culvert diameter of 30 inches or greater should be engineered. Crossing designs should be based on cross-sections, longitudinal profile, and other pertinent physical characteristics specific to each crossing. Installation of culverts with 30-inch or greater diameter should be engineered to allow flows to pass through the crossing at the same velocity and position (i.e., on the floodplain or in the channel) as would occur if the crossing were absent. Bankfull flow should be determined and crossings designed to pass this flow within the channel. Flows in excess of this quantity should be channeled separately through the crossing (i.e., on the floodplain). Flows should not be converged from a floodplain into a channel when passed through by a road crossing. Multiple culverts or combination low-water crossing designs would be encouraged in these circumstances. Where multiple culverts are used, the minimum cumulative capacity of all culverts should be the 10-year flow. Floodplain culvert outlets should be equipped with energy brakes and dispersion fans if needed to preserve existing flow velocity and position. Such stream crossing designs would preserve the physical dimensions of channels such as slope, width, depth, pool/riffle ration, etc.

Spills, leaks, and contaminated soils would be cleaned up, excavated, or treated, to prevent pollution to surface or ground waters.

Additional mitigation specified for Soils (**Section 4.4**) and for Reclamation (**Section 4.17**) would assist in reducing impacts from sedimentation and salinity.

## 4.2.4 Unavoidable Adverse Effects

The primary unavoidable adverse effect to water resources would be the dewatering of the water resource in the Ferron Sandstone. However, due to the poor quality and currently-prohibitive depth of the water, this effect is not considered substantive.

# 4.3 AIR QUALITY

Air quality in and near the Project Area would be affected by construction activities; vehicle-generated road dust during construction and operational activities; emissions of nitrogen dioxide, carbon monoxide, and hazardous air pollutants from the operation of natural gas-powered compressors and hazardous air pollutants from amine units and occasional flaring; and venting of methane gas during the completion of wells. This section quantifies the emissions of pollutants and potential impacts that would be associated with the Proposed Action. The effects on regional visibility in Castle Valley and at the closest Class I airsheds (Arches, Canyonlands, and Capitol Reef National Parks) resulting from the Proposed Action and alternatives are also described.

The purpose of this document is to provide details on the air quality analysis for the Ferron Natural Gas Project. This air quality analysis was prepared in compliance with the requirements of the National Environmental Policy Act to determine significance of impacts. It is not a regulatory analysis. In the absence of detailed engineering specifications and detailed locations, a conservative air quality modeling approach was applied. The National Ambient Air Quality Standards, Prevention of Significant Deterioration increments, and other air quality standards were used as significance criteria for comparative purposes only. Air quality analyses for regulatory purposes would be performed by the UDEQ during the subsequent permitting processes. A more detailed technical description of this air quality analysis is found in the Technical Reference Document, Air Quality Analysis for the Ferron Natural Gas Project on file at the BLM State Office in Salt Lake City, Utah and at the BLM Price Office in Price, Utah.

## 4.3.1 Direct and Indirect Impacts

### 4.3.1.1 Alternative 1 — Proposed Action

#### *4.3.1.1.1 Construction Impacts*

Construction activities would generate fugitive dust from earth-moving activities and construction vehicles. A portion of the fugitive dust contains the $PM_{10}$, defined as inhalable particulates less than 10 microns in diameter, and regulated by federal and State standards as a criteria pollutant. Although temporary area emission of fugitive dust are not subject to State air quality permitting procedures, such emissions are subject to control measures to prevent public nuisance. The Companies would be required to comply with the Utah Air Conservation Rule R307–12–1 to control fugitive dust during construction. This rule requires control of fugitive dust for ground-moving activities over ¼ acre and truck traffic on unpaved roads. The Companies would apply water or dust suppressants (for example, magnesium chloride) to access roads and all construction sites. It is assumed the application of these measures would reduce fugitive dust emissions during construction activities by approximately 50 percent.

Generally, construction activities would occur from April through November because of weather and other environmental factors that would limit or prohibit construction activities during winter. Additionally, the

construction activities would be spread along the linear project facilities (roads and pipelines) and at multiple and widespread areas within the Project Area. Project-related construction fugitive dust emissions are shown on **Table 4–1**. Therefore, while fugitive dust levels may be raised at locations adjacent to construction sites, potential impacts would be minor and temporary, and would not violate ambient air quality standards. These activities are not assumed to result in any exceedances of ambient air quality standards because of dust suppression requirements prescribed by the State of Utah.

**Table 4–1**
**Ferron Natural Gas Project**
**Construction-Related Fugitive Dust Emissions ($PM_{10}$)[1]**

| Activity | North Area (tons/year) | South Area (tons/year) |
|---|---|---|
| Earth-moving | 50 | 88 |
| Vehicles on unpaved access roads | 109 | 358 |
| Vehicles on paved roads within Project Area | 1 | 6 |
| Vehicles on paved roads outside Project Area | 1 | 49 |
| Annual total within Project Area with dust controls applied | 161 | 501 |

Note:
1. Assumes 50 percent control by watering or chemical application.

#### *4.3.1.1.2 Operations Impacts*

##### 4.3.1.1.2.1 Fugitive Dust Emissions Impacts

Fugitive dust would also be generated by vehicles traveling to the wells to perform daily inspections and periodic maintenance, and vehicles performing periodic road grading. The Companies would take measures to reduce fugitive dust emissions from disturbed areas on permanent facilities (CPFs, compressor stations). The Utah Air Conservation Rule R307–12–1 requires the control of dust on land areas more than ¼ acre in size that have been cleared or excavated. The Companies shall take measures, as prescribed by the Utah Air Conservation Rules, to prevent fugitive dust from becoming airborne. Such measures may include, but are not limited to:

- planting vegetative cover,
- providing synthetic cover,
- watering and/or chemical stabilization,
- wind breaks, and/or
- other equivalent methods or techniques approved by the State of Utah.

The Utah Air Conservation Rule R307–12–1 does not require dust control on unpaved roads when the average daily traffic level does not exceed 150 vehicles. The average vehicles per day during operations would consist of pumpers driving pick-up trucks to the wells and facilities for daily inspections, larger vehicles for occasional maintenance operations, occasional road grading, and water trucks to well pads to control dust. Fugitive dust emissions were calculated using factors from the EPA document AP–42 (EPA 1995b). With no control of dust from these roads, the fugitive dust emissions from operational vehicles

would be 266 tons per year in the South Area and 68 tons per year in the North Area. These levels would be approximately 50 percent of the emissions produced during the five-year construction period for any given area. Temporary elevated dust levels would occur near roads. However, any vehicle traveling directly behind Company vehicles or other privately owned vehicle driving on access roads would incur high dust levels.

#### 4.3.1.1.2.2 Compressor Emissions Impacts

Under the Proposed Action, the Companies would construct and operate 12 compressor stations. As development of the Project Area matures, the use of natural gas-powered compressors would diminish and selected units may be replaced with electric-powered compressors. However, the air quality analysis assumed all compressors would initially be natural gas-powered. $NO_x$ and CO would be emitted from the operation of natural gas-powered compressor engines. Each gas-powered compressor station would require an Approval Order from the UDEQ prior to starting construction. The UDEQ has the responsibility to establish and enforce air quality regulations designed to protect the public health and welfare. Their review of the request for an Approval Order would include a review to ensure the application of Best Available Control Technology (BACT) and compliance with all applicable regulations.

#### 4.3.1.1.2.3 Compressor Locations and Size

Chandler has proposed three compressor stations in the South Area, two rated at 2,200 HP and one at 850 HP. Texaco has proposed three new natural gas compressor stations in the South Area each rated at 4,000 HP. The proposed locations of these compressor stations are shown on **Plate 2–1**.

Anadarko has proposed a combination of five new CPFs and compressor stations with two 1,700 HP units at each location. One existing compressor (CPF), rated at 1,015 HP, is operating in the North Area (on State land) and would be upgraded to 3,400 HP. One of the CPFs is proposed on private land outside of the Project Area. Emissions from the four new CPFs and compressor stations proposed in the North Area, plus the existing compressor station in the North Area and the proposed new CPF on private land outside of the Project Area, are based on 3,400 HP rating for each station. The proposed locations of these compressor stations are shown on **Plate 2–1**.

#### 4.3.1.1.2.4 Compressor Emissions

The emission rates and stack parameters used in the modeling of generic compressors are based on data supplied from manufacturers and compressors recently permitted by the UDEQ. Manufacturers' specifications from Cooper Energy Services and Waukesha, major manufacturers of natural gas-fired compressors, for compressor engines specify attainable emission rates of 1.5 to 2.0 g/HP-hour for $NO_X$ and 0.7 to 2.0 for CO. The most conservative values of 2.0 g/HP-hour for $NO_X$ and CO were used for the emissions inventory. The actual permitted emission rates would be based on site-specific data once the actual engine configuration is selected and would conform to BACT based on the pre-NOI meetings with the UDEQ. Based upon the preceding operating parameters, the $NO_X$ and CO emissions from the 12 proposed compressors would be 664.4 tons per year. The contribution from each of the Companies' facilities are shown on **Table 4–2**.

**Table 4–2**
**Ferron Natural Gas Project $NO_X$ and CO Emissions from Compressors**

| Company | Compressor Rating (HP) | Number of Compressors | Total Compression (HP) | $NO_X$ and CO Emissions | |
|---|---|---|---|---|---|
| | | | | lbs/hour | tons/year |
| Anadarko | 3,400 | 6 | 20,400 | 89.88 | 354.6 |
| Texaco | 4,000 | 3 | 12,000 | 52.86 | 208.5 |
| Chandler | 2,200 | 2 | 4,400 | 19.38 | 84.9 |
| | 850 | 1 | 850 | 3.74 | 16.4 |
| Total | | 12 | 37,650 | 165.86 | 664.4 |

#### 4.3.1.1.2.5 Flaring Emissions

Temporary flares may be used to determine if wells are capable of adequate production to justify the installation of a pipeline collection system. Each flare would be allowed to burn approximately 50 million cubic feet or for a maximum of 30 days, whichever occurs first. Normally, no more than ten days would be required to determine the adequacy of a well. Based on emission factors listed in Table 13.5–1 in the EPA's Compilation of Air Pollutant Emission Factors, AP–42 (EPA 1995b), the $NO_X$ emissions from each flare would result in 0.425 lbs/hour or 10.2 lbs/day from each flaring episode.

Approximately 57 wells would be drilled each year in the five-year construction period. If all wells would be flared the maximum of 30 days, the annual $_{NOX}$ emissions would be 8.5 tons. Under the more likely scenario, all wells would be flared an average of ten days per year resulting in $NO_X$ emissions of 2.8 tons per year. Furthermore, the wells would be spread out over the large geographical area of the Project Area and the emissions from flaring would be temporary. As a result, $NO_X$ emissions from flaring would range from 0.4 to 1.3 percent of $NO_X$ emissions from the Project's compressors. Therefore, emissions from flaring were not considered to be significant.

#### 4.3.1.1.2.6 Dispersion Model

Air quality impacts from the operation of gas-powered compressor stations were predicted using the EPA-approved Industrial Source Complex Short Term (ISCST390) Dispersion Model, version 97365 according to the guidelines of the User's Guide for the Industrial Source Complex Dispersion Model User's Instructions (EPA 1995c).

A large grid of receptors was used to ensure an adequate spatial coverage for the Project Area. The receptor grid had a 1,000-meter spacing centered approximately between the North and South areas with an extent of 77 kilometers from north to south and 48 kilometers from west to east. This grid was used to determine the overall effect of all the compressors. To determine the effects of individual compressors with complex terrain in the vicinity of the compressors, a smaller circular grid with a 250-meter spacing was placed around each compressor. The overall grid included 2,950 receptors in and near the Project Area. Additional receptors were placed at the closest residences to compressors and at the key locations in Arches, Canyonlands, and Capitol Reef National Parks. The elevation of each receptor was determined from Digital Elevation Maps (1:24,000 scale) developed by the USGS.

A two-year data set (1986 and 1987) from the Clawson Power Plant site was provided by the UDEQ as meteorological input to the model. The model was run for both years, and the highest ambient concentrations are reported.

#### 4.3.1.1.2.7 Modeled Impacts

The federal and State of Utah Ambient Air Quality Standards have been developed to determine the maximum concentrations of a pollutant in the air to protect the public health and welfare with an adequate degree of safety. The standards established for $NO_2$, shown in **Table 3–11** in **Section 3.3** is 100 $\mu g/m^3$ as an annual average. The standards established for CO, also shown in **Table 3–11** in **Section 3.3** are 40,000 $\mu g/m^3$ as a one-hour maximum and 10,000 $\mu g/m^3$ as an eight-hour maximum. The assumed average $NO_2$ background concentration throughout the vicinity of the Project Area is 17 $\mu g/m^3$ based on measured data at Castle Dale. This means that even if the Proposed Action would produce an increase in the $NO_2$ concentration of 82 $\mu g/m^3$, an adequate margin for the public health and welfare would still be maintained.

$NO_x$ and CO emissions from each compressor station proposed under the Proposed Action were modeled using the 1986 and 1987 Clawson meteorological data and the highest concentrations for each year were compared to the Class II Prevention of Significant Deterioration (PSD) increments and the NAAQS. The modeled $NO_x$ concentrations were multiplied by a factor of 0.75 to represent the conversion of total $NO_x$ to $NO_2$. The results are summarized in **Table 4–3** and the concentration contours are shown on **Plate 4–1**. The maximum concentrations are closely centered around each compressor. The $NO_2$ results represent the incremental impact of the Ferron Project only with the background of 17 $\mu g/m^3$ added on, and the CO results are with the 8,000 and 2,000 $\mu g/m^3$ background values added for the one-hour and 8-hour averaging periods, respectively.

**Table 4–3**
**Ferron Natural Gas Project Proposed Action $NO_2$ and CO Air Quality Impacts**

| Pollutant | NAAQS ($\mu g/m^3$) | PSD Class II Increment ($\mu g/m^3$) | Averaging Period | Maximum Modeled Concentration ($\mu g/m^3$) | Background ($\mu g/m^3$) | Maximum Modeled Concentration with Background ($\mu g/m^3$) | Percent of NAAQS | Incremental Percentage Increase of Class II Increment |
|---|---|---|---|---|---|---|---|---|
| $NO_2$ | 100 | 25 | Annual | 27.75 | 17 | 44.75 | 44 | 111 |
| CO | 40,000 | Not Applicable | one hour | 3,337 | 8,000 | 11,337 | 28.3 | Not Applicable |
| CO | 10,000 | Not Applicable | eight hours | 706 | 2,000 | 2,706 | 27.1 | Not Applicable |

Maximum concentrations would occur on elevated terrain within ½ mile of the compressors. The highest $NO_2$ concentration due to direct impacts was 27.7 $\mu g/m^3$, a value slightly exceeding the PSD Class II increment of 25 $\mu g/m^3$ but only 27.7 percent of the annual NAAQS. This maximum concentrations would at elevated terrain near Anadarko's proposed compressor in Township 13, South Range 10 East, Section 28. The PSD Class II increment also may be slightly exceeded (27.5 $\mu g/m^3$) near Texaco's proposed compressor in Township 17 South, Range 8 East, Section 10. No PSD Class II increments were predicted to be exceeded at any other locations. As shown on **Plate 4–1**, most of the Project Area away from compressors would have a concentration of less than one $\mu g/m^3$, a level considered to have an insignificant air quality impact.

All NEPA analysis comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis. The determination of PSD increment consumption is a regulatory agency responsibility conducted as part of the New Source Review process, which also includes a PSD Class I Federal Land Management Agency's evaluation of potential impacts to Air Quality Related Values (AQRV), such as visibility, aquatic ecosystems, flora, fauna, etc. The review would be conducted by the UDEQ when the Companies apply for construction and operating permits.

Since this NEPA air quality analysis shows that PSD Class II increments could be slightly exceeded on elevated terrain near two of the compressors, the UDEQ may require more stringent design and operational parameters when these compressors are individually permitted. Actual design parameters, as opposed to the conservative assumptions used in this analysis, would be the basis for determining impacts from individual compressors. Furthermore, the UDEQ may require lower emission rate than the 2.0 grams/horsepower-hour used in this analysis.

CO modeled concentrations would be approximately seven to eight percent of the NAAQS. The maximum one-hour concentration would be 3,337 $\mu g/m^3$, a value only 8.3 percent of the one-hour CO NAAQS of 40,000 $\mu g/m^3$. Likewise, the maximum 8-hour concentration would be 706 $\mu g/m^3$, a value only 7.1 percent of the 8-hour CO NAAQS of 10,000 $\mu g/m^3$. When the assumed CO backgrounds are added, the average one-hour CO concentration would be 11,337 $\mu g/m^3$, or 28.3 percent of the NAAQS. The average eight-hour CO concentration would be 2,706 $\mu g/m^3$, or 27.1 percent of the NAAQS. Similar to the $NO_2$ analysis, these maximum CO values would occur at elevated terrain near compressor stations. Since the CO ambient levels would be small compared to the NAAQS, a further analysis of CO was not done.

$NO_2$ concentrations were also modeled and compared to Class I PSD increments at the closest boundary to the Arches, Canyonlands, and Capitol Reef National Parks. The Class I $NO_2$ increment is only 2.5 $\mu g/m^3$ because the highest degree of protection from air quality impacts is enforced at Class I airsheds. The highest direct annual $NO_2$ concentrations were predicted to be 0.041 $\mu g/m^3$ at the Canyonlands and Arches National Parks, and 0.062 $\mu g/m^3$ at Capitol Reef National Park. These values would be less than 3 percent of the Class I increments at these National Parks. Therefore, air quality impacts at the Class I areas are not predicted to be significant.

Based on the results of the air quality dispersion modeling, it can be concluded that the Proposed Action would not cause any exceedances of the NAAQS in or near the Project Area or at distant Class I airsheds. Based on the conservative design and modeling assumptions, Class II increments may be slightly exceed on elevated terrain in the immediate vicinity of some compressors.

#### 4.3.1.1.2.8 Hazardous Air Pollutant Impacts

The incomplete combustion of natural gas can result in the emission of formaldehyde, which is recognized as a carcinogen. The UDEQ has established screening criteria for formaldehyde. Assessment procedures use risk factors established by the EPA (EPA 1997) for carcinogenic compounds. Cancer risk in the in the range 1 per million to 1 per 10,000 is generally acceptable, while risks above 1 in 10,000 imply a need for mitigation.

Maximum predicted ground level concentrations are adjusted for the duration of exposure. The maximum exposed individual was assumed to be exposed for every hour of every day, but the Project would operate for 20 years. Because average human life expectancy is about 70 years, the exposure duration is adjusted

to 20/70 or 0.29. The EPA SCREEN3 dispersion model was used to calculate an annual maximum ambient air impact of 2.7 $\mu g/m^3$ within 200 meters of the largest proposed compressor (4,000 horsepower) because no residences would be closer than 200 meters to a compressor. The risk was calculated from the product of the annual formaldehyde ambient air concentration, the scale factor 0.29, and the unit risk factor 0.000013 (EPA 1997), which resulted in an overall risk of 0.0000102. A risk factor less than 0.0001 is generally acceptable. As a result of the preceding analysis and no residences located within 200 meters of a proposed compressor, no significant formaldehyde impacts would occur with implementation of the Proposed Action.

#### 4.3.1.1.2.9 Visibility Impacts

The formation of regional haze and the resultant impairment of visibility in an area can result from ambient concentrations of particulate matter from $PM_{10}$, $NO_X$, and $SO_2$ emissions. The regional haze analysis in the vicinity of the Project Area incorporates the methods presented in the Interagency Workgroup on Air Quality Modeling (IWAQM) and the UDEQ. It is BLM's position that a reduction of 10 percent in the visibility within a region would be barely discernible to the general public. This method is generally used to evaluate regional haze at distant (over 40 miles) Class I airsheds. The IWAQM method was used, with modifications, to estimate the regional haze impacts in the vicinity of the Project Area.

Using the modified screening method, the standard visual range (SVR) in and near the Project Area was estimated to be reduced by 10 percent on two or fewer days in a year. Therefore, it can be concluded that the Ferron Natural Gas Project would have minimal effect on the regional haze in the vicinity of the Project.

The IWAQM method along with modifications by the UDEQ was used to evaluate effects on regional haze at Canyonlands, Arches, and Capitol Reef National Parks. The BLM recognizes that a SVR reduction of 10 percent would be the level that would be barely discernible to the general public. The National Park Service recognizes a 5 percent reduction as the level where a keen observer seeking a pristine visual experience in a National Park would just begin to notice a reduction. Accordingly, the National Park Service generally uses this 5 percent reduction as a significance level while the BLM recognizes a 10 percent reduction as a significance level, especially for the multiple, geographically-separated sources that are analyzed in the Ferron Natural Gas EIS. The BLM considers more than one day of a visual reduction more than 10 percent as a significant impact. Based on this method and the modeled 24-hour $NO_X$ concentrations at the Class I areas, the regional haze reduction would exceed 10 percent four days at Capitol Reef National Park as a result of the Ferron Natural Gas Project's emissions. The visual reduction would be less than 10 percent on all other days evaluated in the air quality analysis.

#### 4.3.1.1.2.10 Amine and Dehydration Units Impacts

An amine unit and a dehydrator would be co-located with each compressor unit. The amine unit would reduce the carbon dioxide in the gas stream to levels that are acceptable on transmission pipelines. The gas stream would first flow through a separator on the CPF site to remove water. Next, the gas stream would flow through the compressor to increase the pressure to about 700 psi. The gas steam would then pass through the amine unit to remove the carbon dioxide and finally through the tri-ethylene glycol dehydration unit to remove all the excess water.

Emissions associated with the amine units would be the carbon dioxide that is vented to the atmosphere through a 6-inch pipe at an elevation of 30 feet. Daily carbon dioxide emissions would be 3,000 cubic feet per day (cfd) from the approximate 15 million cfd of natural gas. Total annual project carbon dioxide emissions would be 13,140,000 cubic feet (3,000 cfd per unit X 12 units X 365 days per year) or 160 lbs per

year. The amine unit would produce minor levels of BTEX (benzene, toluene, ethylbenzene, and xylenes). The GRI-HAPCalc computer model, developed by the Gas Research Institute (GRI 1996) was used to estimate emissions from each amine unit. BTEX emissions were calculated with the assumption (although not proposed by the Companies) that the gas stream would be routed to a combustion devise before being vented to the atmosphere. If a combustion devise would not be constructed on the amine units, BTEX emissions could be significantly higher. In either case, the Companies would have to be in compliance with the Utah Air Conservation Rule 307–1–7–3 for hazardous pollutants levels emitted to the atmosphere. Based on a gas analysis from Texaco's Orangeville unit during March 1998, the annual BTEX emissions from each amine unit would be less than 0.6 tons per year, of which 0.02 tons per year would be benzene. The Utah Air Conservation Rule 307–1–7–3.C indicates that levels of benzene below 0.119 tons per year do not constitute a health hazard. After the gas stream leaves the amine unit, the stream would be purged of benzene. Therefore, no significant BTEX emissions would be expected from the glycol dehydration process.

#### *4.3.1.1.3 Electric Power Option*

No air pollutants from compressors would be emitted from the Ferron Natural Gas Project with electrically-powered equipment. Therefore, the air quality and visibility impacts resulting from emissions from natural gas compressors described in the Proposed Action would not occur. No indirect impacts would occur from extra generation of electrical power because there is excess electrical capacity at power generating facilities near the Project Area.

### 4.3.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Under Alternative 2, 61 wells (four less than the Proposed Action) and 12.3 miles of roads (2.5 miles less) would be constructed in the North Area. A total of 206 wells (14 less than the Proposed Action) and 71.3 miles of roads (11.9 miles less) would be constructed in the South Area. The reduction in wells and roads would be a result of other environmental restraints. However, the same number of compressors as for the Proposed Action would be required.

Since the same number of compressors would be operated under Alternative 2, the air quality and visibility impacts would be identical to the Proposed Action. Because of concerns raised by public comment concerning adverse visibility impacts at Class I areas under the Proposed Action. Approximately five percent fewer facilities (well pads and roads) would be constructed under Alternative 2. Therefore, the fugitive dust emissions and resultant air quality impacts would be less.

#### *4.3.1.2.1 Construction Impacts*

Construction-related fugitive dust, as $PM_{10}$, is directly related to the amount of surface-disturbing activity. Under Alternative 2, 95 percent of the proposed wells and roads under the Proposed Action would be constructed. Therefore, fugitive dust levels would be approximately 95 percent of those for the Proposed Action. Total annual $PM_{10}$ emissions, with legally-enforceable dust controls applied that would reduce dust emissions by 50 percent, would be 475 tons per year in the South Area, and 153 tons per year in the North Area.

#### 4.3.1.2.2 Operational Impacts

Similar to construction-related fugitive dust, the amount of dust generated by project-related traffic would be approximately 95 percent of the Proposed Action. Because no control of fugitive dust, i.e., application of water or chemicals such as magnesium chloride, from project vehicles has been proposed by the Companies, the annual dust emissions would be 252 tons per year in the South Area and 65 tons per year in the North Area. These levels would be approximately 50 percent of the fugitive dust associated with construction activities.

#### 4.3.1.2.3 Electrical Power Option

No air pollutants from compressors would be emitted from the Ferron Natural Gas Project with electrically-powered equipment. Therefore, the air quality and visibility impacts resulting from emissions from natural gas compressors described in the Proposed Action and this alternative would not occur. No indirect impacts would occur from extra generation of electrical power because there is excess electrical capacity at power generating facilities near the Project Area.

### 4.3.1.3 Alternative 3 — No Action

Under the No Action alternative, a maximum of 155 wells and nine compressors could be developed on State and private land. The compression required for the fewer wells would be approximately 50 percent of the Proposed Action and Alternative 2. Six new compressors would be constructed and operated on State and private land. Since potential impacts may occur under the Proposed Action and Alternative level of development, lesser, but potentially significant, impacts also may occur under the No Action level of development. With the operation of six natural gas compressors, no days at the Class I areas are predicted to have visibility reduced by more than ten percent. However, visibility is predicted to be reduced by more than five percent on five days at Capitol Reef and one day at both Arches and Canyonlands National Parks. The maximum $NO_2$ impact of 27.7 $\mu g/m^3$, 44.7 $\mu g/m^3$ with the background, would still occur near Anadarko's proposed compressor in the North Area.

Since no federal lands or actions would be involved with the No Action Alternative, the level and type of compressors would be totally under the authority of the UDEQ. When the compressors would be individually permitted by the UDEQ, a BACT analysis, an ambient air quality impact analysis, and an analysis of visibility effects on the Class I airsheds would be completed for each action. The BACT analysis would determine the lowest emission rate based upon economical, energy, and environmental impacts to comply with all air quality regulations. As part of the permit review process, the proponents may be required to either install gas-fired compressors with lower, and achievable in the industry, emission rates or install electric-powered compressors, which have no direct pollutant emissions, especially when the total effect on Class I airsheds would approach a significant level.

## 4.3.2 Summary of Impacts

Dust levels would be elevated near construction activities during the five-year construction period. Construction would generally occur from April to November because winter weather restraints and other environmental factors would preclude most winter construction. The Companies would apply dust suppression techniques such as watering or chemical application to reduce construction-related dust. Although dust levels would be elevated in the immediate vicinity of construction activities and along unpaved roads in the morning and evening, the dust levels would not constitute any threat to human health

and safety. During the operational phase, dust levels would be reduced by about 50 percent because of the decreased traffic to the wells and dust suppression techniques applied to exposed areas on well pads and facilities. However, the Companies have stated that no dust suppression would be applied to roads.

Operation of the 12 proposed compressors would result in elevated levels of $NO_2$ in the immediate vicinity of the compressors. The highest ambient air concentration would be 27.7 $\mu g/m^3$, a level 27 percent of the level that has been implemented to protect the public health and safety. The maximum $NO_2$ levels would occur on elevated terrain within ½ mile of the compressor sites. Away from the compressors, the ambient air concentration of $NO_2$ would rapidly decrease and be less than 10 $\mu g/m^3$ at more than 95 percent of the area within the Project Area. Visibility in and near the Project Area, although there is no visibility standard for this area, would be decreased at least 10 percent about 2 days per year. At the distant Class I airsheds of the National Parks, the contribution to air quality degradation would be minuscule and only three percent of the allowable increases. Visibility is predicted to be reduced more than 10 percent on four days at Capitol Reef National Park. This would be considered a significant impact. Under both alternatives 1 and 2, implementation of the electric power option and recommended mitigation would result in no exceedence of $NO_2$ Class II incremental increase. Also, visibility at Capitol Reef National Park would not be reduced by more than 10 percent on any days.

Under the No Action Alternative, the level and type of compressors installed would be under UDEQ's sole authority. Decisions about the level of emissions permitted and the use of electrical or gas-fired equipment would be made by UDEQ during the permit review process. The BLM would have no authority in the process.

### 4.3.3 Mitigation

The operation of compressors would require adherence to the State of Utah Air Conservation Rules. The Companies have proposed compressors with guaranteed emission rates that would be reviewed and subsequently approved by the State.

The state and National Ambient Air Quality Standards set absolute upper limits to specific air pollutant concentrations at all locations where the public has access. The PSD program is designed to limit the incremental increase (depending on the location's classification) of specific air pollutant concentrations above a legally-defined baseline level. All NEPA analysis comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern, and do not represent a regulatory PSD Increment Consumption Analysis. The determination of PSD increment consumption is a regulatory agency responsibility conducted as part of the New Source Review process, which also includes a Federal Land Management Agency's evaluation of potential impacts to AQRV, such as visibility, aquatic ecosystems, flora, fauna, etc.

Dust suppression would be required during construction activities, but the Companies have not proposed watering or other dust suppression techniques on roads during the operational period. This would result in temporarily-elevated dust at some points on roads. Dust suppression should be applied along roads near residential areas and at congested project traffic areas.

Because of concerns raised by public comment concerning adverse visibility impacts at Class I areas under the Proposed Action and Alternative 2, this section analyzes the air quality and visibility impacts that would be associated with lower emissions rates and more refined exhaust parameters, both attainable in the industry.

Therefore, the rest of this section discloses the reduced adverse impacts that would occur with lower emission rates and more refined exhaust parameters.

### 4.3.3.1 Compressor Emissions

Information on compressor engines that would have reduced emission rates of 0.7 gm/HP-hr $NO_X$ and more refined stack parameters has been analyzed. Emissions rates for CO would remain at 2.0 gm/HP-hr because no significant CO impacts were identified under the Proposed Action. Similar to the assumption of the Proposed Action, an Approval Order from the UDEQ would be required for each individual compressor. The UDEQ's review of the request for an Approval Order would include a review to ensure the application of BACT and compliance with all applicable regulations, including the potential effect on visibility at Class I areas.

The compressor emissions and stack parameters used in the mitigation analysis were for Caterpillar Model G3606SITA natural gas-fired compressor engines. An emission rate of 0.7 gm/HP-hr $NO_X$ is guaranteed by Caterpillar for these engines. The following stack and exhaust parameters are referenced by Caterpillar and the compressor building dimensions are proposed by the Companies:

- exhaust stack height: 56 feet,
- stack diameter: 12 inches,
- exhaust temperature: 466 ° Centigrade,
- exhaust velocity: 72.1 meters/second, and
- exhaust downwash resulting from compressor buildings 28 feet high, 65 feet long, 35 feet wide.

The actual engine configuration would be based on specific data once the actual engine configuration is selected and would conform to BACT based upon the UDEQ Approval Order. These emission levels are analyzed for this mitigation because they are attainable in the industry and would significantly reduce potential impacts to visibility at Class I areas as well as significantly reduce ambient air concentrations of pollutants near proposed compressor locations. Based on these operating parameters, the $NO_X$ emissions from the 12 proposed compressors would be 232 tons per year (or 35 percent of the Proposed Action emissions) as shown in **Table 4–4**.

**Table 4–4**
**Ferron Natural Gas Project $NO_X$ Emissions with Mitigation**

| Company | Compressor Rating (HP) | Number of Compressors | Total Compression (HP) | $NO_X$ Emissions | |
|---|---|---|---|---|---|
| | | | | lbs/hour | tons/year |
| Anadarko | 3,400 | 6 | 20,400 | 31.46 | 124.1 |
| Texaco | 4,000 | 3 | 12,000 | 18.50 | 72.9 |
| Chandler | 2,200 | 2 | 4,400 | 6.78 | 29.7 |
| | 850 | 1 | 850 | 1.31 | 5.7 |
| Total | | 12 | 37,650 | 58.05 | 232.4 |

The air quality impacts analyzed for the mitigation used the same dispersion model as described under the Proposed Action. Of course, the compressor parameters were different as previously described.

### 4.3.3.2 Mitigated Air Quality Impacts

$NO_x$ and CO emissions from each compressor station under the mitigation analysis were modeled using both the 1986 and 1987 Clawson meteorological data and compared to the Class II PSD increments and the NAAQS. The modeled $NO_x$ concentrations were multiplied by a factor of 0.75 to represent the conversion of total $NO_x$ to $NO_2$. The results are summarized in **Table 4–5** and the concentration contours are shown on **Plate 4–2**. The maximum concentrations for both pollutants were slightly higher using the 1986 data. The highest $NO_2$ annual concentration would be 20.37 $\mu g/m^3$ with the background added, a value 81 percent of the PSD Class II increment and 20.4 percent of the annual NAAQS. This maximum concentration would occur on elevated terrain near Texaco's proposed compressor station in Township 17 South, Range 8 East, Section 5. However, as shown on **Plate 4–2**, most of the analysis area would have concentrations of less than 1.0 $\mu g/m^3$, a value considered to have an negligible effect on air quality. CO concentrations would be minimal compared to applicable NAAQS. The maximum one-hour average concentration would be 8,279 $\mu g/m^3$ with the assumed background, a value 20.7 percent of the one-hour CO NAAQS of 40,000 $\mu g/m^3$. Likewise, the maximum 8-hour average concentration would be 249 $\mu g/m^3$ with the assumed background, a value 22.5 percent of the 8-hour CO NAAQS. Similar to the $NO_2$ analysis, these maximum CO values would occur east of the aforementioned Texaco compressor station. Since there are few major sources of CO in and near the Project Area and the mitigated ambient concentrations would be minimal compared to all applicable air quality standards, a further analysis of CO was not performed.

**Table 4–5**
**Ferron Natural Gas Project Mitigated $NO_2$ and CO Air Quality Impacts**

| Pollutant | NAAQS ($\mu g/m^3$) | PSD Class II Increment ($\mu g/m^3$) | Averaging Period | Maximum Modeled Concentration ($\mu g/m^3$) | Background ($\mu g/m^3$) | Maximum Modeled Concentration with Background ($\mu g/m^3$) | Percent of NAAQS | Incremental Percentage Increase of Class II Increment |
|---|---|---|---|---|---|---|---|---|
| $NO_2$ | 100 | 25 | Annual | 3.37 | 17 | 20.37 | 20.4 | 81 |
| CO | 40,000 | Not Applicable | one hour | 279 | 8,000 | 8,279 | 20.7 | Not Applicable |
| CO | 10,000 | Not Applicable | eight hours | 249 | 2,000 | 2,249 | 22.5 | Not Applicable |

$NO_X$ emissions were also modeled and compared to Class I PSD increments at the closest boundary to the Canyonlands, Arches, and Capitol Reef National Parks. The Class I $NO_2$ increment is 2.5 $\mu g/m^3$. The highest annual $NO_2$ concentrations would be 0.019 $\mu g/m^3$ at the Canyonlands and Arches National Parks, and 0.028 $\mu g/m^3$ at Capitol Reef National Park. These values would be less than 1.1 percent of the Class I allowable incremental increase at these National Parks.

Based on the results of air quality modeling with recommended mitigation, it can be concluded that no adverse air quality impacts would occur.

#### 4.3.3.3 Mitigated Near-Field Visibility Impacts

The mitigated visibility analysis for the mitigation used the same methodology as for the Proposed Action. Using the modified emission source parameters, the SVR in and near the Project Area would not be reduced by more than ten percent on any day using both the 1986 and 1987 meteorological data. Therefore, it can be concluded that the recommended mitigation for the Ferron Natural Gas Project would result in no effect on the regional haze in the vicinity of the Project.

#### 4.3.3.4 Mitigated Far-Field Class I Visibility Impacts

The IWAQM method along with modifications by the UDEQ was used to evaluate effects on regional haze at Canyonlands, Arches and Capitol Reef National Parks using the mitigated emissions and source parameters. Based on this method and the modeled 24-hour $NO_X$ concentrations at the Class I areas, the regional haze reduction would exceed 5 percent on three days at Capitol Reef National Park using the 1987 meteorological data. When the 1986 meteorological data was used, the regional haze reduction at any of Class I areas would not exceed five percent. There would be no reduction greater than 10 percent using either year. When considering both years of meteorological data (730 days), the standard visual range would be reduced by more than five percent an average of 1.5 days per year, or just slightly exceeding the more restrictive National Park Service guidelines of considering an adverse impact of more than one day per year with a greater than five percent reduction.

The slight exceedance using the conservative IWAQM screening analysis represents the potential effect at Capitol Reef using the mitigated emission source parameters. The analysis demonstrates that there may be a minor impact to visual resources at Capitol Reef if all the natural gas-fired compressors are permitted and operated at the levels indicated in the mitigated analysis. Further analysis of potential visibility impacts may be required by the Utah Division of Air Quality in the future when Approval Order applications are submitted. Because there is a slight potential of adverse visibility impacts at Class I areas, there may be a upper level of gas-fired development approved by the Utah Division of Air Quality. Therefore, considering that the Ferron Natural Gas Project is considering the installation of 12 compressor stations, any compressor proposed beyond an upper level may be disapproved or have to be electrically powered.

### 4.3.4 Unavoidable Adverse Impacts

The Proposed Action and each alternative would lead to temporary increases in fugitive dust during construction. During operations, natural gas-fired compressor engine emissions from the Proposed Action could result in adverse impacts to visibility at Capitol Reef National Park, a PSD Class I area, and an exceedance of the PSD Class II increment for $NO_2$ in the Project Area. Alternative 3 represents actions beyond the jurisdiction of BLM and Forest Service and, if development occurred, potential unavoidable adverse impacts to visibility at Capitol Reef National Park and exceedence of the PSD Class II increment for $NO_2$ in the Project Area could be realized if mitigation is not implemented. With implementation of identified mitigation for Alternative 2, no adverse impacts to Class I visibility areas would be realized from the Ferron Natural Gas Project.

# 4.4 SOILS

## 4.4.1 Direct and Indirect Effects

Direct short-term impacts associated with construction activities include temporary disturbance of soils for installation of pipelines, buried electric transmission lines and construction of roads to access wells and facilities. Immediately following construction of pipelines and transmission lines, soil would be backfilled into trenches and regraded as needed. Portions of the construction right-of-way not necessary as part of the adjacent road would be reclaimed and revegetated. Portions of well pads not needed for production also would be reclaimed.

Long-term impacts would include disturbance of soils for development of production wells, disposal wells, compressor facilities, and access roads needed for the life of the project. Impacts would result from the clearing of vegetation, excavation, salvage, stockpiling, and redistribution of soils during construction and reclamation activities. Blading or excavation to achieve desired grades could result in slope steepening of exposed soils in cut and fill areas, mixing of topsoil and subsoil materials, and the breakdown of soil aggregates into loose particles. Soil structural aggregates also would be broken down by compaction from vehicular traffic. Removal and stockpiling of topsoil for revegetation purposes could reduce the natural fertility of the soil, cause a loss of soil profiles by mixing soil horizons, and a breakdown in soil structure. Soil compaction caused by equipment traffic may decrease infiltration, increase runoff and gully development, and reduce soil productivity. Long-term impacts would be greater on critical soils (as identified in Chapter 3) with slopes in excess of 6 percent. Reclamation would also be more difficult on critical soils. Analysis of reclamation potential is contained in **Section 4.17**.

There would be an increased susceptibility to erosion in newly disturbed areas. The removal of vegetative cover, steepening of slopes, and the breakdown of aggregates would increase the potential for channelized runoff and accelerated soil erosion. Wind erosion could also increase with removal of vegetation and exposure of soils. Erosion would result in the formation of more rills and gullies and increase sedimentation and salinity of surface water. Analysis of sedimentation and salinity associated with soil loss is contained in the **Section 4.2.**

Soils throughout the Project Area are naturally highly erodible. The amount of ongoing soil loss in the area under current conditions ranges from approximately 2 tons per acre per year on level, deeper soils to 12 tons per acre per year on steeper slopes with sparse vegetation (BLM 1997c). Soil loss calculation for this EIS are contained in **Appendix E**.

Indirect impacts would primarily result from off-road vehicle use and include disturbances to vegetative cover and potential for increases in rutting, erosion and compaction of soils.

### 4.4.1.1 Alternative 1 — Proposed Action

Of the 65 new wells proposed for the North Area, 28 would be located on critical soils where slopes are 6 percent or greater. The proposed CPF and compressor sites would not be located on critical soils with slopes greater than 6 percent. Five well pads would be located on slopes greater than 25 percent (including both slopes where critical soils are present and absent). In addition, nine of the new roads proposed to link new well pads with the existing road network would cross areas where slopes are greater than 25 percent. In some cases, only short road segments (less than 200 feet long) would be involved.

Of the 220 new wells proposed for the South Area, 150 would be located on critical soils where slopes exceed 6 percent. The proposed CPFs would not be located on critical soils with slopes greater than 6 percent. Thirty-nine well pads would be located on slopes greater than 25 percent (including both slopes where critical soils exist and are absent). In addition, new roads proposed to link new well pads with the existing road network would cross areas where slopes are greater than 25 percent. In some cases, only short road segments (less than 200 feet long) would be involved.

The transmission pipeline would only traverse small portions of critical soils with slopes in excess of 6 percent.

The rate of soil loss from long-term surface disturbance within the Project Area has been estimated at 11.2 tons/acre/year.

Impacts to soils from well pad, facility, access road, and pipeline construction and utilization would be greater on critical soils with slopes in excess of 6 percent and on all slopes greater than 25 percent. Water and wind erosion would increase in these areas and reclamation would be more difficult. At the end of the project, a slower recovery of these areas would be expected.

#### *4.4.1.1.1 Electric Power Option*

Under the Proposed Action, 187 miles of aboveground power lines would be installed. Half of these power lines would be installed outside of the access road ROW resulting in a temporary disturbance of 113 acres (93.5 miles X 5,280 feet/mile X 10-foot-wide ROW), or 7 percent of the 1,633 short-term disturbance to construct all other facilities within the Project Area. Clearing of vegetation along the ROW would be minimal and only limited blading of vegetation is likely to occur. Some soil compaction would occur as vehicles traverse the ROW to erect the poles and power lines. As a result, erosion potential and subsequent increased sedimentation on these soils would be minimal and short-term during the construction period. Therefore, the installation of almost 94 miles of aboveground power lines would have a minimal and short-term effects on soil resources. Because no long-term clearance of vegetation would occur, long-term impacts to soil resources are not expected.

### 4.4.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Alternative 2 would result in drilling of 18 fewer wells because of various resource protection restrictions. This alternative would also involve the implementation of the environmental protection measures identified in **Section 2.2**, which would reduce soil impacts when compared to the Proposed Action.

Under this alternative, 18 fewer, or 160, proposed wells would be located on critical soils with slopes exceeding 6 percent. Due to the extent of these soils in the project area (see **Plate 3–3**), it would not be possible to exclude the construction of these 160 wells and associated roads and pipelines, although, at the application stage, individual wells and roads could be relocated to different areas within a quarter section to avoid critical soils on slopes exceeding 6 percent if on-the-ground conditions permit. On Federal lands, all proposed wells and roads would be prohibited on slopes greater than 25 percent and would be moved or not permitted.

Soil loss from long term surface disturbance within the Project Area would be 9.9 tons/acre/year. Soil loss for Alternative 2 would be about 88 percent of the loss associated with the Proposed Action.

Impacts to soils from well pad, facility, access road, and pipeline construction and utilization would be slightly less that the Proposed Action. Soil loss from Alternative 2 would be about 12 percent less than Alternative 1. Reclamation of disturbances on critical soils with slopes exceeding 6 percent would be difficult.

#### *4.4.1.2.1 Electric Power Option*

Under Alternative 2, about 97 miles of aboveground power lines would be installed, or 90 miles less than under the Proposed Action. Half of these power lines would be installed outside of the access road ROW resulting in a temporary disturbance of 59 acres (48.5 miles X 5,280 feet/mile X 10-foot wide ROW), or about 4 percent of the 1,472 short-term disturbance to construct all other facilities within the Project Area. Clearing of vegetation along the ROW would be minimal and only limited blading of vegetation is expected to occur. Additionally, construction activities would be avoided on frozen or saturated soils. Therefore, erosion potential and increased sedimentation on these soils would be minimal and short term during the construction period. Therefore, installation of about 48 miles of aboveground power lines would have a minimal and short-term impact on soil resources. Because no long-term clearance of vegetation would occur, there would not be any long-term impacts to soil resources.

Approximately 73 miles of power lines would be buried within the access road ROW. Therefore, no additional short- or long-term disturbance to soils would occur with the installation of buried power lines.

### 4.4.1.3 Alternative 3 — No Action

Under the No Action Alternative, no additional wells would be drilled on Federal lands. Less than one mile of new roads could be constructed across BLM lands to grant access to State or private leases. None of these roads would be constructed on slopes greater than 25 percent and areas where critical soils occur on slopes greater than 6 percent would be avoided. Effects to soils on Federal lands would be slight.

155 wells and 44 miles of roads could be constructed on State and private lands. A maximum of 39 of these wells and their associated access roads could be constructed on critical soils with slopes greater than 6 percent. Increased soil erosion and sedimentation could occur at these locations if facilities would be constructed on steep slopes.

Soil loss from long-term surface disturbance in the Project Area under this alternative would be 6.6 tons/acre/year. When compared to the Proposed Action, soil loss for Alternative 3 would be about 41 percent less.

## 4.4.2 Impacts Summary

Impacts to soils from the construction of well pads, access roads, compressor facilities, injection wells, installation of gas and water pipelines, and installation of electrical power lines include:

- Increased exposure of surface soil materials to accelerated erosion and loss of soils resources.
- Increased sediment loads of stream channels and rivers, particularly increased salinity of surface water as a result of erosion of high to very highly saline soils. (Analysis of sediment and salinity increases resulting from surface disturbing activities are contained in **Section 4.2**).
- Increased volumes of surface runoff resulting in new gully development.

- Soil compaction and rutting from heavy equipment traffic.
- Reduced soil productivity as a result of decreased biological activity and reduced organic matter content of surface soils.
- Loss of soil profile due to mixing of soil horizons.
- A breakdown of soil structure.

Indirect impacts would primarily result from off road vehicle use, and include disturbances to vegetative cover and potential for increases in rutting, erosion, and compaction of soils.

Under the Proposed Action, some roads are proposed to be constructed on slopes greater than 25 percent resulting in accelerated soil erosion. This would result in the formation of more rills and gullies on and along the roads with increased sedimentation and salinity of surface water. The end result would be increased difficulty in achieving successful reclamation. Also, 178 wells would be located on critical soils with slopes greater than 6 percent. Reclamation efforts would be more difficult on these areas. For long-term surface disturbances, soil loss over the entire Project Area would be about 11.2 tons/acre/year.

With Alternative 2, environmental protection measures would be implemented to reduce effects to soils. Roads and well pads would be prohibited on slopes greater than 25 percent. Where possible, construction would be avoided on critical soils on slopes greater than 6 percent, but up to 160 wells could be drilled on such soils. Road grades exceeding 10 percent would be avoided on critical soils. Soil erosion would decrease slightly. Soil impacts would be slightly less than the Proposed Action. The rate of soil loss has been estimated at 9.9 tons/acre/year. Soil loss would be about 88 percent of the Proposed Action. The difficulty in achieving successful reclamation would be similar to the Proposed Action.

Under the No Action Alternative, 39 wells could be constructed on soils with slopes greater than 6 percent on private and State land. Average soil loss has been estimated at 6.6 tons per acre per year. These values represent about a 41 percent reduction in soil loss when compared to Alternative 1.

### 4.4.3 Mitigation

The following mitigation measures would assist in reducing effect to soils:

- To prevent unnecessary damages and soil loss, road construction or routine maintenance should be performed during periods when soils are dry enough to adequately support construction equipment. Soils would be deemed too wet if construction equipment creates ruts more than six inches deep.
- During construction, topsoil should be removed by clearing and stripping and stockpiled within or adjacent to the drill pad. Topsoil depths should be determined for individual applications by the authorizing agency. Saving topsoil would aid in site reclamation.
- To stabilize topsoil stockpiles, any areas left disturbed for more than one year should have stockpiles seeded with mixtures specified by the authorizing agency.
- Topsoil from access road construction should be windrowed along the uphill side of the road for uses as a seed bed top coating during road rehabilitation.

In addition to these measures, mitigation specified for Water Resources (**Section 4.2**) and Reclamation (**Section 4.17**) would aid in reducing erosion and facilitate reclamation.

### 4.4.4 Unavoidable Adverse Effects

Significant unavoidable adverse impacts to soils should not occur due to development of the Proposed Action or other alternatives with implementation of the mitigation measures noted above. The estimated rate of soil loss for each alternative would be within the range of naturally-occurring erosion.

## 4.5 VEGETATION

### 4.5.1 Direct and Indirect Effects

Direct effects to vegetation would occur from the disturbance or removal of vegetation for the construction of well pads, ancillary facilities, and the transmission pipeline. Duration of the effects would vary from short term to long term. Short-term effects would occur in areas where previously-vegetated areas are disturbed, but reclaimed within one to three years of the disturbance. Long-term effects would occur where well pads, roads, or other semi-permanent facilities displace previously-vegetated areas for the life of the project.

Indirect effects to vegetation would occur as a result of activities other than the direct disturbance or removal of vegetation. Sources of indirect effects would include the introduction or spread of noxious weeds; accidental spills of fuels, lubricants, or other materials; fugitive dust; and increases in the incidence of wildfire.

#### 4.5.1.1 Alternative 1 — Proposed Action

The primary impact to vegetation resources would be the direct disturbance of a total of approximately 1,633 acres distributed across seven vegetation types. The seven vegetation types include pinyon-juniper, sagebrush-grassland, barren, salt desert shrub, agriculture, urban, and riparian (impacts to riparian areas are discussed in more detail in **Section 4.6**). This removal would occur during the construction phase of the project and about 43 percent of it would occur on federal lands. Overall, direct disturbance of vegetation types in the Project Area would involve about one percent of the 111,782-acre Project Area and pipeline corridor combined.

Most of the direct disturbance associated with the project (69 percent) would occur in the South Area. Here, about 1,127 acres of vegetation types would be disturbed (about one percent of the 93,170-acre South Area). Although the direct disturbances would involve seven vegetation types, about 94 percent of the disturbance would occur in three vegetation types — the pinyon-juniper, sagebrush/grassland, and salt desert shrub types (**Table 4–6**).

Implementation of this alternative would disturb about 245 acres of the 18,350-acre North Area. However, the disturbances would involve only the pinyon-juniper, sagebrush/grassland, and salt desert shrub vegetation types (**Table 4–6**). None of the direct disturbances would involve the barren, agricultural, urban, or riparian types, which would be disturbed in the South Area and/or along the transmission pipeline's corridor.

Disturbance associated with construction of the transmission pipeline would involve an areal extent of 261 acres (**Table 4–6**). Similar to the situation with the South Area, most of this disturbance would occur

## Table 4–6
## Vegetation Disturbed for Construction of Project Facilities Under Alternative 1

| | Pinyon-juniper | | | Sagebrush Grassland | | | Salt Desert Shrub | | | Barren and Urban | | | Agriculture | | | Riparian | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Facility** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **Total** |
| **North Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 19.3 | 4.1 | 4.1 | 41.3 | 2.8 | 9.6 | 2.8 | 5.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 89.5 |
| Roads | 24.6 | 9.5 | 4.3 | 63.9 | 5.1 | 20.1 | 1.8 | 9.1 | 1.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 139.7 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 |
| CSs | 0.0 | 0.0 | 0.0 | 9.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.3 |
| Subtotal | 43.9 | 13.6 | 8.4 | 114.5 | 7.9 | 35.9 | 4.5 | 14.6 | 1.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 244.8 |
| **South Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 23.4 | 52.3 | 26.2 | 73.0 | 56.5 | 13.8 | 15.2 | 15.2 | 13.8 | 1.4 | 1.4 | 0.0 | 0.0 | 0.0 | 5.5 | 2.8 | 0.0 | 2.8 | 303.0 |
| Roads | 98.7 | 101.9 | 30.8 | 231.9 | 160.3 | 37.8 | 34.0 | 52.8 | 29.8 | 0.9 | 0.7 | 0.0 | 1.0 | 0.0 | 3.9 | 1.0 | 0.0 | 1.0 | 786.5 |
| CPFs | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 18.6 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 37.2 |
| CSs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 122.2 | 154.2 | 63.1 | 304.9 | 216.8 | 70.1 | 49.2 | 68.0 | 49.7 | 2.2 | 2.1 | 0.0 | 1.0 | 0.0 | 15.7 | 5.1 | 0.0 | 2.4 | 1,126.7 |
| **Pipeline** | | | | | | | | | | | | | | | | | | | |
| Pipeline | 11.7 | 2.7 | 36.0 | 33.6 | 0.0 | 34.1 | 17.0 | 0.0 | 48.5 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 73.7 | 0.0 | 0.0 | 2.8 | 261.4 |
| Subtotal | 11.7 | 2.7 | 36.0 | 33.6 | 0.0 | 34.1 | 17.0 | 0.0 | 48.5 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 73.7 | 0.0 | 0.0 | 2.8 | 261.4 |
| **Total** | 177.8 | 170.5 | 107.5 | 453.0 | 224.7 | 140.1 | 70.7 | 82.6 | 99.6 | 2.2 | 2.1 | 1.3 | 1.0 | 0.0 | 89.4 | 5.1 | 0.0 | 5.2 | 1,632.9 |

in the pinyon-juniper, sagebrush/grassland, and salt desert shrub vegetation types. However, the pipeline also would involve the largest areal extent of agricultural land of the Project Area's three primary components.

Upon completion of each well and road, the portion of the disturbance not needed for the facility would be reclaimed. Well pads would be reduced to about 60 percent of their initial disturbance and roads would be reduced to their 40-foot ROW width. Thus, the long-term disturbance associated with the project would be less than the areal extent of disturbances shown on **Table 4–6**. Overall, direct long-term disturbances to vegetation resources (**Table 4–7**) would be about 47 percent of the initial disturbances.

With successful reclamation of the short-term disturbances, about 763 acres of vegetation types would be converted to project facilities for the life of the project (**Table 4–7**). At the end of the project, these long-term disturbances would be reclaimed, but it could take several years. The Companies would reclaim the facilities according to the reclamation plan contained in **Appendix A**.

Implementation of this alternative also would increase the potential for the occurrence of indirect effects. Disturbances from construction would increase the potential for the limited invasion and establishment of noxious weed species. Noxious weeds tend to be aggressive colonists of disturbed areas where the native vegetation has been removed. Therefore, disturbances associated with the construction of well pads, roads, and other ancillary facilities would provide opportunities for noxious weeds to invade and become established. However, implementation of the vegetation and weed management plan (**Appendix C**), which includes the direction on the control of noxious weeds, would minimize the potential for the establishment of noxious weeds.

The increased traffic on dirt roads that would occur in association with construction and operation could also indirectly affect vegetation communities adjoining the roads by increasing the level of fugitive dust. While dust is a common environmental condition in the Project Area, increases in dust along the new roads would increase the amount of dust deposited on the leaves of plants present along those roads (primarily within 100 feet of the roads). This increase in deposition would depress photosynthesis in these plants, until the dust is removed by wind or precipitation. The effect of this deposition would be to reduce the productivity of the plants immediately along the roads.

Wetlands located within disturbance areas are anticipated to experience those impacts detailed for above for upland areas. Project facilities placed in or adjacent to spring and seep wetlands would have short- and long-term impacts to these communities. Project facilities would directly impact the hydrology and vegetation community if placed in a wetland. These impacts would permanently impact the function of the system. Project facilities would indirectly impact wetlands if placed adjacent to them. However, it is anticipated that these impacts (changes to hydrology, increase in noxious weed invasion) would be minimal and would not remain after facilities were removed.

Upon closure of the project, facilities would be removed and their disturbances would be reclaimed to stabilize soils and return the areas to productive use. This would typically entail regrading, replacing salvaged topsoil, and reseeding disturbed areas. Although reclamation of the native vegetation types present in the Project Area, particularly pinyon-juniper and salt desert shrub, efforts directed to successful reclamation of all project disturbances would be repeated until reclamation is successful.

## Table 4–7
## Vegetation Disturbed for the Life-of-Project Facilities Under Alternative 1

| | Pinyon-juniper | | | Sagebrush Grassland | | | Salt Desert Shrub | | | Barren and Urban | | | Agriculture | | | Riparian | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Facility** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **Total** |
| **North Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 11.6 | 2.5 | 2.5 | 24.8 | 1.7 | 5.8 | 1.7 | 3.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 53.7 |
| Roads | 12.6 | 4.8 | 2.2 | 32.8 | 2.6 | 10.3 | 0.9 | 4.7 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 71.7 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 |
| CSs | 0.0 | 0.0 | 0.0 | 9.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.3 |
| Subtotal | 24.2 | 7.3 | 4.7 | 66.9 | 4.3 | 22.3 | 2.6 | 8.0 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 140.9 |
| **South Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 14.0 | 31.4 | 15.7 | 43.8 | 33.9 | 8.3 | 9.1 | 9.1 | 8.3 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 3.3 | 1.7 | 0.0 | 1.7 | 181.8 |
| Roads | 50.6 | 52.2 | 15.8 | 118.9 | 82.2 | 19.4 | 17.4 | 27.1 | 15.3 | 0.4 | 0.4 | 0.0 | 0.5 | 0.0 | 2.0 | 0.5 | 0.0 | 0.5 | 403.3 |
| CPFs | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 18.6 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 37.2 |
| CSs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 64.7 | 83.6 | 37.7 | 162.7 | 116.1 | 46.2 | 26.5 | 36.2 | 29.7 | 1.3 | 1.2 | 0.0 | 0.5 | 0.0 | 11.5 | 2.2 | 0.0 | 2.2 | 622.3 |
| **Pipeline** | | | | | | | | | | | | | | | | | | | |
| Pipeline | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | 88.9 | 90.9 | 42.4 | 229.6 | 120.4 | 68.5 | 29.1 | 44.2 | 30.4 | 1.3 | 1.2 | 0.0 | 0.5 | 0.0 | 11.5 | 2.2 | 0.0 | 2.2 | 763.2 |

#### 4.5.1.1.1 Electric Power Option

Under the Proposed Action, 187 miles of aboveground power lines would be installed. Half of these power lines would be installed outside of the access road ROW resulting in a temporary disturbance of 113 acres (93.5 miles X 5,280 feet/mile X 10-foot wide ROW), or 7 percent of the 1,633 short-term disturbance to construct all other facilities within the Project Area. Clearing of vegetation along the ROW would be minimal and limited blading of vegetation is expected to occur. Vegeatation may be cleared by hand-held chainsaws or other equipment where the vegetation may impede construction or the performance of the power lines. Therefore, installation of about 94 miles of aboveground power lines would have a minimal and short-term impact on vegetation.

### 4.5.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Under Alternative 2, an estimated 1,472 acres of vegetation would be removed for the development of project facilities (**Table 4–8**). The areal extent of vegetation disturbed under this alternative would only be slightly less than that would occur under Alternative 1 (about 161 fewer acres). As with Alternative 1, most of the disturbance would occur in the South Area (about 994 acres) and most would involve the pinyon-juniper, sagebrush grassland, and salt desert shrub vegetation types. Additionally, almost 39 percent of the acreage disturbed by construction of the project would occur on Federal lands. The direct loss of vegetation in the North Area and along the corridor for the transmission pipeline would be the same as under Alternative 1.

Upon completion of each well and road, the portion of the disturbance not needed for the facility would be reclaimed. Well pads would be reduced to about 60 percent of their initial disturbance and roads would be reduced to their 40-foot ROW width. Additionally, the ROW for the transmission pipeline would be reclaimed after the pipeline is constructed. Thus, the long-term disturbance associated with Alternative 2 would be less than the areal extent of disturbances shown on **Table 4–8**. Overall, direct long-term disturbances to vegetation resources (**Table 4–9**) would be about 46 percent of the initial disturbances. With successful reclamation of the short-term disturbances, about 679 acres of vegetation types would be converted to project facilities for the life of the project (**Table 4–9**).

At the end of the project, these long-term disturbances would be reclaimed back to vegetation. The companies would reclaim the facilities according to the reclamation plan contained in **Appendix A** Because direct disturbances and reclamation would be very similar between alternatives 1 and 2, the direct effects of implementing Alternative 2 would be almost the same as those that would occur under Alternative 1.

Under Alternative 2, the vegetation/weed management plan was developed in coordination with the BLM and implemented on federal lands (**Appendix C**). Implementation of this plan would ensure vegetation and weeds around the project's facilities are managed effectively and that the management is coordinated with federal and county agencies. This action would reduce the potential short-term impact of noxious weed invasion and control the establishment of weeds during the life of the project. The potential for noxious weed invasion from facility to undisturbed areas would therefore be diminished, thereby reducing the indirect impacts to undisturbed areas. Other indirect impacts discussed in Alternative 1, such as fugitive dust, would be similar.

## Table 4–8
## Vegetation Disturbed for Construction of Project Facilities Under Alternative 2

| | Pinyon-juniper | | | Sagebrush Grassland | | | Salt Desert Shrub | | | Barren and Urban | | | Agriculture | | | Riparian | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Facility** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **Total** |
| **North Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 17.9 | 4.1 | 4.1 | 38.6 | 2.8 | 9.6 | 1.4 | 5.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 84.0 |
| Roads | 19.5 | 8.1 | 2.0 | 49.8 | 4.8 | 20.2 | 1.3 | 9.3 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 116.7 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 |
| CSs | 0.0 | 0.0 | 0.0 | 9.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.3 |
| Subtotal | 37.4 | 12.2 | 6.1 | 97.7 | 7.6 | 36.1 | 2.7 | 14.8 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 216.3 |
| **South Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 23.4 | 52.3 | 26.2 | 57.9 | 56.5 | 13.8 | 13.8 | 15.2 | 13.8 | 0.0 | 1.4 | 0.0 | 0.0 | 0.0 | 5.5 | 1.4 | 0.0 | 2.8 | 283.7 |
| Roads | 76.8 | 95.0 | 21.1 | 151.4 | 158.5 | 35.4 | 39.9 | 54.8 | 32.1 | 0.0 | 0.6 | 0.0 | 1.0 | 0.0 | 4.6 | 1.2 | 0.1 | 1.0 | 673.6 |
| CPFs | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 18.6 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 37.2 |
| CSs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 100.2 | 147.3 | 53.5 | 209.2 | 215.0 | 67.8 | 53.7 | 70.0 | 52.0 | 1.4 | 2.0 | 0.0 | 1.0 | 0.0 | 16.4 | 2.6 | 0.1 | 3.8 | 994.5 |
| **Pipeline** | | | | | | | | | | | | | | | | | | | |
| Pipeline | 11.7 | 2.7 | 36.0 | 33.6 | 0.0 | 34.1 | 17.0 | 0.0 | 48.5 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 73.7 | 0.0 | 0.0 | 2.8 | 261.4 |
| Subtotal | 11.7 | 2.7 | 36.0 | 33.6 | 0.0 | 34.1 | 17.0 | 0.0 | 48.5 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 73.7 | 0.0 | 0.0 | 2.8 | 261.4 |
| **Total** | 149.3 | 162.2 | 95.6 | 340.5 | 222.6 | 138.0 | 73.4 | 84.8 | 102.1 | 1.4 | 2.0 | 1.3 | 1.0 | 0.0 | 90.1 | 2.6 | 0.1 | 6.6 | 1,472.2 |

## Table 4–9
## Vegetation Disturbed for the Life-of-Project Facilities Under Alternative 2

| | Pinyon-juniper | | | Sagebrush Grassland | | | Salt Desert Shrub | | | Barren and Urban | | | Agriculture | | | Riparian | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Facility** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **Total** |
| **North Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 10.7 | 2.5 | 2.5 | 23.1 | 1.7 | 5.8 | 0.8 | 3.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 50.4 |
| Roads | 10.0 | 4.1 | 1.0 | 25.6 | 2.5 | 10.4 | 0.7 | 4.8 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 59.9 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 |
| CSs | 0.0 | 0.0 | 0.0 | 9.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.3 |
| Subtotal | 20.8 | 6.6 | 3.5 | 58.0 | 4.1 | 22.4 | 1.5 | 8.1 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 125.8 |
| **South Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 14.0 | 31.4 | 15.7 | 34.7 | 33.9 | 8.3 | 8.3 | 9.1 | 8.3 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 3.3 | 0.8 | 0.0 | 1.7 | 170.2 |
| Roads | 39.4 | 48.7 | 10.8 | 77.6 | 81.3 | 18.2 | 20.5 | 28.1 | 16.4 | 0.0 | 0.3 | 0.0 | 0.5 | 0.0 | 2.4 | 0.6 | 0.0 | 0.5 | 345.4 |
| CPFs | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 18.6 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 37.2 |
| CSs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 53.4 | 80.1 | 32.7 | 112.3 | 115.2 | 45.0 | 28.8 | 37.2 | 30.9 | 0.0 | 1.1 | 0.0 | 0.5 | 0.0 | 11.9 | 1.4 | 0.0 | 2.2 | 552.9 |
| **Pipeline** | | | | | | | | | | | | | | | | | | | |
| Pipeline | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | 74.2 | 86.7 | 36.2 | 170.3 | 119.3 | 67.4 | 30.3 | 45.3 | 31.7 | 0.0 | 1.1 | 0.0 | 0.5 | 0.0 | 11.9 | 1.4 | 0.0 | 2.2 | 678.7 |

#### 4.5.1.2.1 Electric Power Option

Under Alternative 2, 97 miles of aboveground power lines would be installed. Half of these power lines would be installed outside of the access road ROW resulting in a temporary disturbance of 59 acres (48.5 miles X 5,280 feet/mile X 10-foot wide ROW), or 4 percent of the 1,472 short-term disturbance to construct all facilities within the Project Area. Clearing of vegetation along the ROW would be minimal and no blading of vegetation would occur. Installation of power poles would be aligned to avoid sensitive plant species. None of these species would be removed without prior consultation with the BLM. Vegeatation may be cleared by hand-held chainsaws or other equipment where the vegetation may impede the performance of the power lines. Therefore, it is concluded that the installation of 48.5 miles of aboveground power lines would have a minimal and short-term impact on vegetation.

Approximately 73 miles of power lines would be buried within the access road ROW. Therefore, no additional short- or long-term disturbance to vegetation would occur with the installation of buried power lines.

### 4.5.1.3 Alternative 3 — No Action

Under Alternative 3, no additional gas drilling would be authorized on federal lands. Drilling on private and state lands would entail the placement of an additional 155 wells in the Project Area, 19 in the North Area and 136 in the South Area. As is common to all of the alternatives, the primary impact to vegetation resources caused by Alternative 3 would be the direct removal of vegetation during the construction phase of the project. A total of about 917 acres of vegetation on state and private lands would be disturbed for the construction of these 155 wells and the roads and CPFs needed to support them (**Table 4–10**). Although the proportional distribution of the disturbances would be similar to those associated with alternatives 1 and 2, the overall areal extent of disturbance under this alternative would be smaller than would occur under either of the other two alternatives.

Long-term effects to vegetation probably would be similar to the short-term effects. The Companies would reclaim the well pads, access roads, and other facilities on state and private lands according to agreements developed between each company and individual landowner. Assuming the reduction in pad size is similar to what would occur under alternatives 1 and 2, long-term disturbance would involve about 367 acres (**Table 4–11**).

The types of indirect effects that would occur under this alternative would be the same as those described for alternatives 1 and 2. However, the extent of the effects would be substantially smaller because the number and areal extent of facilities and disturbances would be smaller. Consequently, any increase in the potential for noxious weeds and the effects of dust accumulating on plants near roads would be smaller than would occur under alternatives 1 or 2.

## 4.5.2 Impacts Summary

All three alternatives would remove at least some of seven vegetation types present in the Project Area. Alternatives 1 and 2 would remove similar amounts of vegetation, over both the short and long terms. The indirect effects of Alternative 2 would be less than those that would occur under Alternative 1 due to the implementation of the Vegetation and Weed Management Plan. Alternative 3 would have the fewest direct and indirect effects, primarily due to the more limited scope of development that would occur under that alternative.

## Table 4–10
## Vegetation Disturbed for Construction of Project Facilities Under Alternative 3

| | Pinyon-juniper | | | Sagebrush Grassland | | | Salt Desert Shrub | | | Barren and Urban | | | Agriculture | | | Riparian | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Facility** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **Total** |
| **North Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 0.0 | 4.1 | 4.1 | 0.0 | 2.8 | 9.6 | 0.0 | 5.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.2 |
| Roads | 0.05 | 7.9 | 3.4 | 1.0 | 5.1 | 13.4 | 0.1 | 9.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 40.5 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| CSs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 0.0 | 12.1 | 7.5 | 1.0 | 7.8 | 23.1 | 0.1 | 14.8 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 66.6 |
| **South Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 0.0 | 52.3 | 26.2 | 0.0 | 56.5 | 13.8 | 0.0 | 15.2 | 13.8 | 0.0 | 1.4 | 0.0 | 0.0 | 0.0 | 5.5 | 0.0 | 0.0 | 2.8 | 187.3 |
| Roads | 0.0 | 96.5 | 18.8 | 2.1 | 151.1 | 25.3 | 0.0 | 52.2 | 25.1 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | 3.9 | 0.1 | 0.0 | 1.2 | 377.3 |
| CPFs | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 12.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 24.8 |
| CSs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 0.0 | 148.9 | 51.1 | 2.1 | 207.6 | 51.5 | 0.0 | 67.6 | 38.9 | 0.0 | 2.1 | 0.0 | 0.0 | 0.0 | 15.7 | 0.1 | 0.0 | 4.0 | 589.4 |
| **Pipeline** | | | | | | | | | | | | | | | | | | | |
| Pipeline | 11.7 | 2.7 | 36.0 | 33.6 | 0.0 | 34.1 | 17.0 | 0.0 | 48.5 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 73.7 | 0.0 | 0.0 | 2.8 | 261.4 |
| Subtotal | 11.7 | 2.7 | 36.0 | 33.6 | 0.0 | 34.1 | 17.0 | 0.0 | 48.5 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 73.7 | 0.0 | 0.0 | 2.8 | 261.4 |
| **Total** | 11.7 | 163.7 | 94.6 | 36.7 | 215.4 | 108.7 | 17.1 | 82.4 | 87.5 | 0.0 | 2.1 | 1.3 | 0.0 | 0.0 | 89.4 | 0.1 | 0.0 | 6.8 | 917.4 |

## Table 4–11
## Vegetation Disturbed for the Life-of-Project Facilities Under Alternative 3

| | Pinyon-juniper | | | Sagebrush Grassland | | | Salt Desert Shrub | | | Barren and Urban | | | Agriculture | | | Riparian | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Facility** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **BLM** | **State** | **Private** | **Total** |
| **North Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 0.0 | 2.5 | 2.5 | 0.0 | 1.7 | 5.8 | 0.0 | 3.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.7 |
| Roads | 0.0 | 4.1 | 1.7 | 0.5 | 2.6 | 6.9 | 0.1 | 4.8 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.7 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| CSs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 0.0 | 6.6 | 4.2 | 0.5 | 4.3 | 12.7 | 0.1 | 8.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 36.5 |
| **South Area** | | | | | | | | | | | | | | | | | | | |
| Wells | 0.0 | 31.4 | 15.7 | 0.0 | 33.9 | 8.3 | 0.0 | 9.1 | 8.3 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 3.3 | 0.0 | 0.0 | 1.7 | 112.4 |
| Roads | 0.0 | 49.5 | 9.6 | 1.1 | 77.5 | 13.0 | 0.0 | 26.9 | 12.9 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.6 | 193.5 |
| CPFs | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 12.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 24.8 |
| CSs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 0.0 | 80.9 | 31.5 | 1.1 | 111.4 | 33.6 | 0.0 | 36.0 | 21.1 | 0.0 | 1.2 | 0.0 | 0.0 | 0.0 | 11.5 | 0.0 | 0.0 | 2.3 | 330.7 |
| **Pipeline** | | | | | | | | | | | | | | | | | | | |
| Pipeline | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | 0.0 | 87.5 | 35.7 | 1.6 | 115.7 | 46.3 | 0.1 | 44.1 | 21.2 | 0.0 | 1.2 | 0.0 | 0.0 | 0.0 | 11.5 | 0.0 | 0.0 | 2.3 | 367.2 |

## 4.5.3 Mitigation

No additional mitigation is recommended.

## 4.5.4 Unavoidable Adverse Effects

Unavoidable direct and indirect adverse effects would occur under each of the three alternatives. In each case, at least 917 acres of vegetation types would be directly disturbed. The areal extent of disturbance would be greatest with Alternative 1 and smallest with Alternative 3. Furthermore, the acreage that would be disturbed under each alternative would be subject to a higher potential for the invasion of noxious weeds and would require annual attention and, possibly, treatment to prevent the spread of these weeds. Revegetation could take several years to complete.

# 4.6 RIPARIAN AREAS

## 4.6.1 Direct and Indirect Effects

### 4.6.1.1 Alternative 1 — Proposed Action

Under the Proposed Action, approximately one well pad would be placed on private land and three well pads would be placed on public lands in the riparian communities defining Huntington Creek and Cottonwood Creek. Additionally, several access roads and the transmission pipeline would cross riparian areas. One compressor station would be placed very near to a privately-owned portion of the Cottonwood Creek riparian area.

Impacts associated with the placement of these facilities would be both short and long term. Construction of the four well pads, access roads, and transmission pipeline would disturb about 5.5 acres, 2.0 acres, and 2.8 acres of riparian areas, respectively. About half of this disturbance would occur on State and privately-owned lands. Following the successful completion of these wells, part of the pads (about 3.3 acres for the four wells), part of the ROWs for the access roads (about 1.0 acres of the access roads' ROWs), and the ROW for the transmission pipeline would be reclaimed. However, this reclamation would not replace any of the larger trees removed for construction. Thus, these reclaimed areas would not return to a state similar to that present in the existing environment until the new trees had the time to grow and mature, which would be many years after the project's expected life. Additionally, the disturbance would increase the potential opportunities for noxious weeds to move in, which would affect the natural structure of the understory and the diversity native species present in the areas.

Under the Proposed Action, no specific reclamation is proposed for riparian areas that are disturbed by facility placement, and thus it is anticipated that long-term impacts to the Huntington Creek and Cottonwood Creek riparian communities would occur as a result of the project. Long-term impacts to the riparian areas would result primarily as a result of the removal of mature woody over story. Over the 20-year life of the project, this removal of mature trees would change the microclimate (temperature, moisture retention) of the community, modifying the vegetative productivity of the area and hindering the potential recovery of the riparian understory. Furthermore, the associated increase in sedimentation and water temperature brought on by a reduction of vegetation coverage in riparian areas is often associated with the degradation of the a

stream bank. The loss of overstory trees also would have a limited effect on species of wildlife that inhabit riparian areas, especially birds that nest or forage in the overstory that would be removed.

#### *4.6.1.1.1 Electric Power Option*

Implementation of the this option would result in minimal additional effects to riparian areas. Disturbance associated with construction of the 94 miles of aboveground power lines located away from access roads may affect minor portions of riparian areas, depending upon the final alignments of the power lines. However, these effects would be limited and probably avoidable with minor relocations of the power lines.

### 4.6.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Under Alternative 2, disturbances to riparian areas would be slightly less than those expected for the Proposed Action. About 6.4 acres of riparian areas may be affected by the construction of three wells and access roads and 2.8 acres would be affected by the construction of the transmission pipeline. About 2.6 acres of the disturbance would occur on federal lands. Although an environmental protection measure was developed to encourage avoidance of wetlands and riparian areas by avoiding disturbances within 220 feet of streams/riparian areas, the 9.2 acres potentially affected under this alternative may be difficult to avoid. With reclamation of parts of the well pad and road disturbances, the understory on about 5.6 acres of riparian areas disturbed for the construction of the well pad and access roads would be redeveloped. However, the woody species (e.g., cottonwood trees) are unlikely to become reestablished before the end of the project's 20-year life. Thus, the effects of the disturbance would be long term in nature and would affect both the vegetative and wildlife communities.

The indirect effects of implementing this alternative would be similar to those identified for Alternative 1. An increase in the potential for the establishment of noxious weeds would occur and the loss of the overstory may have relatively minor effects on local water quality and wildlife.

#### *4.6.1.2.1 Electric Power Option*

Implementation of the this option would result in minimal additional effects to riparian areas. Disturbance associated with construction of the 59 miles of aboveground power lines located away from access roads may affect minor portions of riparian areas, depending upon the final alignments of the power lines. However, these effects would be limited and probably avoidable with minor relocations of the power lines.

### 4.6.1.3 Alternative 3 — No Action

Under this alternative, only a very small amount of riparian areas (0.1) on federal lands would be affected. Construction of well pads and access roads on privately-owned lands may directly affect about 4.0 acres of riparian areas and construction of the transmission pipeline may directly affect about 2.8 acres of riparian areas. The loss of this acreage of riparian areas would long term in nature, primarily because of the length of time needed to reestablish the woody species.

Although the BLM and Forest Service would have no jurisdiction over the well constructed under this alternative, they assume the other landowners would require reclamation and these efforts would begin the first fall after the well goes into production and continue through the development period and beyond, as necessary. Assuming the disturbances associated with the well pad and roads would be reduced as soon as

the wells are completed and brought on line, reclamation would begin on most (4.5 acres)of the 6.9 acres of riparian areas disturbed under this alternative.

### 4.6.2 Impacts Summary

All three alternatives would adversely affect riparian areas present in the South Area (no riparian areas are present in the North Area). However, the areal extent of riparian areas affected would range from about 6.9 acres (Alternative 3) to 10.3 acres (Alternative 1). Essentially, the disturbances would be limited to the Huntington Creek and Cottonwood Creek drainages.

### 4.6.3 Mitigation

Reclamation of roads and facilities that includes planting of seedlings would speed up the reclamation of riparian areas. No additional mitigation is proposed, beyond the avoidance of riparian areas to the extent practical. The essence of this measure is contained in the Environmental Protection Measure for wetlands and riparian areas included under Alternative 2. The application of this measure as mitigation for Alternative 1 also would minimize the adverse effects to riparian areas. This Environmental Protection Measure cannot be added to Alternative 3 as mitigation because the location of almost all the roads and the one well on state and private lands would be determined through negotiations between the landowner and specific company involved.

### 4.6.4 Unavoidable Adverse Impacts

Unless the BLM is able to move all well pads and access roads outside of riparian areas during the APD process, at least a few acres of riparian areas would be disturbed by construction of each of the three alternatives. The amount of this disturbance may reach as high as about 10.3 acres of riparian areas in the Huntington Creek and Cottonwood Creek drainages.

## 4.7 WILDLIFE

### 4.7.1 Introduction

Several direct and indirect effects to aquatic species are of primary concern with natural gas development projects, such as the Ferron Natural Gas Project, and were considered in this analysis. They include changes in the timing and amounts of runoff, increases in sedimentation and concentration of salts of streams, accidental spills of fuels or drilling fluids, and the loss of or reduction in the function of springs or seeps. Increased sedimentation can affect aquatic resources by filling inter-gravel spaces and pool habitats. This filling can reduce available aquatic habitat, thereby reducing spawning habitat, rearing habitat, and macroinvertebrate production (the fishery's primary food supply). Increases in salts can alter the algae and macroinvertebrate composition and, if severe enough, alter the abundance and diversity of fish species. Spills of fuels or drilling fluids could affect the aquatic resource by killing fish and macroinvertebrates. The level and downstream extent of such a kill would depend on the volume spilled, distance the spill occurs from surface water, and the ability of the particular surface water to dilute the spill. The loss of or reduction in function of springs or seeps could reduce the volume of water in the stream or reduce the quality of water downstream of the spring or seep. It also could eliminate the aquatic invertebrates that depend on the system for survival, thereby, eliminating a portion of the adjacent fishery's food supply.

The principal impacts to terrestrial wildlife likely to be associated with the proposed project include: (1) the loss of certain wildlife habitats due to the development of drilling and production operations, (2) habitat fragmentation, (3) the displacement of some wildlife species, (4) an increase in the potential for collisions between wildlife and motor vehicles, and (5) an increase in the potential for illegal kill and harassment of wildlife. The magnitude of impacts to wildlife resources would depend on a number of factors including the type and duration of disturbance, the species of wildlife present, time of year, and implementation of recommended and required mitigative measures. Mule deer and raptors are the wildlife species that would be most adversely affected by the development under all alternatives. Adverse effects are primarily associated with disturbances on, and displacement from winter ranges.

## 4.7.2 Direct and Indirect Effects

### 4.7.2.1 Alternative 1 — Proposed Action

#### *4.7.2.1.1 Aquatic Species*

As discussed under Water Resources (**Section 4.2**), no substantial long-term, direct or indirect effects to surface water quality are anticipated under this alternative. Similarly, no depletions of surface water are expected. Consequently, long-term, direct or indirect effects to aquatic species caused by adverse changes in the quality or quantity of water in the Project Area's streams also are not expected over the long term.

Although long-term, direct or indirect effects to aquatic species are not anticipated, short-term direct or indirect effects would occur in the South Area and along the corridor for the transmission pipeline. Impacts to the aquatic resources within the North Area would be less than those in the South Area. This is because the Proposed Action has no wells or facilities have been proposed adjacent to perennial streams or 100-year floodplains within the North Area. Five wells are proposed in intermittent or ephemeral channel beds, which would produce substantial sediment loss through those facilities during precipitation events. However, no fish populations occur within the North Area and, as a result, impacts to the fisheries would only occur downstream where fish occur.

Impacts to the aquatic resources in the South Area would be greater than those in the North Area. This is primarily because four existing wells and twelve proposed wells will likely occur in floodplains adjacent to perennial streams in the South Area (which include acreage outside of riparian areas). Furthermore, 17 proposed wells and six existing wells are in the middle of intermittent or ephemeral channel beds in the South Area.

Potential impacts to aquatic resources could result from increased sedimentation, temperature, and potential impacts resulting from spills. Increased sedimentation can affect aquatic resources by filling inter-gravel spaces and pool habitats. This reduces available aquatic habitat, thereby reducing spawning habitat, rearing habitat, and macroinvertebrate production (the fishery's primary food supply). Increases in temperature could affect aquatic resources by altering the algae and macroinvertebrate composition and, if severe enough, altering the fish species abundance and diversity. Spills of fuel or drilling fluids could have an adverse effect to aquatic resources by directly killing fish and macroinvertebrates. The level and downstream extent of impact would be determined by the spill volume, distance from a surface water, and diluting ability of the particular surface water.

The pipeline would cross many ephemeral or intermittent washes and four perennial stream: Ferron, Cottonwood, Huntington, and Miller creeks. Stream sedimentation would exceed typical levels throughout

construction and for several days following installation. Sedimentation loss associated with underground utilities would be similar to those of the pipeline installation except that the right-of-way is only 10 feet rather than 30 feet.

#### 4.7.2.1.2 Terrestrial Wildlife

Under the Proposed Action, 353 production wells and related facilities would be developed and interconnected within the Project Area over a five-year period. This development includes 80 wells within the North Area (15 existing and 65 proposed) and 273 wells in the South Area (53 existing and 220 proposed). The precise number of wells and their exact locations, however, would be determined subsequent to the EIS based on further refinement of environmental and engineering constraints at each site during the APD process as previously discussed in Chapter 1. By combining current approved spacing scenarios with information on existing well locations, the analysis of impacts to wildlife for the proposed project was based on reasonably foreseeable spacing and drilling projections into areas within the North and South project boundaries where the planned production and development activities would likely occur.

Implementation of the proposed 353-well program would result in the direct disturbance of 245 and 1,127 acres of general wildlife habitats in the North and South Areas, respectively, over five years of construction. Additionally, construction of the transmission pipeline would disturb another 261 acres.

During the production phase, the unused portions of well sites would be reclaimed. Following completion of production operations, the well field and ancillary facilities would be reclaimed and abandoned. Well pads would be removed and the areas revegetated with seed mixes approved by the BLM, some of which are specifically oriented to enhance wildlife use. The duration of impacts to vegetation would depend, in part, on the success of mitigation and reclamation efforts and the time needed for natural succession to return revegetated areas to pre-disturbance conditions. Grasses and forbs are expected to become established within the first several years following reclamation, however, an estimated 8 to 20 years would be required for shrub establishment and production of useable forage (Plummer et al. 1968, Environmental Studies Board 1974, Fisser 1981, and Wasser and Shoemaker 1982). Consequently, the disturbance of pinyon-juniper and sagebrush habitats within the Project Area would represent a long-term loss to those species that depend on such vegetation for forage or shelter.

Indirect effects due to displacement of wildlife also would occur, particularly during the construction phase. In response to the increase in human activity, equipment operation, vehicular traffic, and noise, wildlife would avoid or move away from the sources of disturbance to other habitats. This avoidance or displacement would result in under use of the physically-unaltered habitats adjoining the disturbances. The net result would be that the value of the habitats near the disturbances would be decreased, previous distributional patterns would be altered, and the habitats would not support the same level of use by wildlife as before the onset of the disturbance. Additionally, use of other habitats would increase as the animals move away from the disturbances and at least some degree of overuse and degradation of those habitats would occur. The amount of avoidance that would occur would vary by species and individual. The primary concern for displacement effects would be for mule deer and elk, which are discussed below.

The primary concern for displacement effects would be for mule deer and elk. Displacement of big game (mule deer and elk) has been documented by various studies, including Rost and Bailey (1979), Ward et al. (1980), and Lyon (1985) . These studies suggest disturbances associated with human activities and traffic on roads reduces the use of habitats near the activities by deer and elk. The distance the animals in the studies moved away from the disturbances ranges from about 660 feet (200 meters) for deer to more than

2,600 feet (800 meters) for elk. The actual distance the animals moved to avoid vehicular traffic and other human activities was influenced by topography, the presence of vegetation that screened the disturbance, the intensity of the activities or disturbance, speed of traffic, and the amount of out-of-vehicle activity.

Although deer and elk tend to avoid human activities and vehicular traffic, they do adapt to these disturbances to some degree. This is particularly apparent where the disturbances are predictable or constant in occurrence and no out-of-vehicle activity occurs. Additionally, non-migratory and non-hunted populations tend to adapt more readily (herds in the Project Area are migratory and are hunted).

Depending upon the carrying capacity of the habitats and the number of animals involved, displacement would likely result in the under utilization of habitats near the disturbances and overcrowding of habitats into which the animals are displaced. This overcrowding may cause an increase in competition for space and forage, increase in the animals stress, and a decrease in the animals physical condition. Also, winter mortality may increase and successful reproduction may decrease. The effects of displacement would be of greatest concern in the crucial and high priority winter ranges.

#### 4.7.2.1.2.1 Mule Deer

All of the proposed new wells in the North Area would be drilled in crucial winter range or high priority winter range. Forty-six wells would be drilled within crucial winter range. The development of these wells and their associated roads and pipelines would directly disturb approximately 164 acres of crucial winter range, which represents about 1.4 percent of the 11,852 acres of crucial winter range delineated in the North Area. Additionally, the development of the other 19 wells and their associated roads and pipelines would directly disturb about 65 acres of high priority winter range. This accounts for about 1 percent of the 6,611 acres of high priority winter range delineated in the North Area.

An estimated 177 (80 percent) of the 220 new wells proposed for drilling in the South Area would be drilled in crucial winter range or high priority winter range for mule deer. Ninety-nine wells would be drilled within crucial winter range. The development of these wells and their associated roads and pipelines would directly disturb about 500 acres of this crucial winter range, which is less than 2 percent of the 31,290 acres of crucial winter range delineated in the South Area. Another 78 wells would be drilled within high priority winter range and would disturb approximately 390 acres of this range. These wells and their associated roads and pipelines would disturb about 1.5 percent of the 26,124 acres of high priority winter range delineated in the South Area.

Construction of the transmission pipeline would not disturb any mule deer crucial or high priority winter range.

Reclamation efforts would proceed beginning the first fall after wells go into production and continue through the five-year development period and beyond. Such reclamation includes pipeline and utility ROWs, partial restoration of active well pads, and total restoration of abandoned well sites and associated roads. Projected reclamation efforts associated with wells and roads would reduce direct disturbance (short-term) of crucial winter range in the North Area (164 acres) and in the South Area (500 acres) to 90 acres and 269 acres, respectively, over the life of the project. Similarly, reclamation efforts would reduce direct disturbance of high priority winter range in the North Area (65 acres) and in the South Area (390 acres) to 36 acres and 210 acres, respectively, over the life of the project.

Indirect effects to mule deer include displacement of animals from winter range that is not physically disturbed, deer-vehicle collisions, and poaching. Displacement of mule deer has been documented by various studies, including Rost and Bailey (1979), Ward et al. (1980), and Lyon (1985) . These studies suggest disturbances associated with human activities and traffic on roads reduces the use of habitats near the activities by deer. The distance deer in the studies moved away from the disturbances ranged up to about 660 feet (200 meters). The actual distance the animals moved to avoid vehicular traffic and other human activities was influenced by topography, the presence of vegetation that screened the disturbance, the intensity of the activities or disturbance, speed of traffic, and the amount of out-of-vehicle activity. Within the Project Area, agricultural areas in particular would likely experience an increase in use by deer displaced from crucial winter and high priority winter ranges. This displacement could continue longer than the life of the project due to habituation of deer to use of these agricultural areas.

Assuming the use of winter range within 660 feet of the project's facilities would be reduced by some unknown amount, the areal extent of effects would increase from the direct effects described above. In the North Area, proposed facilities would indirectly affect 2,819 acres of crucial winter range and about 1,416 acres of high priority winter range, in addition to the direct disturbance identified above. Thus, directly and indirectly, this alternative may affect about 24 percent of crucial winter range and 22 percent of high priority winter range present within the North Area. In the South Area, the project's facilities would indirectly affect about 7,533 acres of crucial range and 5,972 acres of high priority winter range. When considered with direct effects, about 26 percent of crucial winter range would be directly or indirectly affected over the life of the project. Similarly, about 24 percent of the high priority winter range delineated in the South Area would be affected directly or indirectly for the life of the project. The "loss" of these indirectly-affected acreages may cause the deer to remain on ranges on the Manti-La Sal National Forest later into the winter than the deer may otherwise, which would affect the availability of forage on the Forest. Big game winter range could be fragmented if connections between winter range are disturbed.

Although deer and elk tend to avoid human activities and vehicular traffic, they do adapt to these disturbances to some degree. This is particularly apparent where the disturbances are predictable or constant in occurrence and no out-of-vehicle activity occurs. Use of telemetry by Texaco would reduce the levels of human activities and vehicular traffic in Texaco's portion of the Project Area. Additionally, non-migratory and non-hunted populations tend to adapt more readily (herds in the Project Area are migratory and are hunted).

The direct and indirect disturbances of crucial winter and high priority winter ranges combined with the increase in human activities and vehicular traffic are likely to decrease the ultimate carrying capacity of the Project Area for mule deer. However, the amount of this decrease cannot be projected effectively due to the large number of variables that affect carrying capacity. Depending upon the final degree of this likely decrease in carrying capacity, the UDWR may not be able to attain its current management objectives for the populations of deer in the four herd units that encompass the Project Area. As a consequence, UDWR may not be able to meet its management objectives for harvests in these units.

Although the project is unlikely to affect predators of mule deer presently occupying the Project Area, it could indirectly affect the ultimate size of their future populations. If UDWR cannot attain its management objectives for populations of mule deer in the herd units encompassing the Project Area, the ultimate number of predators supported by mule deer in the Project Area also could be reduced. As a result, the number of predators supported by local populations of mule deer may not grow as much as they might without the project.

Depending upon the carrying capacity of the habitats and the number of animals involved, displacement would likely result in the under utilization of habitats near the disturbances and overcrowding of habitats into which the animals are displaced. This overcrowding may cause an increase in competition for space and forage, increase in the animals stress, and a decrease in the animals physical condition. Also, winter mortality may increase and successful reproduction may decrease. The effects of displacement would be of greatest concern in the crucial and high priority winter ranges.

The potential for vehicle collisions with mule deer, especially during the spring, summer, and fall months, would increase with the creation of 15 and 83 miles of new access roads in the North Area and South Area, respectively. The potential would be highest during construction of the wells due to the larger number of vehicles involved. Although the higher potential would continue throughout all phases of the well operations, it would be at a lower rate.

The short-term influx of temporary construction workers and the long-term increase in the use of the area by gas field employees could increase the potential for poaching and general harassment of mule deer. However, because the companies have committed to not allowing workers to carry firearms in the Project Area and to informing workers of the adverse effects of harassing wildlife, the potential increase in poaching and general harassment would be limited. The potential for poaching and harassment could increase over current conditions with implementation of this alternative.

Public vehicle use on roads built to access gas wells can have a similar, additive, or possibly a synergistic influence on reducing mule deer use of adjacent habitats, as well as causing additional impacts. Public access to isolated road systems in the Project Area increases the potential for poaching and general harassment of deer.

#### 4.7.2.1.2.2 Elk

Under this alternative, an estimated 37 of the 220 proposed wells (17 percent) would be drilled within crucial winter range for elk in the South Area. No crucial or high priority winter ranges have been delineated in the North Area or along the pipeline corridor. The development of these wells along with associated road and pipeline installation would initially disturb an estimated 173 acres of habitats. An additional 13 wells would be drilled in high priority winter range resulting in the disturbance of approximately 34 acres of this range. The remainder of the proposed wells are not in designated elk winter ranges. Following the initial construction period (5 years) and reclamation, disturbance would be reduced to 93 and 19 acres in crucial winter range and high priority winter range, respectively.

Indirect effects to elk include displacement of animals from winter range that is not physically disturbed, elk-vehicle collisions, and poaching. Displacement of elk has been documented by various studies, including Rost and Bailey (1979), Ward et al. (1980), and Lyon (1985). These studies suggest disturbances associated with human activities and traffic on roads reduces the use of habitats near the activities by elk. The distance elk in the studies moved away from the disturbances ranged up to about 2,600 feet (800 meters). As with deer, the actual distance the animals moved to avoid vehicular traffic and other human activities was influenced by topography, the presence of vegetation that screened the disturbance, the intensity of the activities or disturbance, speed of traffic, and the amount of out-of-vehicle activity.

Assuming the use of winter range within 2,600 feet of the project's facilities would be reduced by some unknown amount, the areal extent of effects would increase from the direct effects described above. Overall, the project's facilities could indirectly affect the entire 8,989 acres of crucial range and 2,980 acres of high

priority winter range delineated in the South Area, depending upon topography and other considerations. The project may indirectly influence the winter ranges on the Forest. As was discussed with mule deer, the "loss" of these indirectly-affected acreages may cause the elk to remain on ranges on the Manti-La Sal National Forest later into the winter than the elk may otherwise, which would affect the availability of forage on the Forest. Big game winter range could be fragmented if connections between winter range are disturbed.

Displacement of the elk from crucial winter range may result in a substantial adverse effect because the number of elk that would be involved is sufficiently large. Within the Project Area, agricultural areas in particular are likely to experience an increase in use by elk displaced from crucial winter and high priority winter ranges. However, vehicle collision and poaching/harassment impacts to elk are expected to be minimal. Limited adverse impacts to elk are expected as a result of direct habitat disturbance under this alternative because of the relatively small total area involved and habitats similar to those impacted are readily available in surrounding areas.

As with mule deer, the direct and indirect disturbances of crucial winter and high priority winter ranges combined with the increase in human activities and vehicular traffic are likely to decrease the ultimate carrying capacity of the Project Area for elk. However, the amount of this decrease cannot be projected effectively due to the large number of variables that affect carrying capacity. Depending upon the final degree of this likely decrease in carrying capacity, the UDWR may not be able to attain its current management objectives for the populations of elk in the herd units that encompass the Project Area. As a consequence, UDWR may not be able to meet its management objectives for harvests in these units.

#### 4.7.2.1.2.3 Antelope

Implementation of this alternative is not expected to result in adverse effects to antelope. Unlike the situation with mule deer and elk, facilities comprising this alternative do not involve any crucial or high priority ranges for antelope. Additionally, the Project Area does not support any populations of antelope.

#### 4.7.2.1.2.4 Raptors

Potential impacts of the Proposed Action on raptors are: (1) territory abandonment, nest desertions and/or reproductive failure caused by project-related disturbance, (2) increased public access and subsequent human disturbance resulting from new road construction, (3) temporary or permanent reductions or changes in prey populations, and (4) increases in the sizes of raptor territories. Based on aerial inventories conducted in the spring of 1997 and 1998, 140 raptor nests were identified within the Project Area.

##### 4.7.2.1.2.4.1 Nesting-Related Impacts

When human activities occur within the zone of influence of raptor nests during the breeding/nesting season, stress from increased human activity and increased noise levels may result in nest abandonment, lowered productivity levels, or abandonment of the entire territory. Potential effects that human disturbance can have on nesting raptors include nest desertion, damage to eggs or young caused by frightened adults, overexposure of eggs or young to heat or cold, missed feedings, premature fledging of young, and possible increased predation (Fyfe and Olendorff 1976). The nest construction and egg laying phases in Buteo nesting cycles are considered to be a very sensitive time for disturbance. Later in the nesting cycle, however, tolerance to humans is much greater (Call 1978). The potential for these impacts would greatest during the construction phase when human activity levels are highest, and would generally decrease during production.

Wells, access roads, or other facilities would be constructed within 0.5 mile of the nest under Alternative 1. No facilities would be constructed within 0.5 mile of a raptor nest in the North Area or along the ROW for the transmission pipeline. With the seasonal restriction (discussed below), breeding birds would not be disturbed.

#### 4.7.2.1.2.4.2 Buffer Zones

Construction activities near active nests in the Project Area would be subject to seasonal restrictions as specified in the management plans and would be protected until raptor use for nesting that season was determined. For purposes of analysis in this EIS, buffer zones extend outward from each nest ½-mile in all directions. However, final shapes of zones would be determined in coordination with USFWS and UDWR on a site-specific basis based on the degree of visual screening associated with each nest. Where there is no visual screening, zone widths are at the ½-mile maximum; where visual obscurity is provided by topography, zone widths could be reduced to something less than ½ mile, if approved by the Authorizing Officer in coordination with the USFWS and UDWR. The exclusionary time window for all species of raptors nesting activities would extend from February 1 through August 15. If no nesting activity is observed by June 1 (after the annual raptor survey is completed), it can be concluded that it is almost certain that the given nest would not be used during the current nesting season and the BLM could authorize construction activities to proceed at such sites.

Once a well is constructed within the buffer zone for a specific nest, various activities would occur irrespective of the nest's occupancy status. The Companies' field personnel would conduct daily well inspections and maintenance on an as-needed basis. The daily disturbance by the field personnel could prevent raptors from utilizing the established nest locations and raptors may abandon the nesting territory altogether. As adjacent habitats become increasingly fragmented due to concentrated well densities in portions of the Project Area, the availability of alternative nest sites could become limited. Maintenance, such as workovers or other activities that involve noisy, heavy equipment or a continuous human presences may result in abandonment of the nest and loss of eggs or young.

According to the radius applied on the raptor nests identified for analysis under this alternative, approximately 22,663 acres in the South Area and 3,407 acres in the North Area (associated with 111 nests and 29 nests, respectively) could be subject to seasonal restrictions (however, all but 81 of these nests do not have any facilities proposed within their 0.5-mile buffer zones). The combined extent of all buffer zones would variously affect an estimated 59 of the 285 proposed well site locations (21 percent) within the Project Area.

#### 4.7.2.1.2.4.3 Prey-Related Impacts

The development of proposed well pads and associated roads and pipelines within the South Area would initially disturb an estimated 1,633 acres of potential habitats for several species of small mammals that serve as prey items for raptors. This short-term moderate impact would affect approximately 1.5 percent of the Project Area and is not likely to be the determining factor in the level of use the Project Area receives by raptors because the small amount of short-term change in prey base populations is minimal in comparison to the overall status of the rodent and lagomorph cycles, which is controlled over the region and state by natural forces. While prey populations on the Project Area would likely sustain some stress during the initial phase of the project, prey numbers are expected to soon rebound to approximate pre-disturbance levels following reclamation of approximately 50 percent of the total initial disturbance area involving pipelines, unused portions of well pads and roads, and wells that are no longer productive. Although the long-term

disturbance of habitats would be slight, some small changes or shifts in the prey base are likely to occur as a result. These changes or shifts may cause a slight change or shift in the populations of raptors inhabiting the Project Area. However, once reclaimed, the disturbed areas would likely promote a density and biomass of small mammals that is comparable to those of undisturbed areas (Hingtgen and Clark 1984). For these reasons, implementation of the Proposed Action is not expected to produce any appreciable long-term negative changes to the raptor prey base within the Project Area.

#### 4.7.2.1.2.4.4 Other Impacts

The creation of new roads outlined in the Proposed Action would increase public access to areas within the Project Area. As use of the Project Area by both workers and recreationists increases, the potential for encounters between raptors and humans would increase and could result in increased disturbance to nests and foraging areas, vehicle collisions, and shooting incidences.

### 4.7.2.1.2.5 Upland Game Birds

#### 4.7.2.1.2.5.1 Mourning Dove

Since mourning doves are found on the Project Area it is likely that at least some breeding and nesting activity occurs there. Therefore, there is a possibility that mourning dove nests occur within the 1,633 acres of habitats that would be directly disturbed by the proposed construction. Because of the low density of doves in the area and the availability of comparable habitats in the area, the disturbance of 1,633 acres of possible dove habitat would not be a substantial impact.

#### 4.7.2.1.2.5.2 Ring-necked Pheasant

Because pheasants are found in the Project Area, some breeding and nesting activities likely occur there. Therefore, the possibility exists that nests of ring-necked pheasants occur within the 1,633 acres of habitats that would be disturbed under the Proposed Action. Because of the low density of pheasants in the Area and the availability of comparable habitats in the Area, the disturbance of 1,633 acres of potentially-suitable habitats for ring-necked pheasants would only be a minor effect of the Proposed Action.

### 4.7.2.1.2.6 Other Species

As discussed in Chapter 3, a variety of other groups of species occur or potentially occur within the Project Area. They include furbearers, predators, small mammals, waterfowl and shorebirds, songbirds, reptiles and amphibians. Implementation of the Proposed Action is likely to displace or remove at least some individuals of species in these groups through the removal of existing habitats during direct disturbance of the 1,633 acres. However, the effects of these displacements and removals are not expected to be substantial or long term because species in these groups are highly mobile or have very high reproductive rates. The highly mobile species would experience displacement and would adjust to the loss of 1,633 acres by moving away from the disturbance. The less mobile species, which usually have higher reproductive rates, would experience the loss of individuals, but would compensate for the loss through their reproductive rates. Overall, these species would experience some reduction in numbers due to the loss of habitats.

#### 4.7.2.1.3 Electric Power Option

Under the Proposed Action, all electric lines would be installed above ground on poles, primarily along existing and new roads. The installation of electric power above ground lines would have few effects on terrestrial wildlife. The primary concerns involve birds in general and raptors specifically. The power lines would pose a hazard to birds flying by and could pose an electrocution hazard to raptors. Some birds would likely not see the conductors suspended between poles and fly into them resulting in some undeterminable number of deaths annually. Electrocution is a well documented source of mortality for raptors and most electrocutions involve electric distribution lines rather than high-voltage transmission lines (Avian Power Line Interaction Committee [APLIC] 1996). However, the potential for electrocution would be minimized because any power lines installed for this project would be designed using the Suggested Practices for Raptor Protection on Powerlines: the State of the Art in 1996 (APLIC 1996).

### 4.7.2.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

This alternative would incorporate very similar construction and operational components as the Proposed Action with additional environmental protection measures applied to those actions taking place on federal lands. Although levels of direct surface disturbance would be nearly the same as those under the Proposed Action, overall indirect impacts to wildlife and their habitats under Alternative 2 would be lower than those resulting from the Proposed Action. Resource-specific protection measures are described in detail in Chapter 2. These protection measures can be classified into three general categories as either exclusionary stipulations, avoidance stipulations, or timing stipulations.

**Exclusion Areas.** An exclusion stipulation is intended for use only when other stipulations are determined insufficient to adequately protect specific resources. Exclusion means no surface occupancy that would prevent well pads, roads, and/or ancillary facilities from being constructed in specific areas. Preclusion of oil and gas activities would be limited to slopes >25 percent, road grades in excess of 15 percent on critical soils, and zones around active raptor nests.

**Avoidance Areas.** An avoidance stipulations are intended for use when gas development activities are generally allowed on all or portions of the lease year-round, but because of special values, or resource concerns, lease activities must be strictly controlled. These stipulations would require careful siting of facilities and operating practices to minimize adverse effects. The primary example of this category of stipulation is the wildlife corridors resource protection measure.

**Timing Limitations.** Timing limitation stipulations would limit surface use during a prescribed period of time on all or a portion of the lease. Although surface disturbance and direct habitat loss would still occur, indirect impacts such as reduced habitat effectiveness and displacement would be greatly reduced. Direct loss of habitat would not be reduced.

#### 4.7.2.2.1 Aquatic Species

The effects to aquatic species with implementation of this alternative would be slightly less than those described for Alternative 1. The primary difference between this alternative and Alternative 1 is the slight reduction in the potential for sedimentation of Cottonwood Creek. Due to environmental protection measures for the peregrine falcon (discussed below), six wells along Cottonwood Creek near the western boundary of the South Area would not be drilled under this alternative. Other than this slight reduction in the potential

for sedimentation of Cottonwood Creek, the effects of this alternative on aquatic species would be the same as those identified for Alternative 1.

#### 4.7.2.2.2 Terrestrial Wildlife

Alternative 2 would impose similar levels of impact to terrestrial wildlife that are expected to occur during the short-term as those under the Proposed Action because traffic volumes, workforce numbers, and projected levels of surface disturbance would be similar. However, under this alternative, activities in wildlife habitats would be limited by stipulations specific to additional resource protection measures. Each of the measures is discussed below with the species to which it applies.

##### 4.7.2.2.2.1 Mule Deer

As with Alternative 1, project facilities would be constructed in crucial and high priority winter ranges. All of the proposed new wells in the North Area would be drilled in crucial winter range or high priority winter range. Forty-three wells would be drilled within crucial winter range. The development of these wells and their associated roads and pipelines would directly disturb approximately 122 acres of crucial winter range, which represents about 1.0 percent of the 11,852 acres of crucial winter range delineated in the North Area. Additionally, the development of the other 18 wells and their associated roads and pipelines would directly disturb about 79 acres of high priority winter range. This accounts for about 1.2 percent of the 6,611 acres of high priority winter range delineated in the North Area.

In the South Area, initial disturbance for construction would involve 93 wells and about 435 acres of crucial winter range and 70 wells and 305 acres of high priority winter range. These acreages, which are only slightly less than those that Alternative 1 would disturb, account for less than 2 percent of the 31,290 acres of crucial winter range delineated in the South Area and about 1.2 percent of the 26,124 acres of high priority winter range delineated in the South Area.

Reclamation efforts would proceed beginning the first fall after wells go into production and continue through the five-year development period and beyond. Such reclamation includes road ROWs, pipelines and utility ROWs, partial restoration of active well pads, and total restoration of abandoned well sites and associated roads. Projected reclamation efforts associated with wells and roads would reduce direct disturbance (short-term) of crucial winter range in the North Area (122 acres) and in the South Area (435 acres) to 68 acres and 234 acres, respectively, over the life of the project. Similarly, reclamation efforts would reduce direct disturbance of high priority winter range in the North Area (79 acres) and in the South Area (305 acres) to 43 acres and 165 acres, respectively, over the life of the project.

Under Alternative 2, a timing limitation stipulation would be applied to all big game crucial and high priority winter range habitat. This would limit construction of facilities during the November 30 to April 15 critical wintering period for mule deer. Additionally, gates would be installed at selected locations to close areas of crucial and high priority winter ranges from vehicle access during this same period. These limitations would ensure deer occupying the crucial and high priority winter ranges would not be needlessly disturbed during their time on the winter ranges, which is when the animals are subject to the highest physiological stresses.

An additional environmental resource protection measure directed at protecting deer on their winter ranges identified big game wildlife corridors. New project-related disturbances within these drainages and critical areas would be avoided and where the disturbances cannot be avoided, their locations would be selected to

minimize environmental effects and maximize the maintenance of the corridor as a single unit. These corridors would connect big game winter range and reduce fragmentation of the winter habitat.

The re-establishment of crucial and high priority winter range would be an on-going process throughout the life of the well field and would, over time, replace lost acreage. However, under natural succession an estimated 8 to 20 years would be required for shrub reestablishment and production of usable forage. Reclamation rates would be accelerated under this alternative by the hand planting of seedling brouse plants and use of seedling protectors.

To offset direct impacts to crucial and high priority mule deer winter range that would be eliminated and disturbed by the construction and operation of wells and roads within these habitats, enhancement of an equivalent acreage of adjacent habitats should be completed, commensurate with the surface-disturbing activities, as identified in the governing land use plans. This planning provision could be satisfied by providing a monetary contribution into a dedicated account managed by the National Fish and Wildlife Foundation, under provisions of an agreement among the BLM, UDWR, and Companies. The mitigation would involve a one time payment of $1,301.26 (1998 dollars) per well on federal surface and/or subsurface ownership in all high priority or crucial big game winter range in the Project Area. Funds accumulated in this account would be used to enhance additional habitats within the herd units that would directly benefit big game and other wildlife species. Payment would be made to this fund for about 100 new wells (42 in the North Area and 58 in the South Area.

The analysis of potential indirect impacts to big game due to displacement, vehicle collisions, and poaching/ harassment are similar to those presented under the Proposed Action, but would be reduced due to implementation of the Environmental Protection Measures. In the North Area, proposed facilities would indirectly affect 2,283 acres of crucial winter range and about 1,251 acres of high priority winter range, in addition to the direct disturbance identified above. Thus, directly and indirectly, this alternative may affect about 20 percent of crucial winter range and 20 percent of high priority winter range present within the North Area. In the South Area, the project's facilities would indirectly affect about 6,378 acres of crucial range and 4,704 acres of high priority winter range. When considered with direct effects, about 22 percent of crucial winter range would be directly or indirectly affected over the life of the project. Similarly, about 19 percent of the high priority winter range delineated in the South Area would be affected directly or indirectly for the life of the project. The "loss" of these indirectly-affected acreages may cause the deer to remain on ranges on the Manti-La Sal National Forest later into the winter than the deer may otherwise, which would affect the availability of forage on the Forest. Big game winter range could be fragmented if connections between winter range are disturbed.

Additionally, the gating and closure of selected roads in big game winter range habitat would reduce the potential for adverse affects from disturbances and collisions in those areas.

#### 4.7.2.2.2.2 Elk

Under Alternative 2, a timing limitation stipulation would be applied to all big game crucial and high priority winter range habitat. This would limit construction of facilities during the November 30 to April 15 critical wintering period for elk. The development of Alternative 2 would initially disturb an estimated 172 acres of crucial winter range. In addition, wells drilled in high priority winter range would result in the disturbance of approximately 24 acres of this range. The remainder of the proposed wells are not in designated elk winter ranges. Following the initial construction period and reclamation, disturbance would be reduced to 93 and 14 acres in crucial winter range and high priority winter range, respectively.

The analysis of potential impacts to elk due to displacement, vehicle collisions, and poaching/ harassment would be nearly the same as those presented under the Proposed Action except for the fact that the potential for impacts under Alternative 2 is reduced from that under the Proposed Action, since ten wells and their access roads would not be developed due to restrictions associated with other resources. In addition, the gating and closure of selected roads in big game winter ranges, application of wildlife corridors, and consideration of remote monitoring would reduce the potential for adverse affects from disturbance and collisions in those areas. Thus, about 8,482 acres of crucial winter range and 2,529 acres of high priority winter range would be affected indirectly.

#### 4.7.2.2.2.3 Raptors

The types of potential nesting-related effects of Alternative 2 on raptors would be similar to those described for the Proposed Action, with one primary exception As described in Chapter 2, this alternative would provide continuous protection to active raptor nests and nesting habitat rather than protecting nesting raptors only during the nesting season. Under Alternative 2, stipulations specifying a seasonal ½-mile buffer would be expanded to a year-round ½-mile buffer for all nests active during at least one of the previous three years.

Buffers around active raptor nests provide insulation from facilities, human activity, and altered habitat. Buffer size and dates may vary, however, as determined by the BLM (in coordination with the USFWS' draft guidelines for raptor protection (USFWS 1998b) and UDWR, depending on the status of current use, species involved, and the arrangement and size of natural topographic barriers. The application of these spatial and temporal buffer zones to raptor nests under the Proposed Action would provide insulation from facilities, human activity, and altered habitat on a season by season basis, but would not provide long-term protection. An inherent problem with the seasonal buffer zone concept is that it only protects nesting raptors during the nesting season prior to or during the construction phase(s) of the project. Continuous protection of raptor nests and nesting habitat is not provided, since facilities may be constructed near formerly productive nests outside of the exclusionary period. Once facilities are established in an area, raptors may be deterred from using these nest sites again during subsequent breeding seasons. If the disturbance is sufficiently high, the birds may abandon their territory altogether. As adjacent habitats become increasingly fragmented due to concentrated well densities in portions of the Project Area, the availability of alternative nest sites could become limited. For these reasons, the implementation of temporal and spatial buffer zones alone, may not be enough to sufficiently offset impacts to local raptor populations under the Proposed Action.

According to the radius applied on the 140 raptor nests identified for analysis under this alternative, approximately 22,663 acres in the South Area and 3,407 acres in the North Area would be excluded from future development of surface facilities.

The application of the year-round ½-mile buffer zone, could eliminate as many as ten wells from development because they would be within ½ mile of a raptor nest (if the nests are active at least one of the previous three years before construction occurs). All other facilities were moved to avoid the ½-mile buffer zones around known raptor nests. Construction of the transmission pipeline would be limited by seasonal restrictions along those portions of the pipeline corridor extending into the Price CBM Project Area.

With regard to opportunities for raptors to hunt, potential impacts resulting from Alternative 2 would be less than described for the Proposed Action in that much of the available hunting habitat would be covered by other stipulations. For the same reasons as described under the Proposed Action, implementation of this alternative is not expected to appreciably affect populations of small mammals that serve as prey for raptors within the Project Area.

The analysis of potential impacts to raptors due to increased public access and potential for electrocution are identical to those presented under the Proposed Action except for the fact that the potential for impacts under Alternative 2 is substantially lower than for the Proposed Action, because there would be no new development of facilities or roads within ½-mile of an active nest.

#### 4.7.2.2.2.4 Upland Game Birds

##### 4.7.2.2.2.4.1 Mourning Dove

The analysis for this alternative is identical to that presented under the Proposed Action except for the fact that the potential for impacts under Alternative 2 is proportionately lower than for the Proposed Action, because nesting habitats within some of the acreage that would be disturbed under Alternative 1 would be avoided.

##### 4.7.2.2.2.4.2 Ring-necked Pheasant

Because pheasants are found in the Project Area, some breeding and nesting activities likely occur there. Therefore, the possibility exists that nests of ring-necked pheasants occur within the 1,472 acres of habitats that would be disturbed under this alternative. Because of the low density of pheasants in the Area and the availability of comparable habitats in the Area, the disturbance of 1,472 acres of potentially-suitable habitats for ring-necked pheasants would only be a minor effect of the implementing Alternative 2.

#### 4.7.2.2.2.5 Other Species

As discussed in Chapter 3, a variety of other groups of species occur or potentially occur within the Project Area. They include furbearers, predators, small mammals, waterfowl and shorebirds, songbirds, reptiles and amphibians. Implementation of Alternative 2 is likely to displace or remove at least some individuals of species in these groups through the removal of existing habitats during direct disturbance of the 1,472 acres. However, the effects of these displacements and removals are not expected to be substantial or long term because species in these groups are highly mobile or have very high reproductive rates. The highly mobile species would experience displacement and would adjust to the loss of 1,472 acres by moving away from the disturbance. The less mobile species, which usually have higher reproductive rates, would experience the loss of individuals, but would compensate for the loss through their reproductive rates. Overall, these species would experience some reduction in numbers due to the loss of habitats.

### *4.7.2.2.3 Electric Power Option*

Under Alternative 2, about 97 miles of electrical power lines would be installed above ground on poles, primarily along existing and new roads. The rest of the power lines (73 miles) would be buried. As discussed under Alternative 1, the installation of electric power above ground lines would have few effects on terrestrial wildlife. The primary concerns involve birds in general and raptors specifically. The power lines would pose a hazard to birds flying by and could pose an electrocution hazard to raptors. Some birds would likely not see the conductors suspended between poles and fly into them resulting in some undeterminable number of deaths annually. Electrocution is a well documented source of mortality for raptors and most electrocutions involve electric distribution lines rather than high voltage transmission lines (APLIC 1996). However, the potential for electrocution would be minimized because any power lines installed for this project would be designed using the Suggested Practices for Raptor Protection on Powerlines: the State of the Art in 1996 (APLIC 1996). The burial of 73 miles of power lines is not likely to substantively affect

wildlife because the burial would occur along existing and proposed roads. Thus, the installation of buried power lines would not affect a large amount of habitats.

### 4.7.2.3 Alternative 3 — No Action

#### *4.7.2.3.1 Aquatic Species*

Under the No Action Alternative, no additional natural gas drilling would occur on federal land but drilling would likely still occur on State and private land. This would result in 222 total wells (including the 68 existing wells) and associated facilities, compared with 353 or 335 total wells for alternatives 1 and 2, respectively.

The potential for impacts to aquatic species from this alternative would be lower than alternatives 1 and 2 because of the lack of development on federal lands. However, because the State and private lands contain most of the wells proposed near perennial streams, the potential impacts would not be reduced substantially compared with the other two alternatives. That is, the level of impact reduction would not be reduced in direct proportion to the reduction in number of wells.

#### *4.7.2.3.2 Terrestrial Wildlife*

Implementation of the No Action alternative would result in fewer adverse effects to terrestrial wildlife than either Alternatives 1 or 2. None of the unconstructed facilities (wells, roads, compressors, and other ancillary facilities) comprising the project under Alternatives 1 or 2 that would involve federal lands would be constructed. Therefore, none of the effects associated with these facilities would occur. A total of 222 wells would be constructed under this alternative, which is less than the 353 or 335 wells that would be constructed under Alternative 1 or Alternative 2, respectively.

However, additional effects would occur with the 155 wells that could still be constructed on private and state lands. Overall, this alternative would disturb about 916 acres of habitats. The effects associated with the disturbance of this acreage would be similar to those described under alternatives 1 and 2.

##### 4.7.2.3.2.1 Mule Deer

Implementation of the No Action Alternative would affect mule deer. However, the effects would be less than those associated with either Alternative 1 or Alternative 2. Of the 19 wells that would be constructed in the North Area under this alternative, eight would be in mule deer crucial winter range. Thus, about 24 acres (<1 percent) of the total crucial winter range delineated in the North Area would be disturbed. The remaining 11 wells and their associated roads and utilities would be constructed in mule deer high priority winter range, which would involve about 43 acres (<1 percent) of the 6,611 acres of high priority winter range delineated in the North Area.

Within the South Area, 106 of the 136 wells that would be constructed under this alternative would involve mule deer crucial winter range or mule deer high priority winter range. Sixty-nine wells and their associated access roads would be constructed in crucial winter range, which would involve about 307 acres (1 percent) of the 31,290 acres of crucial winter range delineated in the South Area. Thirty-seven wells would be constructed in high priority winter range. These wells and their associated roads and utilities would disturb about 122 acres (<1 percent) of the 26,124 acres of high priority winter range delineated in the South Area.

Although the BLM and Forest Service would have no jurisdiction over the 155 wells constructed under this alternative, it is assumed reclamation efforts would proceed beginning the first fall after wells go into production and continue through the development period and beyond. Using the same assumptions about reclamation applied to alternatives 1 and 2, long-term disturbance of crucial and high priority winter ranges in the South Area after the first five years would be reduced to 233 acres, on which on-going project activities would remain throughout the 20-year life of production. In contrast, long-term disturbance in the North Area would be reduced to about 88 acres.

In the North Area, proposed facilitites would indirectly affect 2,283 acres of crucial winter range and about 1,251 acres of high priority winter range, in addition to the direct disturbance identified above. Thus, directly and indirectly, this alternative may affect about 20 percent of crucial winter range and 20 percent of high priority winter range present within the North Area. In the South Area, the project's facilities would indirectly affect about 4,707 acres of crucial range and 2,137 acres of high priority winter range. When considered with direct effects, about 16 percent of crucial winter range would be directly or indirectly affected over the life of the project. Similarly, about 9 percent of the high priority winter range delineated in the South Area would be affected directly or indirectly for the life of the project.

#### 4.7.2.3.2.2 Elk

Implementation of the No Action alternative also would affect elk and as with mule deer, the effects would be less than those associated with alternatives 1 or 2. Within the South Area, 46 of the 136 wells that would be constructed would involve elk crucial winter range or elk high priority winter range. Thirty-six wells would be constructed in crucial winter range, which would involve about 156 acres (about 1 percent) of the 16,410 acres of crucial winter range delineated in the South Area. Ten wells would be constructed in high priority winter range. These wells and their associated roads and utilities would disturb about 23 acres (0.3 percent) of the 7,940 acres of high priority winter range delineated in the South Area. Long-term disturbance of crucial and high priority winter ranges in the South Area after the first five years would be reduced to about 97 acres, on which on-going project activities would remain throughout the 20-year life of production.

The potential impacts to elk due to displacement, vehicle collisions, and poaching/ harassment would be less than those presented under the alternatives 1 and 2 due to the fewer number of wells that would be developed. About 7,920 acres of crucial winter range and 2,176 acres of high priority winter range would be affected indirectly.

#### 4.7.2.3.2.3 Raptors

Twenty-two of the 155 wells that would be constructed under this alternative may occur within the ½-mile of a known raptor nest. Nineteen of the nests are in the South Area and three are in the North Area. Because the seasonal buffers would not apply under this alternative, these nests could be adversely affected and possibly abandoned if the companies construct facilities within ½ mile of the nests, especially if that construction occurs during the nesting season.

#### 4.7.2.3.2.4 Upland Game Birds

##### 4.7.2.3.2.4.1 Mourning Dove

The analysis for this alternative is identical to that presented under alternatives 1 and 2, except for the fact that the potential for impacts under Alternative 3 is proportionately lower because nesting habitats on federal lands would be avoided.

##### 4.7.2.3.2.4.2 Ring-necked Pheasant

Because pheasants are found in the Project Area, some breeding and nesting activities likely occur there. Therefore, the possibility exists that nests of ring-necked pheasants occur within the 917 acres of habitats that would be disturbed under this alternative. Because of the low density of pheasants in the Area and the availability of comparable habitats in the Area, the disturbance of 917 acres of potentially-suitable habitats for ring-necked pheasants would only be a minor effect of the implementing Alternative 3.

#### 4.7.2.3.2.5 Other Species

As discussed in Chapter 3, a variety of other groups of species occur or potentially occur within the Project Area. They include furbearers, predators, small mammals, waterfowl and shorebirds, songbirds, reptiles and amphibians. Implementation of Alternative 3 is likely to displace or remove at least some individuals of species in these groups through the removal of existing habitats during direct disturbance of the 917 acres. However, the effects of these displacements and removals are not expected to be substantial or long term because species in these groups are highly mobile or have very high reproductive rates. The highly mobile species would experience displacement and would adjust to the loss of 917 acres by moving away from the disturbance. The less mobile species, which usually have higher reproductive rates, would experience the loss of individuals, but would compensate for the loss through their reproductive rates. Overall, these species would experience some reduction in numbers due to the loss of habitats.

## 4.7.3 Impacts Summary

All three of the alternatives would involve similar types of effects. However, the magnitude of the effects would vary according to the number and distribution of facilities. All alternatives would involve construction of facilities within crucial and high priority winter ranges for mule deer and elk. Effects to elk and deer would occur from disturbance of habitats during construction, long-term occupancy of habitats by facilities, increased human presence and activities, increased public use of the expanded road network, and higher potential for animal-vehicle collisions.

All alternatives also would involve the construction of facilities within active raptor territories. The construction of these facilities and associated long-term occupancy of parts of territories would affect the foraging opportunities that exist on those territories. Also, the nests would be exposed to various effects, depending upon the alternative. Alternative 2 includes a year-round restriction on the construction of surface facilities within ½ mile of a nest active during at least one of the three previous years. Alternative 2 includes a seasonal restriction from constructing within ½ mile of an active raptor nest during the breeding season. Since Alternative 3 has no development of federal land, no seasonal or surface restrictions on the construction of facilities near a raptor nest would be applied.

Other species of aquatic and terrestrial wildlife present in the Project Area would experience varying degrees of effects from the implementation of the alternatives. These effects include the loss of habitats, displacement from presently-occupied habitats, and the loss of some individuals. Successful reclamation would minimize these effects.

With the electric power options for alternatives 1 and 2, additional disturbance would be minor. Also, the power lines would be constructed according to the APLIC's guidelines. Thus, the potential for electrocuting raptors would be minimized.

### 4.7.4 Mitigation

Elimination of loop routes to access a well would reduce human disturbance. The Companies could help reduce impacts to wildlife by not allowing the discharge of firearms by on-duty employees and contractors and by not allowing harassment of wildlife by employees and contractors. Scheduling routine, non-emergency visits to project facilities to avoid the low-light periods of sunrise and sunset also would help reduce effects to big game during the critical winter period.

### 4.7.5 Unavoidable Adverse Effects

Unavoidable adverse effects vary with the alternative considered. Under Alternative 1, unavoidable adverse effects would include the direct loss of aquatic habitats; loss of mule deer and elk crucial and high priority winter range habitats; the displacement of deer and elk from crucial and high priority winter ranges; reduced carrying capacity of mule deer and elk winter ranges in the Project Area for the life of the project and beyond; increased potential for wildlife-vehicle-related mortalities and poaching; and nest desertions and/or reproductive failures for raptors as a result of human disturbances in the vicinities of nests. With Alternative 2, unavoidable adverse impacts would be similar, but substantially less. Adverse impacts would be expected to aquatic habitats, big game habitats, big game populations, deer and elk carrying capacity and a reduction in raptor nesting in areas where mitigation via the environmental protection measures is not incorporated. Alternative 3 adverse impacts would be similar to those described for Alterative 1, but proportionately less.

## 4.8 SPECIAL-STATUS SPECIES

As discussed in Chapter 3 (**Section 3.8**), 53 species that have a special-status designation have at least some potential to occur in the Project Area. They include species of plants, reptiles, fish, birds, and mammals (**Table 4–12**).

## Table 4–12
## Summary of Direct and Indirect Effects to Special-status Species

| | Alternative | | | | | |
|---|---|---|---|---|---|---|
| | 1 — Proposed Action | | 2 | | 3 — No Action | |
| Species | North Area[1] | South Area[1,2] | North Area | South Area | North Area | South Area |
| Barneby reed-mustard | UAA | UAA | UAA | UAA | UAA | UAA |
| Jones cycladenia | UAA | UAA | UAA | UAA | UAA | UAA |
| Last chance townsendia | UAA | UAA | UAA | UAA | UAA | UAA |
| San Rafael cactus | UAA | UAA | UAA | UAA | UAA | UAA |
| Winkler cactus | UAA | MAA | UAA | UAA | UAA | UAA |
| Wright fishhook cactus | UAA | UAA | UAA | UAA | UAA | UAA |
| Creutzfeldt-flower | UAIH | MAIH | UAIH | MAIH | UAIH | UAIH |
| Low hymenoxys | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Canyon sweetvetch | UAIH | MAIH | UAIH | MAIH | UAIH | MAIH |
| Silver milkvetch | MAIH | MAIH | MAIH | MAIH | UAIH | UAIH |
| Mussentuchit gilia | MAIH | MAIH | MAIH | MAIH | UAIH | UAIH |
| Psoralea globemallow | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Utah milk snake | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Bonytail chub | UAA | UAA | UAA | UAA | UAA | UAA |
| Colorado pikeminnow | UAA | UAA | UAA | UAA | UAA | UAA |
| Humpback chub | UAA | UAA | UAA | UAA | UAA | UAA |
| Razorback sucker | UAA | UAA | UAA | UAA | UAA | UAA |
| Roundtail chub | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Flannelmouth sucker | UAIH | MAIH | UAIH | MAIH | UAIH | UAIH |
| Bluehead sucker | UAIH | MAIH | UAIH | MAIH | UAIH | UAIH |
| Colorado River cutthroat trout | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| White-faced ibis | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Osprey | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |

## Table 4–12 (continued)
## Summary of Direct and Indirect Effects to Special-status Species

| Species | Alternative | | | | | |
|---|---|---|---|---|---|---|
| | 1 — Proposed Action | | 2 | | 3 — No Action | |
| | North Area[1] | South Area[1,2] | North Area | South Area | North Area | South Area |
| Northern goshawk | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Ferruginous hawk | UAIH | MAIH | UAIH | MAIH | UAIH | UAIH |
| Swainson's hawk | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Northern harrier | MAIH | MAIH | MAIH | MAIH | MAIH | MAIH |
| Bald eagle | UAA | UAA | UAA | UAA | UAA | UAA |
| Peregrine falcon | UAA | UAA | UAA | UAA | UAA | UAA |
| Snowy plover | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Mountain plover | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Long-billed curlew | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Black tern | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Caspian tern | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Yellow-billed cuckoo | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Short-eared owl | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Burrowing owl | UAIH | MAIH | UAIH | MAIH | UAIH | UAIH |
| Bewick's wren | MAIH | MAIH | MAIH | MAIH | MAIH | MAIH |
| Loggerhead shrike | MAIH | MAIH | MAIH | MAIH | MAIH | MAIH |
| Common yellowthroat | UAIH | MAIH | UAIH | MAIH | UAIH | UAIH |
| Yellow-breasted chat | UAIH | MAIH | UAIH | MAIH | UAIH | UAIH |
| Grasshopper sparrow | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Lark bunting | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Brewer's sparrow | MAIH | MAIH | MAIH | MAIH | UAIH | UAIH |
| Dwarf shrew | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |

**Table 4–12 (continued)**
**Summary of Direct and Indirect Effects to Special-status Species**

| | Alternative | | | | | |
|---|---|---|---|---|---|---|
| | 1 — Proposed Action | | 2 | | 3 — No Action | |
| Species | North Area[1] | South Area[1,2] | North Area | South Area | North Area | South Area |
| Spotted bat | UAIH | MAIH | UAIH | MAIH | UAIH | UAIH |
| Small-footed myotis | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Fringed myotis | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Townsend's big-eared bat | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Big free-tailed bat | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Brazilian free-tailed bat | UAIH | UAIH | UAIH | UAIH | UAIH | UAIH |
| Ringtail | UAIH | MAIH | UAIH | MAIH | UAIH | UAIH |
| Black-footed ferret | UAA | UAA | UAA | UAA | UAA | UAA |

Notes:

1. UAA = Implementation of the alternative is unlikely to adversely affect this listed species.
   MAA = Implementation of the alternative may adversely affect this listed species.
   UAIH = Implementation of the alternative is unlikely to affect individuals or habitats occupied or potentially occupied by the species.
   MAIH = Implementation of the alternative may affect individuals or habitats occupied or potentially occupied by the species, but would not likely contribute to a trend towards Federal listing or loss of viability of the population or species.
2. South Area includes the corridor for the gas transmission pipeline.

## 4.8.1 Direct and Indirect Effects

### 4.8.1.1 Alternative 1 — Proposed Alternative

#### *4.8.1.1.1 Plant Species*

Implementation of this alternative is not expected to result in substantive adverse effects to any of the 13 species of special-status plants considered in this analysis. Of the seven species listed as threatened or endangered or proposed for listing as endangered, only the Winkler cactus is known to occur in the Project Area. Although limited amounts of potentially-suitable habitats exist in the Project Area for the other six species, no occurrences of these species have been recorded. Thus, implementation of this alternative is unlikely to adversely affect any of these species.

Five locations for well pads have been sited near existing populations of the Winkler cactus in the South Area. Additionally, about 1,800 feet of access roads actually cross habitats for the cactus, the potential for direct adverse effects exists. Based on the 1997 surveys, construction of the access roads as proposed would directly disturb about 3.2 acres of habitats known to be occupied by the cactus. However, the BLM, in coordination with the USFWS, would require clearance surveys of all well pads, access roads, and pipeline corridors that cross known, suitable, or potentially-suitable habitats for the Winkler cactus on Federal lands before construction could begin. Surveys are difficult because of the cactus' unusual habit of shrinking underground during periods of unfavorable weather. Consequently, the Winkler cactus surveys can only be done from April 15 to May 1 during its flowering period.

If the surveys locate any plants, locations of the facilities would be changed to avoid disturbing the plants. This procedure has worked quite successfully in this general area and other areas. Thus, although the potential exists for direct adverse effects to the Winkler cactus in the South Area only, results of the clearance surveys and subsequent mitigation, such as relocating well pads or roads, would minimize adverse effects occur on Federal lands in the Project Area (**Table 4–12**). Because the BLM should be able to reroute the 1,800 feet of access roads around occupied habitats, implementation of this alternative is not expected to cause adverse effects to the known locations of Winkler cactus.

Implementation of the Proposed Action also would have limited potential to adversely affect several of the other special-status plants where potentially-suitable habitats may be disturbed. Of primary concern would be the locations of known populations of Creutzfeldt-flower and canyon milkvetch. Proposed locations for six well pads and about 6,120 feet of access roads have been sited in or near known existing populations of the Creutzfeldt-flower. If constructed as proposed, these facilities would disturb about 19 acres of habitats occupied by the Creutzfeldt-flower. However, as with the cactus, the BLM would require clearance surveys of well pads, access roads, and pipeline corridors that would cross known, suitable, or potentially-suitable habitats for the Creutzfeldt-flower or canyon milkvetch on Federal lands. If the surveys locate any plants, locations of the facilities may be relocated to avoid disturbing the plants or limiting the number of plants disturbed. Thus, the unlisted species of special-status plants may experience direct affects to individuals or habitats occupied or potentially-occupied by the species. However, implementation of the alternative would not likely contribute to a trend towards Federal listing or loss of viability of any populations or species.

The Proposed Action has a slight potential to indirectly affect special-status plant species present in the Project Area. Surface disturbances proposed by the project would disturb an average of 20 acres per section. Although localized, this disturbance would extend over a substantial portion of western Castle Valley in the South Area. As a consequence, the potential for noxious weed encroachment into the valley would increase.

The Proposed Action also would increase accessibility to more remote areas of western Castle Valley. Access roads to well pads would cross through several populations of Creutzfeldt-flower and Winkler cactus. Because these roads may be used by the public, they would increase the potential for several recreational-related impacts. For example, the roads would open up areas to all-terrain vehicle use, which has been known to severely affect the viability of populations of special-status plants. Also, the increased accessibility would increase the potential for collection by the public.

#### 4.8.1.1.2 Wildlife Species

Implementation of the Proposed Action is expected to have limited direct and indirect effects on special-status species of wildlife (**Table 4–12**). The primary special-status species of concern are the bald eagle and peregrine falcon, which are listed as threatened and endangered, respectively. Because the territory of a pair of bald eagles encompasses parts of the South Area, the Proposed Action may cause the eagles to alter their patterns of foraging within the South Area (they feed on prairie dogs, coots, and other animals when they are on their territory). Although the birds may alter their patterns of foraging, implementation of this alternative is unlikely to cause them to abandon their territory or the parts of the territory within the South Area. Thus, implementation of this alternative overall is likely to affect, but not adversely affect, the bald eagle.

As proposed, a portion of the transmission pipeline would be constructed within 1.5 to 2 miles of the bald eagle's nest. However, construction of this segment of the pipeline is not expected to adversely affect the nest. Human activities associated with construction would be short-term in nature at this location. Additionally, Highway 10 and other human activities and man-made disturbances would occur between the pipeline and the nest. Because the pipeline's ROW would be more than one mile from the eagles' nest and the eagles tolerate the other disturbances and activities present within that 1-mile buffer zone, the short-term construction activities are not expected to affect the nest or the birds.

The peregrine falcon also is not expected to experience adverse direct or indirect effects under this alternative. The falcon aeries would not be affected by the activities comprising this alternative. The 1-mile buffer zone in combination with the aeries' locations would provide sufficient protection for the birds. Additionally, the falcons' hunting habitats are widespread on BLM-administered lands and National Forest System lands. Consequently, implementation of the Proposed Action is unlikely to adversely affect the peregrine falcon. Additionally, about 1,300 acres in the South Area and 500 acres in the North Area would be excluded from surface occupancy by the Companies as a result of the expanded 1-mile buffer zone for the peregrine falcon aeries, assuming they are active least one of the previous three years before construction occurs.

Some of the other special-status species of wildlife may experience limited effects from the implementation of this alternative (**Table 4–12**). Potentially-suitable habitats for some species would be disturbed for the long-term. However, most of the vegetation types disturbed by project-related activities would be those that are widely distributed and available throughout both the North Area and South Area. Disturbances to the more limited vegetation types, such as riparian areas, wetlands, mountain fir, spruce-fir, and ponderosa pine-mountain shrub, would be minor, if any. Additionally, the nests of the northern goshawk, ferruginous hawk, and Swainson's hawk would be surrounded by a seasonal buffer that would provide protection to the young-of-the-year. However, the nest could be abandoned in subsequent years as a result of project activities within ½ mile of the nest.

Overall, implementation of the Proposed Action is unlikely to affect individuals or habitats occupied or potentially occupied by special-status species with only very limited potentially-suitable habitats present in

the Project Area (**Table 4–12**). The Proposed Action may affect individuals or habitats occupied or potentially occupied by other species, such as the loggerhead shrike (**Table 4–12**). However, it would not likely contribute to a trend towards Federal listing or loss of viability of the populations or species because few individuals and only minor amounts of habitats would be involved.

Although no prairie dog colonies are known to occur along the transmission pipeline corridor, they may expand onto the corridor before the pipeline is constructed. If such a colony developed, it would be potentially-suitable habitat for the black-footed ferret. A survey for prairie dog colonies would be conducted as part of the pipeline's final permitting. If a colony is found and it meets the minimum requirements to be considered potentially-suitable habitat for the ferret, appropriate ferret surveys would be conducted.

#### *4.8.1.1.3 Aquatic Species*

As discussed in detail in Chapter 3, none of the four endangered Colorado River fish (Colorado River pikeminnow, humpback chub, bonytail chub and razorback sucker) are known or thought to occur within the Project Area. Therefore, no direct impacts to these endangered fish would occur from any of the action alternatives. The closest documented occurrence of any of the four endangered Colorado River fish is in the Price and San Rafael rivers downstream of the Project Area.

The water resource's analysis determined that about 84 acre feet of water depletions are expected to occur from the proposed project. However, it is below the threshold for requiring mitigation for the fish as presented in the USFWS' the "Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin" (USFWS 1987).

Indirect impacts within Colorado River fish habitat are also expected to be minor. These minor impacts, such as reduced water quality and increased sedimentation, would be similar (but less) than those described in the Aquatic Species Section above. Because the Colorado River fish do not occur within the Project Area, any impacts should be much less than those described for the aquatic species within the Project Area.

As discussed in detail in Chapter 3, sensitive fish species that occur or are likely to occur within the Project Area are bluehead and flannelmouth suckers. The other sensitive fish species, roundtail chub, Colorado River cutthroat trout, are not thought to occur in the Project Area, but do occur in Huntington Creek upstream of the Project Area. Therefore, impacts to the bluehead and flannelmouth suckers would be the same as those described for aquatic species in the Aquatic Species section and impacts to the roundtail and Colorado River cutthroat trout would be similar to those described for the endangered Colorado River fish in the Threatened and Endangered Species section.

#### *4.8.1.1.3 Electrical Power Option*

Installation of above ground power lines and electrical equipment would have little effect on special-status species. At most, only minor amounts of potentially-suitable habitats would be disturbed, primarily along existing and new roads, for construction of the power lines. The primary concerns involve the avian species. The power lines would pose a hazard to birds flying by and could pose an electrocution hazard to large birds, such as the bald eagle. Some birds would likely not see the conductors suspended between poles and fly into them resulting in some undeterminable number of deaths annually. Electrocution is a well documented source of mortality for raptors and most electrocutions involve electric distribution lines rather than high voltage transmission lines (APLIC 1996). However, the potential for electrocution would be minimized because any power lines installed for this project would be designed using the Suggested Practices for Raptor Protection

on Powerlines: the State of the Art in 1996 (APLIC 1996). Thus, use of an electrical system instead of natural gas to power wells and compressors would have little potential to adversely affect special-status species overall.

### 4.8.1.2 Alternative 2 — Proposed Action With Additional Environmental Protection Measures

#### *4.8.1.2.1 Plant Species*

The effects of implementing this alternative would be almost the same as those described for Alternative 1, the Proposed Action (**Table 4–12**). Clearance surveys of Federal lands for the Winkler cactus, Creutzfeldt-flower, and canyon milkvetch would still occur along with subsequent adjustments to the locations of project-related facilities to minimize effects. However, APDs for wells near known populations of Winkler cactus would have to be submitted before April 1 and if the weather is too dry that year, surveys may be postponed until the next year that conditions are suitable for conducting the clearance survey. Access roads would still cross about 3.2 acres of habitats occupied by the Winkler cactus and 17 acres of habitats occupied by the Creutzfeldt-flower. Also, the weed management plan that would be developed in coordination with the BLM and implemented on federal lands would reduce the potential for noxious weed invasions and control the establishment of weeds during the life of the project. Finally, the installation of gates on some roads (a wildlife protection measure) may also limit access to some populations of plants by off-road vehicles (during the winter and early spring only), which may help minimize indirect effects of recreational activities.

#### *4.8.1.2.2 Wildlife Species*

The effects of implementing this alternative would be very similar to those described for the Proposed Action. The bald eagle, peregrine falcon, and most of the other special-status species of wildlife would experience similar effects. The primary difference would involve any of the special-status species of raptors listed on **Table 4–12**. Under this alternative, a no occupancy environmental protection measure would be implemented that would not allow the construction of project-related facilities within a ½ mile of raptor nests active during at least one of the three years immediately prior to construction of the well. The seasonal buffer zone of Alternative 1 would be extended to a year-round exclusion area. Overall, the bald eagle and peregrine falcon are unlikely to be adversely affected and potential direct and indirect effects to the other special-status species of wildlife would not likely contribute to a trend towards Federal listing or loss of viability of the populations or species.

#### *4.8.1.2.3 Aquatic Species*

Impacts to the four endangered Colorado River fish species would be similar to those described for Alternative 1 except that the remote possibility of any adverse effect would be even further reduced because of implementation of the additional environmental protection measures on federal lands as described in the Water Resources Section. Impacts on the State and private lands would be the same as those described for Alternative 1 due to the lack of the additional environmental protection measures.

Impacts to the sensitive fish species from Alternative 2 would be similar to those described for Alternative 1 except that the likelihood of any effect would be reduced because of implementation of the additional environmental protection measures on federal lands as described in the Water Resources Section. Impacts on the State and private lands would be the same as those described for Alternative 1 due to the lack of the additional environmental protection measures.

#### 4.8.1.2.3 Electrical Power Option

Under Alternative 2, about 97 miles of electrical power lines would be installed above ground on poles, primarily along existing and new roads. The rest of the power lines (73 miles) would be buried. As discussed under Alternative 1, installation of the electrical equipment would have little effect on special-status species. At most, only minor amounts of potentially-suitable habitats would be disturbed, primarily associated with the burial of power lines along existing and new roads. The primary concerns would still involve the avian species, although the concerns would be less because fewer miles of above ground power lines would be constructed. The power lines would pose a hazard to birds flying by and could pose an electrocution hazard to large birds, such as the bald eagle. Some birds would likely not see the conductors suspended between poles and fly into them resulting in some undeterminable number of deaths annually. Electrocution is a well documented source of mortality for raptors and most electrocutions involve electric distribution lines rather than high voltage transmission lines (APLIC 1996). However, the potential for electrocution would be minimized because any power lines installed for this project would be designed using the Suggested Practices for Raptor Protection on Powerlines: the State of the Art in 1996 (APLIC 1996). Thus, use of an electrical system instead of natural gas to power wells and compressors would have little potential to adversely affect special-status species overall.

### 4.8.1.3 Alternative 3 — No Action

#### 4.8.1.3.1 Plant Species

Implementation of this alternative would eliminate all project-related activities on Federal lands and the direct and indirect effects associated with these activities. However, the development of wells, roads, and ancillary facilities on private and State lands would still occur. Populations of special-status plants, if present on the private and State lands, would still experience the same effects related to disturbance as would occur on these lands under alternatives 1 and 2. Additionally, the potential for indirect effects resulting from an invasion of noxious weeds would still occur. Overall, the levels of effects and the potential for adverse effects would be lower under this alternative than under either of the other alternatives, primarily because the areal extent of physical disturbance would be substantially reduced.

#### 4.8.1.3.2 Wildlife Species

Implementation of this alternative would eliminate all project-related activities on Federal lands and the direct and indirect effects associated with these activities. However, the development of wells, roads, and ancillary facilities on private and State lands would still occur. Populations of special-status wildlife that may be present on the private and State lands would still experience the same effects related to disturbance as would occur on these lands under alternatives 1 and 2. Thus, the levels of effects and the potential for adverse effects overall would be lower under this alternative than under either of the other alternatives, primarily because the areal extent of physical disturbance would be substantially reduced.

#### 4.8.1.3.3 Aquatic Species

The potential for impacts to the Colorado River fish from this alternative would be lower than Alternative 1 and 2 because of the lack of development on federal lands. However, because the State and private lands contain most of the wells that are proposed near perennial streams, the potential impacts would not be reduced substantially compared to the action alternatives. That is, the level of impact reduction would not be reduced in direct proportion to the reduction in number of wells.

Potential impacts to the Sensitive Aquatic Species from this alternative would be lower than Alternative 1 and 2 because of the lack of development on federal lands. However, because the State and private lands contain most of the wells that are proposed near perennial streams, the potential impacts would not be reduced substantially compared to the action alternatives. That is, the level of impact reduction would not be reduced in direct proportion to the reduction in number of wells.

## 4.8.2 Impacts Summary

Alternatives 1 and 2 would disturb habitats on BLM lands occupied by the Winkler cactus and Creutzfeldt-flower, if the access roads are constructed as proposed. In addition, several animal species may experience some minor effects due to loss of foraging habitats, breeding habitats, or both because habitats would be avoided to the maximum extent possible. However, with the necessary clearance surveys and coordination with USFWS and UDWR, none of the alternatives are expected to adversely affect listed or proposed species because habitat would be avoided to the maximum extent possible. Also, none of the alternatives are expected to contribute to a trend towards Federal listing or loss of viability of any population of sensitive species.

With the electric power options for alternatives 1 and 2, additional disturbance would be minor. Also, the power lines would be constructed according to the APLIC's guidelines. Thus, the potential for electrocuting raptors would be minimized.

Since the DEIS was published, the USFWS provided the BLM with its opinion on the alternatives' effects on federally-listed species of plants and animals (Harris 1999). The USFWS concurs with the BLM's conclusions that the project would have no effect on the black-footed ferret, Wright fishhook cactus, San Rafael cactus, Barneby reed-mustard, Maguire daisy, Jones cycladenia, and last chance townsendia. USFWS' biologists also concur with the conclusion that implementation of the alternatives would is not likely to adversely affect the peregrine falcon, bald eagle, and Winkler cactus, as long as the environmental protection measures and mitigation measures associated with Alternative 2 are followed. Finally, the USFWS concluded that with continued implementation of the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin as the reasonable and prudent alternative to avoid jeopardy to the endangered species of fish in the Upper Colorado River Basin, the project would not jeopardize the fish and the depletion fee could be waived (Harris 1999).

## 4.8.3 Mitigation

With the application of clearance surveys, agency coordination, and the resource protection measures already included, no additional mitigation measures are necessary.

## 4.8.4 Unavoidable Adverse Effects

Unavoidable adverse effects to special-status wildlife species would be a loss of some foraging and nesting habitats. Unavoidable adverse effects to special-status species of plants could result from construction and vehicular trampling of plants.

## 4.9 CULTURAL RESOURCES

The BLM has determined that the proposed Ferron Natural Gas project is a Federal undertaking in accordance with 36 CFR 800, the regulations implementing provisions of Section 106 of the National Historic Preservation Act. Any federal undertaking must consider potential effects to significant historic properties, and must conform to federal regulations (particularly 36 CFR 800) in determining effects that a project may have on significant cultural resources, and in the mitigation of effects determined to be adverse. Analysis and consideration of cultural resources, including Native American Traditional Cultural Properties (TCPs), conforms to the following federal laws, the National Historic Preservation Act of 1966, as amended (Public Law [PL] 89–665, PL 91–243, PL 93–54, PL 94–422, PL 94–458, etc.), the Archaeological Resources Protection Act (PL 96–95), the American Indian Religious Freedom Act (PL 95–341), other relevant state and federal statutes, policies and implementing regulations. The established procedures entail review by designated Federal and state agencies including, but not limited to, the Federal land managing agency, the State Historic Preservation Office, and the President's Advisory Council on Historic Preservation.

The Area of Potential Effect (APE) for this project is defined as lands within the project area boundary. This is the area where potential direct and indirect impacts could be likely to occur. The APE is larger than the area of direct surface disturbance. This affords consideration of indirect loss of important cultural materials due to private collection or vandalism, or where there may be direct or indirect disturbance or destruction of important Native American religious or culturally significant sites.

Adverse effects to significant historic properties would include physical alteration, damage or destruction, alteration of the character of the setting of a property which contributes to its significance, or neglect resulting in deterioration or destruction. All of these classes of potential adverse effects are of concern for archaeological, historical, or Native American traditional resources.

A complete inventory and analysis of the cultural resources of the APE is not feasible as the exact location of individual well and facility sites and roads is not known at this time. However, individual site, road and other linear right-of-way applications would not be approved until appropriate inventories are complete and clearances granted following procedures outlined in 36 CFR 800.4 through 800.6. However, since individual cultural resources consultations can result in long delays, the BLM is developing a Programmatic Agreement (PA) with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP) that would be designed to comply with cultural resource requirements. The PA would contain a management plan prepared by BLM and the Companies that would describe procedures to be followed in the project area to determine the effect an individual application may have on significant cultural resources. The management plan would also specify how significant cultural resources are to be treated, including site avoidance, recordation, protection measures, monitoring and mitigation of adverse effects. The PA will achieve the Federal agencies' compliance with the National Historic Preservation Act for this EIS and will be completed and signed prior to the ROD of this EIS.

### 4.9.1 Direct and Indirect Effects

Cultural resources are sensitive and non-renewable resources that can be irreversibly damaged by ground-disturbing activities, such as site and road construction and by secondary surface activities, including vehicular and pedestrian traffic. Many archaeological sites in the general area of the project are shallow and cultural deposits could be damaged or destroyed by vegetation clearing, right-of-way blading, or excavation of soils. Standing historic buildings or structures are more visible than archaeological deposits, and are more easily avoided by ground-disturbing activities.

Historic and prehistoric cultural resources may also be subject to increased indirect impacts, such as vandalism, surface artifact collection, excavation and off road traffic, because of improved access to the area from new and upgraded roads. Indirect impacts may consist of inadvertent damage, destruction or removal of significant scientific information, or destruction of the character or setting of a site. These indirect effects can be short term or occur in the future as long as improved access is available.

The numbers and types of significant cultural sites within the APE is presently unknown and cannot be statistically predicted, as neither an area wide cultural resource inventory, nor random sampling have been completed. Therefore, in order to estimate the number of cultural resources that could be discovered and/or impacted by the Proposed Action, certain assumptions were made.

Assumptions developed in the San Rafael Resource Area RMP (BLM 1991c) are used to estimate site density and impacts in the project area. Although it is known that sites are generally concentrated in certain areas such as water sources and ledges, it is necessary to assume that site location is random. Number estimates in the analysis should not be construed as exact, but they can be used for comparison and indication of what could happen to cultural resources under the various alternatives.

It is assumed that a density of 18 sites per square mile or 0.05 sites per acre could be located within the Project Area. The number of sites within an affected area can be calculated by multiplying 0.05 by the number of acres involved. The North Area is estimated to have 917 sites. The South Area is assumed to contain 4,658 sites and the transmission corridor would have 8 undiscovered sites. Based on professional experience of BLM archaeologists, it is expected that as many as one-half of these sites could be considered eligible for the National Register of Historic Places.

Combined direct and indirect impacts are estimated based on the assumption that projects subject to standard operating procedures would avoid or mitigate the impacts to 9 out of 10 sites within their affected area. Impacts would be expected to occur in 1 out of 10 sites despite mitigation or avoidance measures. This could be due to inadvertent destruction of sites not identified during inventory or indirect impacts.

The potential for direct impacts from surface disturbances of wells, facilities, access roads and pipelines can be estimated by factoring the 0.05 sites per acres assumption with anticipated surface disturbances of each alternative (**Table 2–16**) plus transmission line disturbances. Direct disturbances to sites would be expected to occur in one out of 10 of these sites.

Finally, it is assumed that any required on-the-ground cultural resource inventories for individual site/road applications would include a 300-foot-wide corridor centered on proposed permanent linear disturbance, such as access roads and pipelines, and a minimum of ten acres centered on proposed well sites or support facility sites. Temporary linear disturbances, such as the transmission lines, would have a 200-foot-wide survey corridor. Factoring the 0.05 site per acre assumption with the survey acreage provides an estimate of the number of sites that may be identified.

The site number estimates derived through this analysis serve best for comparison of various alternatives. In practice, on the ground activities are designed to take all necessary measures to avoid impacts to cultural resources.

### 4.9.1.1 Alternative 1 — Proposed Action

Based on assumptions made for this EIS, it is estimated that 92 sites could be impacted directly and indirectly in the North Area. In the South Area, 466 sites could be affected, and one site impacted in the transmission line corridor. This results in a total of 559 sites in the project area that could be affected by direct and indirect impacts. Of these sites, approximately one-half or 280 sites could be anticipated to be eligible for nomination to the National Register.

The estimate of actual surface disturbances for the Proposed Action would result in a probability of 77 sites that could be directly affected in the APE during life of the project. Of these 77 sites, it is anticipated that eight sites could be impacted from inadvertent destruction of the sites, and up to four of these sites could be expected as eligible for the National Register.

On the ground, Class III cultural resource surveys would be conducted on approximately 8000 acres in the APE. Thus, there is a potential that 400 sites could be identified.

#### *4.9.1.1.1 Electric Power Option*

Under the electric power option, an additional six sites could be affected directly and indirectly. Only one additional site would be anticipated to be affected by inadvertent destruction.

### 4.9.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Under Alternative 2, 18 fewer wells and associated access roads would be constructed in the project area. Combined direct and indirect impacts would be anticipated to be essentially the same as Alternative 1. Approximately 559 sites could be affected with 280 sites anticipated for National Register eligibility.

There would be a probability that 69 sites could be directly affected based on anticipated surface disturbances from wells, roads, facilities, pipelines and the transmission line. It is anticipated that seven sites would be impacted from inadvertent destruction, with up to four of these sites eligible for the National Register.

Approximately 7,760 acres of land would be surveyed under this alternative with a potential of identifying 388 cultural sites.

#### *4.9.1.2.1 Electric Power Option*

Under the electric power option, three additional sites could be affected directly and indirectly. Based on the analysis' assumptions, one additional site would be affected by inadvertent destruction.

### 4.9.1.3 Alternative 3 — No Action Alternative

The No Action Alternative would entail drilling of 155 wells on State and private lands and installation of the transmission line. Surface disturbances are estimated at 811 acres. This represents nearly a 48 percent decrease from the Proposed Action. While the project area boundary would remain the same, activities would be reduced substantially from the Proposed Action. For the sake of analysis, it is assumed that direct and indirect impacts would reduce accordingly. Therefore, approximately 290 sites would be impacted with about 145 of those sites eligible for the National Register.

There would be a probability that 40 sites could be directly impacted, with four sites impacted by inadvertent damage. Two of these sites would be anticipated as eligible for the National Register.

Even though there would be no wells drilled on Federal lands with Alternative 3, Rights-of-Way would be necessary for roads that cross Federal lands to access State and private leases. Any new construction or reconstruction of access roads could require completion of Class III pedestrian surveys as the surface disturbances would constitute a Federal action. It is estimated that about 6,000 acres of cultural surveys could be required. Thus, under analysis assumptions, there would be a potential to identify 315 sites during the surveys.

## 4.9.2 Impacts Summary

Direct impacts to cultural resources occur from ground disturbing actions, such as construction. Indirect impacts are caused by vandalism, artifact collection and secondary activities, such as vehicular and pedestrian traffic. Indirect effects can be short term or long term. That is, they could occur immediately or in the future.

Cultural resource sites in the project area are unknown and cannot be statistically predicted. However, assumptions were made following values identified in the San Rafael Resource Area RMP to estimate site density and potential impacts from the alternatives. This estimation method also assumes that cultural resource sites are randomly distributed, although, it is known that sites are generally concentrated in certain areas. The number if sites estimated should not be construed as exact or fact, but they can be used for comparison purposes among the various alternatives.

Based on the general assumptions made for analysis of potential impacts to cultural resources and comparison of alternatives, it is anticipated that direct and indirect impacts from both Alternatives 1 and 2 could affect 558 sites in the Project Area. Of these sites, about 279 sites could be anticipated to be eligible for nomination to the National Register of Historic Places. There is a probability that 77 sites could be directly affected under Alternative 1, with up to four National Register eligible sites impacted from inadvertent destruction. With the electric power option, an additional six sites could be affected. Alternative 2 could result in a probability of affecting 69 sites directly. Approximately four National Register eligible sites could be inadvertently damaged or destroyed. Alternative 3, No Action, has the potential to affect approximately 290 cultural sites with up to half of them eligible for the National Register. There is a probability of 40 sites that could be directly affected with a potential for one National Register eligible site impacted by inadvertent damage.

Essentially, these assumption estimates identify that Alternatives 1 and 2 could directly affect nearly two times as many sites as Alternative 3. The ratio of indirect site impacts for Alternative 3 is higher.

## 4.9.3 Mitigation

Potential effects to significant cultural resources resulting from direct and indirect project impacts would be mitigated through development of a Programmatic Agreement between BLM, SHPO, and the Advisory Council. The agreement would contain a management plan developed by BLM and the Companies that would detail strategies proposed to minimize or mitigate the effects of the undertaking. Following is a general description of the procedures and elements that are detailed in the Cultural Resources Management Plan.

### 4.9.3.1 Inventory

- All proposed actions require cultural resource surveys for consideration of effects to historic properties. Various process steps would be followed for individual applications for well sites, facilities roads and pipelines, etc.

- The first step is a file search and literature review (Class I survey) to determine if previous surveys have been completed and to identify known sites or properties that could be affected and may be eligible for, or are listed on the National Register of Historic Places. Known cultural resource sites within the APE that could be affected by the proposed action have been identified and are listed in **Section 3.9**.

- If previous surveys were not completed, an on-the-ground Class III pedestrian survey would be completed for any individual application that would involve ground disturbance. The survey would include a 300 foot wide corridor centered on proposed narrow linear disturbance, such as access roads, pipelines, or transmission line corridors, and a minimum of ten acres centered on proposed well sites or support facility sites.

### 4.9.3.2 Evaluation

- All discovered sites would be evaluated for their eligibility as National Register of Historic Places historic properties. Criteria for evaluation would be developed in the Cultural Resource Management Plan through a research design identifying the significant characteristics or research data of the known site types expected in the area. This research design should be kept current by a synthesis and review of collected information every five years.

- The Programmatic Agreement would outline the consultation process, with the SHPO and/or the Advisory Council needed for each action.

- If no historic properties are identified during the surveys, a "no effect" determination could be made by the authorizing agency (BLM) and the proposed action may proceed.

- For historic properties eligible for the National Register, several options are available.

    - The first option is avoidance, or to move or alter the proposed action in such a way as to avoid any effects. Avoidance of sites is BLM policy in accordance with current instructions for cultural resources and oil and gas development.

    - If avoidance of an eligible site would not be possible, a site specific treatment plan would be completed and implemented. This is a lengthy process, dependant on the nature, character and degree of significance of a site and could entail excavation for informational values.

    - In some cases, minimal data recovery recondition of a National Register eligible site may be preferred rather than avoidance. This would be the option of the proponent and would be completed according to the research designs specified in the Cultural Resources Management Plan.

- If historic or archaeological materials are uncovered or discovered during construction, operations would cease to avoid further disturbances and the authorizing agency would be notified. The site would be evaluated for eligibility to the National Register, and mitigation would be developed for implementation

before the site could be used. Relocation of development activities to avoid mitigation or delays would be an option for the proponent.

#### 4.9.3.3 Monitoring

- Monitoring of sites eligible for the National Register that are identified during surveys, and avoided by construction or nearby disturbed areas would be one method of mitigating indirect impacts. A monitoring plan should include provisions for site investigation, identification of any changes to the sites and provisions for making determinations of the causes for the change. Monitoring could also result in changes in management that would insure protection of the resource.

#### 4.9.3.4 Miscellaneous

- Indirect impacts to archaeological resources could be mitigated by providing a training/orientation program for employees/contractors to inform them of cultural resource laws and reasons for protection.

- Conducting inventories on areas larger than proposed disturbed areas would mitigate indirect impacts by identifying sites thus allowing monitoring.

### 4.9.4 Unavoidable Adverse Effects

Most direct adverse effects to cultural resources would be mitigated. It is possible, however, that inadvertent destruction of some cultural resources could occur. Based on assumptions made for analysis comparison purposes only, there is a potential for a few archaeologic or historic sites to be damaged. In reality, on-the-ground activities would be designed to avoid damages to cultural resources. Indirect impacts, such as vandalism, artifact collection and off road traffic could also result in adverse impacts to cultural resources. Archaeological surveys covering areas in excess of actual planned disturbances would help to identify sites for monitoring. This could ultimately result in a reduction of indirect effects. Physical damage to a cultural site and archaeological data recovery (excavation) of a cultural resource site are irreversible commitments of a non-renewable resource.

## 4.10 LAND USE

The Project Area consists of public, state, and private lands in the South Area, North Area and the Pipeline Corridor, as shown in **Plate 2–1**. Land use in the Project Area is primarily grazing, wildlife habitat, and to a small extent, residential. Direct impacts to land uses result from the removal of land from existing uses on public lands by the disturbance areas required by proposed coal bed methane facilities. Indirect effects to land use would include the effects on existing land uses on private lands in the Project Area.

A small portion of the wells proposed are split estate (private or State surface ownership and federal minerals ownership). For wells planned under FLPMA requirements, BLM is responsible for both considering the impacts and approvals in land use planning, as well as managing the impacts. However, this responsibility is only for public lands, defined as any land and interest in land owned by the federal government. With respect to split estate lands, the federal government only has an interest in the minerals and not the surface. Activities and use of the surface are not subject to FLPMA planning requirements, and BLM has no authority under FLPMA over use of the land by the land owner. However, the impacts to surface resources and surface uses from BLM-authorized mineral development must be considered under NEPA.

BLM procedures for APDs on split estate leases are contained in Onshore Oil and Gas Order No. 1., Section VII. Through Order No. 1, BLM requires an operator to obtain a private surface owner agreement. If agreement cannot be reached it is up to the operator to pursue legal action, usually, through the provisions of 43 CFR 3814, involving the Federal right of reentry from the Stock Raising Homestead Act).

Each action alternative would consist of natural gas wells and associated facilities in the North and South Areas, as described in Chapters 1 and 2. The proposed Pipeline Corridor parallels the existing Questar ROW in Emery County. Long-term impacts to existing land uses would occur from the implementation of any action alternative in the Project Area.

During the construction phase of the project under any alternative, existing land uses would be temporarily disrupted as properties are entered by construction crews in order to assemble and install the new structures. Residents of the area would be impacted by the sights and sounds of construction. Public access would also be temporarily disrupted at some locations. Short-term disruption during construction would consist of the physical intrusion of the crew and equipment, the generation of dust and noise, and the obstruction of traffic.

Long-term, permanent effects on land use in the Project Area would result from the installation and operation of the proposed facilities. Existing land uses would be displaced by project facilities over the lifetime of the project under any action alternative. The only change to existing land uses from the installation of the gas transmission line in the proposed Pipeline Corridor would be that no structures could be constructed on the permanent ROW.

Public access opportunities would also increase as a result of the development of new and upgraded access roads. These effects would occur under any action alternative.

Maintenance of each well and other facilities would occur over the life of the facility, or approximately 20 years. Maintenance activities would consist of daily inspections trips to each well site, periodic inspections of CPF and compressor stations, and workovers at well sites. These inspections would result in periodic disturbances of noise, dust, and traffic, and possibly restricted access to properties located adjacent to the wellpads and other facilities.

## 4.10.1 Direct and Indirect Effects

### 4.10.1.1 Alternative 1 — Proposed Action

#### *4.10.1.1.1 Land Ownership*

Land ownership in the Project Area consists of BLM-administered federal lands, Manti-La Sal National Forest lands, private lands, and state lands. It is not anticipated that land ownership would change as a result of the implementation of any action alternative. Easements on private lands would be negotiated with the landowners and secured through the permitting process of the appropriate state and local agencies.

The number of acres of long-term disturbance on public and private lands for each alternative is summarized in **Table 2–16**. Long-term disturbance would consist of well pads, new road construction, and land disturbed by CPFs and compressor stations. Land disturbed by the installation of the natural gas transmission line in the proposed Pipeline Corridor comprises temporary construction disturbance that would be reclaimed to pre-existing surface conditions.

The rights of private property owners would not be affected by any element of the proposed project. The location of any proposed facility, and the mitigation required for each facility on private lands would be negotiated with the individual property owner.

#### 4.10.1.1.1.1 North Area

The long-term disturbance area required for the 65 proposed wells and associated access roads in the North Area totals 125 acres. There are 84 acres of disturbance proposed for BLM lands, or about 67 percent of the total proposed disturbance. Disturbance on private and state lands account for the remaining 41 acres. The access roads and the adjacent rights-of-way required for gathering lines and water lines would be 78 feet in average width. There would be a total of 14.8 miles of new road and pipeline rights-of-way.

Other facilities, including one CPF and 3 compressor stations, would require an additional 15.5 acres. The total proposed long-term disturbance for the North Area would be 141 acres. The number of proposed and existing facilities by land status shown in **Table 4–13**.

#### 4.10.1.1.1.2 South Area

The total long-term disturbance area required for the 220 proposed wells, access roads, and facilities on public, state, and private lands in the South Area totals 622 acres, an increase of about three times the approximate existing disturbance of 230 acres from 47 existing wells and access roads. There are 259 acres of well pad and access road long-term disturbance proposed for BLM lands, or about 42 percent of the total proposed long-term disturbance for the South Area of 622 acres. Long-term disturbance on private and state lands account for the remaining 363 acres. The number of proposed and existing facilities, according to land status, are shown in **Table 4–14**.

**Table 4–13**
**Number of Facilities in North Area by Land Ownership**

| Facilities | Private | BLM | State | Total |
|---|---|---|---|---|
| *Wells* | | | | |
| existing | 0 | 7 | 8 | 15 |
| proposed | 10 | 46 | 9 | 65 |
| *Central Production Facilities* | | | | |
| existing | 0 | 0 | 1 | 1 |
| proposed | 0 | 0 | 1 | 1 |
| *Compressor Stations* | | | | |
| existing | 0 | 0 | 0 | 0 |
| proposed | 0 | 3 | 0 | 3 |
| *Roads (miles)* | | | | |
| existing | 17.5 | 48.8 | 11.9 | 78.2 |
| proposed | 2.7 | 9.6 | 2.5 | 14.8 |

**Table 4–14**
**Number of Facilities in South Area by Land Ownership**

| Facilities | Private | BLM | State | Total |
|---|---|---|---|---|
| *Wells* | | | | |
| existing | 20 | 23 | 10 | 53 |
| proposed | 44 | 85 | 91 | 220 |
| *Central Production Facilities* | | | | |
| existing | 3 | 0 | 0 | 3 |
| proposed | 4 | 0 | 0 | 4 |
| *Roads (miles)* | | | | |
| existing | 61.6 | 144.2 | 19.5 | 225.3 |
| proposed | 11 | 38.8 | 33.4 | 83.2 |

#### 4.10.1.1.2 Land Management Plans

NEPA implementation regulations require discussion of possible conflicts with Federal, regional, state, and local land use plans (40 CFR 1502.16(c)). Land management plans provide a framework for development within various government jurisdictions.

All action alternatives would be in conformance with multiple use Federal land management plans covering the Project Area. The Proposed Action and alternatives were reviewed against provisions of the Price River MFP, San Rafael RMP, and the Manti-La Sal National Forest's LRMP. Within the Project Area, oil and gas leasing was identified as a primary land use. Leases have been issued with restrictions (stipulations) as identified in the governing land use plans.

The San Rafael RMP states that no management restrictions are necessary in Recreation Opportunity Spectrum (ROS) areas classified as Roaded Natural, Rural, and Urban. Specific conditions were identified in the plan for maintenance of areas assigned Primitive and Semi-primitive Nonmotorized classifications, however, no special conditions were identified for Semi-primitive Motorized designations, which occur in the Project Area. The analysis supports the assertion that lands would be subject to leasing without any stipulations in Semi-primitive Nonmotorized areas.

The provision for year-round protection of raptor nests as specified in Alternative 2 is inconsistent with the raptor protection prescription of the San Rafael RMP. The plan prescribes seasonal buffer zones around known raptor sites to protect them from human disturbance to the greatest extent possible. With the increased development proposed for coal bed methane production, the analysis supports the need for protection consistent with the raptor protection provisions of the Price River MFP while meeting the goals of the San Rafael RMP. Therefore, year-round buffer zones around "occupied" raptor nests were prescribed as an Environmental Protection Measure for the entire FNG Project.

Land management plans and zoning ordinances have been implemented by Carbon and Emery counties. The action alternatives would be compatible with the planning and zoning of both counties. The Proposed Action would not be consistent with some of the provisions of the Carbon County Trails Plan (see **Section 1.5.5**).

Both the Proposed Action and Trails Plan intend to develop the same area for separate uses. Alternative 2 offers to diminish the inconsistency by including measures to study the development of alternative trails that could offset impacts.

#### 4.10.1.1.2.1 South Area

Most of the proposed wells (220) and 7 CPFs are in the Emery County zoning district M&G–1 — Mining and Grazing (**Plate 3–8**). Production wells are a Permitted Conditional Use of the zoning district that is subject to the prior approval of the County Commission.

Agricultural lands along creeks that run through the South Area are in the A–1 — Agricultural District. There are 29 wells and three CPFs proposed for the A–1 district. Exploratory, oil and gas wells are a Permitted Administrative (Planning Commission) Conditional Use requiring a Small Site Plan Approval. Production wells are a Permitted Legislative Conditional Use requiring a Large Site Plan Approval.

There are no facilities proposed for the I–1 Industrial zone or the CE–1 Critical Environmental zone district.

#### 4.10.1.1.2.2 North Area

All of the proposed facilities are within the Carbon County zoning district M&G–1 — Mining and Grazing (**Plate 3-8**). Production wells are Permitted Non-Conditional Use of the zone. There are no facilities proposed for the R–1–8 zone in Kenilworth or the small area of CE–1 — Critical Environmental zone in the northeast part of the North Area.

#### 4.10.1.1.2.3 Transmission Line Corridor

The Transmission Line Corridor consists of lands in Emery County's A–1 and M&G zoning districts. In Emery County, major utility transmission lines in an A–1 zone are a Permitted Legislative Conditional Use requiring a Large Site Plan Approval. Major lines in the M&G zone are a Permitted Conditional Use of the zoning district that is subject to the prior approval of the County Commission.

### *4.10.1.1.3 Land Use*

Short-term construction disturbance would consist of acreage for each facility sufficient to accommodate construction equipment and activities, and store construction material. Subsequent to installation, disturbed land required for construction would be reclaimed and revegetated back to pre-existing uses, leaving only the long-term, permanent disturbance area required for operation and maintenance over the life of the proposed project. The natural gas transmission line proposed for the Transmission Line Corridor would not result in a long-term permanent disturbance area. Surface disturbance within pipeline construction right-of-way would be reclaimed and revegetated to pre-existing land uses.

Land uses within the proposed disturbance areas would shift to natural gas extraction for the life of the project. Areas surrounding active operations would continue to serve the existing land uses during project operations. Reclamation and final closure of the proposed operations would re-establish the land uses of cropland, grazing and wildlife habitat in the disturbance areas under any action alternative. There are no project facilities proposed for Forest lands in the Project Area, therefore no impacts to existing land uses would occur from the proposed project on Forest lands.

#### 4.10.1.1.3.1 North Area

As shown on **Plate 3–7**, existing land uses in the North Area consist of rangeland and urban uses. No croplands and wetlands occur in the North Area. There are three soil types in the North Area that are prime farmland when irrigated. None of the land in the North Area is irrigated, therefore prime farmland soils would not be disturbed by proposed project facilities. Land would be temporarily removed from existing rangeland in the North Area by proposed natural gas facilities in all action alternatives. No facilities would be located within the urban land use area of Kenilworth. Recreation in the North Area is limited to trails and roads, as described in the Recreation section of Chapter 3. Impacts to recreational uses are described in **Section 4.12**.

#### 4.10.1.1.3.2 South Area

Land would be temporarily removed from existing uses of rangeland and agriculture (croplands) in the South Area by proposed natural gas facilities under all action alternatives (**Plate 3–7**). Existing land uses of urban, industrial, and recreation areas would not be affected by any proposed facility. **Table 4–15** summarizes the acres of land removed from existing uses for each affected land use type that occurs in the South Area. Impacts to recreational uses are described in **Section 4.12.**

**Table 4–15**
**Proposed Disturbance in South Area by Land Use**

| | Rangeland | | Cropland | | Total | |
|---|---|---|---|---|---|---|
| Facility | Number of Facilities | Disturbance (acres) | Number of Facilities | Disturbance (acres) | Number of Facilities | Disturbance (acres) |
| Well pads | 215 | 296 | 5 | 7 | 220 | 303 |
| CPF | 5 | 31 | 1 | 6 | 7 | 37 |
| New roads (miles) | 82.5 | 783 | 0.7 | 7 | 83.2 | 790 |
| Total | - | 1,110 | - | 20 | - | 1,130 |

#### 4.10.1.1.3.3 Transmission Line Corridor

Land uses in the transmission line corridor consist of cropland (agriculture), rangeland and urban uses. The natural gas transmission line would not require long-term permanent disturbance. Surface disturbance within pipeline construction right-of-way would be reclaimed and revegetated to pre-existing land uses. Approximately 1.3 acres of croplands would be temporarily disturbed by installation of the pipeline in the transmission line corridor. The remainder of disturbance would occur in rangeland. The disturbance acres by vegetation type, including agriculture, are described in **Section 4.5.**

#### 4.10.1.1.3.4 Residential

Impacts to residential uses by well facilities can occur when the sights and sounds from the operation of a well intrude on residential uses and during construction of the well, road, compressor facilities and other

associated facilities, which would result in temporary increases in noise, dust, odors, and traffic. The impacts to residences in the Project Area would be similar for each action alternative.

Proposed wells within a one-mile zone of residences in the South Area occur along SR 31 (Huntington Canyon Road) and near the towns of Huntington, Orangeville and Clawson. In the North Area, residences would be affected in Kenilworth, Price and Spring Glen. Approximately one-half of the wells located within one mile of any residence would be located on BLM lands, as shown in **Table 4–16**. In general, proposed wells nearest to residences (within one-half mile) in the Project Area would be located on private lands.

**Table 4–16**
**Number of Wells Within One-Half Mile and One Mile of Residences in North and South Areas**

| Distance from Residence | BLM | Private | State | Total |
|---|---|---|---|---|
| *North Area* | | | | |
| ½ mile | 1 | 2 | 0 | 3 |
| 1 mile | 6 | 6 | 1 | 13 |
| *South Area* | | | | |
| ½ mile | 4 | 18 | 1 | 23 |
| 1 mile | 27 | 25 | 1 | 53 |

Impacts to residential areas would consist of increased traffic levels at concentrated points of entry and departure from the Project Area. Impacts from traffic levels would consist of increased noise, dust, and the potential for a higher rate of traffic accidents. Most impacts would occur during the construction phase. These impacts would decrease after the construction phase. Fewer vehicles would be required and the use of large construction-related vehicles and trucks would be minimal.

### 4.10.1.1.3.5 Transportation

In general, impacts on the transportation system and traffic levels in Carbon and Emery counties would be construction related and short term in nature. Traffic on roads crossed by any of the proposed pipelines would experience relatively minor delays during construction by lane closures. The remaining lanes would be capable of handling the expected traffic levels. Impacts to transportation would be similar for any action alternative.

The Utah Statewide Transportation Improvement Program has scheduled projects on roads in Carbon and Emery counties for the fiscal years 1998 through 2002. SR 29 through the South Area is scheduled for widening and overlay (Project No. SP–0029(14)10).

Project-related traffic would not conflict with existing traffic or existing uses of the road. There would be a small increase in the traffic level of the primary access routes, however, any increase in traffic levels at any one time on the roads would most likely fall within capacity of the roads. Construction-related traffic would consist of an average of 85 trips per day in the South Area and 25 trips per day in the North Area that would

transport personnel and equipment to any project site during the annual eight-month construction period. Construction-related traffic to any site within the Project Area would occur only over the period of time it would take to install the facilities. Each well would require approximately 20 days to install. The average increase of one percent to the traffic levels near the South Area and five percent near the North Area would probably lead to a proportional increase in the risk of traffic accidents. These risks would probably occur during the morning and evening hours when most of the construction vehicles are traveling to and from construction sites.

An existing transportation-related problem is the need for improved road conditions and improved signage on the primary transportation routes such as SR 10 and on the roads that connect with the highway. The addition of trucks hauling equipment over local roads to sites within the North and South areas could result in the further deterioration of road conditions, as heavy trucks and heavy equipment have a disproportionate effect on road conditions relative to small and lighter passenger vehicles. There would also be potential for conflict at road intersections where project-related traffic turns onto highways from access roads.

There are currently no maintenance or roadway plans or schedules in place for any state routes that access the North and South areas. Carrying capacities and vehicle weight restrictions have not been determined for any of these state routes. Maintenance on the highways generally occurs on an as-needed basis. Maintenance activities are usually scheduled between the months of May and September.

Seasonal weight restrictions do occur on the highways and are implemented only when conditions require them. Restrictions are generally implemented during spring freeze and thaw cycles. Heavy vehicles can cause the edge of the pavement to crumble at intersections where they turn onto the highway, therefore UDOT requires access roads to be constructed with a flat surface at the intersection with the highway to minimize damage. Each access road should be paved back at least 50 feet from the intersection. The Companies would be required to pave the 50 feet of adjoining access along U.S. 6 and SR 57 and County Roads 31 and 29. Permits for each access road are issued on a case-by-case basis (Stapley 1998).

#### 4.10.1.1.3.5.1 North Area

The maximum possible number of vehicles along U.S. 6 would constitute a small percentage of the total average daily traffic (ADT). The 1996 average daily traffic count on U.S. 6 between Price and Helper ranged between 6,095 to 10,070 trips per day, as shown on **Table 3–26**. The addition of project vehicles to the highway would result in a less than one percent increase in traffic levels on U.S. 6 during the eight-month annual construction period. The average number of 25 trips per day would result in an increase in traffic levels of nearly five percent on SR 157 to Kenilworth (555 ADT) for the duration of the installation of proposed facilities accessed by this road.

Project-related traffic involved in operations and maintenance over the life of the project would not result in a noticeable increase in traffic levels on U.S. 6 and SR 157. There would be a maximum of 5 trips per day, resulting in an insignificant increase of traffic on U.S. 6 and a one percent increase of traffic on SR 157.

#### 4.10.1.1.3.5.2 Impacts to Airports

Federal Airport Regulation Sub-Part 77 (FAR Part 77) establishes standards for determining obstructions to air navigation. The standards apply to existing and proposed manmade objects, objects of natural growth, and terrain. Any structure would be an obstruction to air navigation if it is of a height that is 200 feet above

ground level or above the established airport elevation, whichever is higher, and within 3 nautical miles of the established reference point of an airport.

The Federal Aviation Administration (FAA) would require notification at least 30 days before proposed construction takes place near an airport (FAA Form 7460–1 "Notice of Proposed Construction or Alteration") under certain situations. Construction or alteration requires notice in the event that the construction/alteration is of greater height than an imaginary surface extending outward and upward at one of the following slopes:

1) 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of each airport (public use or military) with at least one runway more than 3,200 feet in actual length, excluding heliports.

2) 50 to 1 for a horizontal distance of 10,000 feet from the nearest point of the nearest runway of each airport (public use or military) with its longest runway no more than 3,200 feet in actual length, excluding heliports.

3) 25 to 1 for a horizontal distance of 5,000 feet from the nearest point of the nearest landing and takeoff area of each heliport (public use or military).

The Carbon County Airport is located partially within the North Area. Runway 18/36 is 8300 feet x 100 feet in size and is oriented in a southwest–northeast direction. There are four wells located under the approach and takeoff flight path of the runway between one and three miles from the end of the runway. The maximum elevation of the top of the pump unit at one mile from the runway can be about 50 feet higher than the runway. The pump unit at this well would be approximately 20 feet in height, located at an elevation of approximately 40 feet higher than the runway elevation, for a total height of 60 feet greater in elevation than the end of the runway. The FAA Form 7460–1 "Notice of Proposed Construction or Alteration" would need to be submitted to the FAA at least 30 days before installation of the well. All other wells under the flight path would be within the height restriction.

Runway 14/32 is oriented in a southeast–northwest direction. There are two existing and three proposed wells located beneath the flight path between 0.9 and 5.0 miles from the end of the runway. Strobe lights on the top of drill rigs at these three well sites would be required by the FAA during the drilling process. The elevation of the nearest well site is approximately 20 feet higher than the end of the runway. If the pump unit is 20 feet tall, then the total elevation of the top of the pumping unit would be about 40 feet higher in elevation than the runway. At 0.9 miles, the maximum elevation of the top of the pump must be under 46 feet higher than the end of the runway elevation. The pumping unit at the well site is within the height restriction.

The approach and takeoff flight path for runway 07/25 is oriented in an east–west direction. There are no proposed wells located under the flight path of the runway.

The well rigs that would be used to install every proposed well under approach and takeoff flight paths would be approximately 100 feet in height. All rigs within 20,000 feet (3.8 miles) pose a potential hazard to aircraft, therefore the FAA form 7460–1 "Notice of Proposed Construction or Alteration" would need to be submitted to the FAA at least 30 days before construction.

#### 4.10.1.1.3.5.3 South Area

The maximum possible number of vehicles along a primary transportation route such as SR 31 or SR 10 would constitute a small percentage of the total average daily traffic. The 1996 ADT count on SR 10 between Price and Ferron ranged between 3,250 to 6,780 trips per day, as shown on **Table 3–26**. The addition of project vehicles to the highway would result in a one to three percent increase in traffic levels on SR 10 over the five-year construction period. The average number of 85 trips per day would result in an increase in traffic levels of about two percent on SR 31 (ADT between 3,445 and 4,125) between the junction with SR 10 and the Huntington power plant. SR 57, which provides access to the Wilburg Mine, had an ADT of 865 in 1996. The 85 maximum number of trips would result in a ten percent increase of traffic along this road for the duration of the installation of proposed facilities accessed by this road.

Project-related traffic involved in operations and maintenance over the life of the project would not result in a noticeable increase in traffic levels on any of the primary transportation routes that access the South Area. There would be a maximum of 5 trips per day, resulting in a less than one percent increase of traffic on SRs 10, 31, 29, and 57.

#### *4.10.1.1.4 Electric Power Option*

Under the Proposed Action, 187 miles of aboveground power lines would be installed. Half of these power lines would be installed outside of the access road ROW resulting in a temporary disturbance of 113 acres (93.5 miles X 5,280 feet/mile X 10-foot-wide ROW), or 7 percent of the 1,633 short-term disturbance to construct all other facilities within the Project Area. Clearing of vegetation along the ROW would be minimal and only limited blading of vegetation is likely to occur. Construction of the power lines would result in disturbances to the local land uses during installation. However, the effects of these disturbances would be minimal and short term in nature. Because no long-term clearance of vegetation would occur, long-term effects to land uses, such as grazing, are not expected.

### 4.10.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Alternative 2 is similar to Alternative 1 in the siting of project facilities and the acreage of land to be disturbed for each facility. This alternative differs from Alternative 1 in that Environmental Protection Measures have been developed for critical resources, as described in **Section 2.2**. Critical resources that may pose constraints to the siting of some proposed facilities consist of water resources, soils, wetlands/riparian, wildlife habitats, and visual resources. Implementation of Alternative 2 would result in the development of 18 fewer wells in the Project Area and many well locations would be moved to areas where wells could be assessed without crossing slopes greater than 25 percent. Therefore, the effects on existing land uses, land ownership, public access opportunities, the transportation system and traffic levels from the implementation of Alternative 2 would be slightly less than those described for the Proposed Action.

Gates would be placed at certain points on proposed constructed roads on BLM land in the Project Area to prevent public traffic uses during the periods when big game occupy winter range areas. The gates would not be placed on county roads because only the County officials have the authority to close county roads. This period would be from December 1 through April 15. The purpose of the road gates would be to restrict public use along these public roads to reduce impact to big game in their winter range habitat. The main impact to land use would be the restriction of motor vehicle traffic during these times. Other recreational users, such as hikers, horse riders, and bike riders would still be able to access the lands. Because the

incidence of motor vehicles is probably smaller during the winter than during the rest of the year, the gating should not have a significant effect on land use during the winter range period. However, after a period of time when people become acquainted with using these new roads for recreational activity, the closures could become noticeable.

#### *4.10.1.2.1 Electric Power Option*

Under Alternative 2, about 97 miles of aboveground power lines would be installed, or 90 miles less than under the Proposed Action. Half of these power lines would be installed outside of the access road ROW resulting in a temporary disturbance of 59 acres (48.5 miles X 5,280 feet/mile X 10-foot wide ROW), or about 4 percent of the 1,472 short-term disturbance to construct all other facilities within the Project Area. Clearing of vegetation along the ROW would be minimal and only limited blading of vegetation is likely to occur. Construction of the power lines would result in disturbances to the local land uses during installation. However, the effects of these disturbances would be minimal and short term in nature. Because no long-term clearance of vegetation would occur, long-term effects to land uses, such as grazing, are not expected.

Approximately 73 miles of power lines would be buried within the access road ROW. Therefore, no additional short- or long-term disturbance to soils would occur with the installation of buried power lines.

### 4.10.1.3 Alternative 3 — No Action Alternative

No direct or indirect impacts to existing BLM land uses from the proposed project would occur under this alternative. No wells or facilities would be constructed on BLM lands. Less than one mile of new roads could be constructed on BLM land to give reasonable access to valid leases on State and private land. Therefore, the land use on these lands would be very temporarily interrupted during the construction of these roads. The existing condition of BLM lands in the Project Area would be maintained under the current management direction as defined in the BLM San Rafael and Price management plans currently in effect. There would continue to be natural gas development on private and State lands within and adjacent to the North and South areas. Effects to the State and private land use would be the same as described under the action alternatives.

A maximum of 155 wells could be drilled on state and private lands under the No Action Alternative. The construction of these 155 wells would probably be completed within three to four years assuming a level of development of about 40 wells per year. Traffic levels for this construction phase would probably be near the same levels as the Proposed Action for these two years. After development of the state and private leases, traffic levels would decrease to pre-construction levels. However, traffic conflicts would be expected to increase in the future under current road conditions as a result of population growth and continued resource development in the counties, including natural gas production.

## 4.10.2 Impacts Summary

The majority of land use within the Project Area is within the Mining and Grazing land zoning category. The short-term disturbance within the Project Area under the Proposed Action would be would be 1,633 acres, and then reduced to 763 acres after interim reclamation of well pads, facilities, and construction disturbance along roads. The disturbance along the pipeline corridor would be temporary (2 to 4 months). Thus, the total long-term disturbance would be 0.7 percent of the 111,500-acre Project Area and 261-acre pipeline corridor, combined. Most of the disturbance would occur on lands dedicated to grazing activities. Traffic would be elevated 2 to 5 percent during the construction period. It is anticipated that the accident rate may increase

a corresponding 2 to 5 percent during this period. The potential for increased traffic accidents would most likely occur at the key locations along U.S. 6 and SR 10 where vehicles would enter and exit the Project Area. Short-term disturbance under Alternative 2 would be 1,472 acres and then decrease to 679 acres (0.6 percent of the Project Area). The potential increase in traffic accidents would be equivalent to the Proposed Action. Under the No Action alternative, short-term disturbance would be 917 acres and then decrease to 367 acres (0.3 percent of the Project Area).

## 4.10.3 Mitigation

All new roads across BLM or national forest system lands should be constructed to the standards of the BLM or Forest Service.

## 4.10.4 Unavoidable Adverse Effects

There would be unavoidable effects from noise associated with the use of roads and lands near residential areas. The potential for traffic accidents would increase slightly at locations along U.S. 6 and SR 10 where vehicles enter and exit the Project Area. This potential would be the highest during construction periods.

# 4.11 LIVESTOCK MANAGEMENT

## 4.11.1 Direct and Indirect Effects

### 4.11.1.1 Alternative 1 — Proposed Action

Implementation of this alternative would cause direct and indirect effects on the management of livestock as a result of the construction and operation of the project. However, most of these impacts would be limited to the life of the project. Long-term impacts are not anticipated to occur once vegetation productivity is restored after closure of the project.

Three general types of direct impact are anticipated to occur. They are the disturbance or removal of forage, increased difficulty in managing livestock, and increased potential for the establishment of new populations of noxious weeds. Construction of the project's proposed facilities would disturb and/or eliminate native vegetation used for grazing forage (**Section 4.5**). By reducing the amount of forage available, the overall level of livestock production would decrease. This decrease in the grazing resource has been estimated in AUMs for each grazing allotment. About 70 AUMs (49, BLM) would be lost in the Project Area during construction of the project (**Table 4–17**). The long-term operational loss would be approximately 46 AUMs (33, BLM).

The Proposed Action would increase the difficulty of managing livestock by directly affect range improvements, stock watering, and facilities related to the control of livestock movement. The number of gates to control livestock would increase with the level of project-related facilities and access roads. This increase, in tandem with the increased traffic levels, would increase the potential for gates to be left open and livestock to get out of the allotment. In their study, Fowler and Witte (1985) also found that ranches had increased labor requirements from activities, such as gathering cattle, fixing fences, closing gates, removing litter and repairing vandalism damages that occurred during the occupation of oil and gas development.

## Table 4–17
## Impacts to Grazing Allotments

| Allotment Name | Acres per AUM | Acres Affected/ AUMs lost | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Construction | | | | | | Operation | | | | | |
| | | Public | | State/Private | | Total | | Public | | State/Private | | Total | |
| | | Acres Impacted | AUMs Lost | Acres Impacted | AUMs Lost | Acres Impacted | AUMs Lost | Acres Impacted | AUMs Lost | Acres Impacted | AUMs Lost | Acres Impacted | AUMs Lost |
| *SOUTH AREA* | | | | | | | | | | | | | |
| Clawson Dairy | 28 | 23 | 0.82 | 0 | 0.00 | 23 | 0.82 | 12 | 0.43 | 0 | 0.00 | 12 | 0.43 |
| Cowley | 7 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Cox (Don) | 7 | 12 | 1.71 | 1 | 0.14 | 13 | 1.86 | 6 | 0.86 | 1 | 0.14 | 7 | 1.00 |
| Cox (John) | 9 | 84 | 9.33 | 6 | 0.67 | 90 | 10.00 | 45 | 5.00 | 3 | 0.33 | 48 | 5.33 |
| Deep Wash | 148 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| East Grimes | 14 | 95 | 6.79 | 29 | 2.07 | 124 | 8.86 | 50 | 3.57 | 15 | 1.07 | 65 | 4.64 |
| Humphrey | 4 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Jensen | 26 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| N. Huntington | 12 | 0 | 0.00 | 99 | 8.25 | 99 | 8.25 | 0 | 0.00 | 53 | 4.42 | 53 | 4.42 |
| Northwest Ferron | 17 | 11 | 0.65 | 0 | 0.00 | 11 | 0.65 | 6 | 0.35 | 0 | 0.00 | 6 | 0.35 |
| North Wolf Hollow | 11 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Peacock | 56 | 35 | 0.63 | 0 | 0.00 | 35 | 0.63 | 19 | 0.34 | 0 | 0.00 | 19 | 0.34 |
| Reid | 17 | 5 | 0.29 | 3 | 0.18 | 8 | 0.47 | 3 | 0.18 | 0 | 0.00 | 3 | 0.18 |
| Rock Canyon | 12 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 2 | 0.17 | 2 | 0.17 |
| South Wolf Hollow | 25 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| West Grimes | 15 | 61 | 4.07 | 1 | 0.07 | 62 | 4.13 | 32 | 2.13 | 1 | 0.07 | 33 | 2.20 |
| West Huntington | 87 | 5 | 0.06 | 192 | 2.21 | 197 | 2.26 | 2 | 0.02 | 104 | 1.20 | 106 | 1.22 |
| West Orangeville | 21 | 3 | 0.14 | 5 | 0.24 | 8 | 0.38 | 2 | 0.10 | 2 | 0.10 | 4 | 0.19 |
| Wilberg | 16 | 135 | 8.44 | 87 | 5.44 | 222 | 13.88 | 72 | 4.50 | 46 | 2.88 | 118 | 7.38 |
| **Total** | | 469 | 32.93 | 423 | 19.26 | 892 | 52.18 | 249 | 17.48 | 227 | 10.36 | 476 | 27.84 |

## Table 4–17 (continued)
## Impacts to Grazing Allotments

| Allotment Name | Acres per AUM | Acres Affected/ AUMs lost | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Construction | | | | | | Operation | | | | | |
| | | Public | | State/Private | | Total | | Public | | State/Private | | Total | |
| | | Acres Impacted | AUMs Lost | Acres Impacted | AUMs Lost | Acres Impacted | AUMs Lost | Acres Impacted | AUMs Lost | Acres Impacted | AUMs Lost | Acres Impacted | AUMs Lost |
| *NORTH AREA* | | | | | | | | | | | | | |
| Coal Creek | 18 | 160 | 8.89 | 30 | 1.67 | 190 | 10.56 | 160 | 8.89 | 30 | 1.67 | 190 | 10.56 |
| Hayes Wash | 18 | 46 | 2.56 | 10 | 0.56 | 56 | 3.11 | 46 | 2.56 | 10 | 0.56 | 56 | 3.11 |
| Wood Hill | 16 | 80 | 4.44 | 0 | 0 | 80 | 4.44 | 80 | 4.44 | 0 | 0 | 80 | 4.44 |
| **Total** | | 286 | 15.89 | 40 | 2.23 | 326 | 18.11 | 286 | 15.89 | 40 | 2.23 | 326 | 18.11 |
| *FOREST SERVICE ALLOTMENTS - SOUTHERN AREA ONLY* | | | | | | | | | | | | | |
| East Mountain | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Horn Mountain | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gentry Mountain | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trail Mountain | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Furthermore, the increase in the number of roads constructed to access wells within allotments and the associated use of these roads would increase vehicular traffic within allotments. Although these roads would be constructed for use by the Companies, the public likely would use many of the roads for recreation. This increase in use would increase the potential for collisions with livestock and harassment of livestock. Additionally, in their study of the effects of oil and gas operations on New Mexico ranch operations, Fowler and Witte (1985) determined an increase in vehicular traffic was responsible for decreases in calving percentage and calf market weight.

The increased potential for noxious weed invasion resulting from project construction and operations could impact the grazing resources within the Project Area. Noxious weeds are generally unpalatable to livestock and, thus, their establishment results in the reduction of available forage. Unless new populations of noxious weeds are actively controlled or managed, they could become a problem for livestock managers.

These indirect impacts would be eliminated upon the closure and reclamation of the facilities. No long-term impacts would occur to grazing resources within the Project Area. However, restoration of grazing potential is based upon reclamation success (see **Section 4.17**). The reclamation efforts could take several decades to restore vegetation.

#### *4.11.1.1.2 Electric Power Option*

Installation of above ground power lines and poles would have a minimal impact on livestock. During installation of poles and power lines, there would be a short-term disturbance, about the five days required to install one mile of line, on grazing activities due to the presence of vehicles and equipment. After installation activities, there would be a slight long-term loss of forage around the pole locations.

### 4.11.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Impacts to grazing resources and their management under Alternative 2 are expected to be the same as those described in Alternative 1 with the following exception. Alternative 2 proposes that all range improvements would meet BLM or Forest Service standards as applicable (BM 1741, FSM 2242.03, and BLM Price Field Office and Manti-La Sal National Forest policies). This action would help to keep the livestock within the allotment and reduce the potential for conflict with traffic. However, long-term impacts to the grazing management and grazing facilities may occur with reduced forage production and the potential for noxious weeds on disturbed land.

#### *4.11.1.2.2 Electric Power Option*

Installation of above ground power lines and poles would have a similar minimal impact on livestock as the Proposed Action. However, under Alternative 2, 97 miles of aboveground lines would be installed instead of the 187 miles under the Proposed Action. Therefore, the slight impacts described under the Proposed Action would be about 52 percent less for Alternative 2.

### 4.11.1.3 Alternative 3 — No Action Alternative

No additional wells would be developed on federal lands. However, road rights-of-way may be issued to provide access to state or private leases. The companies would be required to construct gates and cattleguards where needed. Impacts of fugitive dust, disruption of livestock operations, and noxious weeds

also would occur at a reduced level of activity. Thus, most of the 49 AUMs that would be lost to construction of the project under alternatives 1 and 2 would not occur with implementation of Alternative 3. The approximately 21 AUMs lost on state and privately-owned lands still would occur under Alternative 3.

### 4.11.2 Impacts Summary

Alternatives 1 and 2 would reduce grazing by about 70 AUMs (49 BLM). Most of this loss would occur in the South Area (52 AUMs). Long-term losses would be 46 AUM (33, BLM). Also, both alternatives would experience an increase in the difficulty of managing livestock and a potential project-related increase in the establishment on new populations of noxious weeds. Alternative 3 would remove only minor amounts of grazing land and few AUMs on federal lands. However, 21 AUMs on state and privately-owned lands would be lost under all three alternatives.

### 4.11.3 Mitigation

Landowners and livestock permittees should be notified by the Companies prior to any surface activities and/or disturbances of existing livestock facilities. Additionally, mitigation measures for other resources, such as vegetation and soils also would help mitigate the direct and indirect effects identified for livestock management.

### 4.11.4 Unavoidable Adverse Effects

Disturbance of vegetation would occur under each alternative. Thus, a loss of forage production and a reduction in AUMs supported by several allotments also would occur. An increased potential for livestock-vehicle collisions and livestock harassment also would occur under each alternative, at least to some small degree.

## 4.12 RECREATION

The potential effect of the construction and operation of the proposed facilities on recreation resources is related to how much recreation opportunity is being created by the proposed project versus how much opportunity is being lost for recreation pursuits. Local residents, especially in Price and Kenilworth, value the federal lands for recreational activities because of the proximity to their homes and the relative solitude that can be achieved within a short distance from their homes. The main recreational issue identified in the scoping process is the alteration of the recreational experience for local users resulting from the change in solitude and the natural setting. The visual character of the surrounding landscape is also an important element in the quality of a recreation experience. The Project Area is predominantly rural in character with some industrial-type modifications from existing wells. The structures proposed for each well in the Project Area may constitute an intrusion that would impact the ambience sought by recreationists. The construction and operation of the proposed facilities can also affect recreational activities by changing access opportunities and by directly disrupting existing recreation activities.

Direct impacts to recreation occur by the displacement of acreage from existing uses by proposed natural gas facilities. Impacts to recreation resources are considered significant if they change the recreational opportunities. The impacts are also significant if BLM or county objectives for recreation cannot be met. The

main impact of the proposed natural gas activities would be an alteration of the recreational experience for people living near the Project Area, especially the North Area because of the denser population.

Indirect impacts to recreation would occur if the proposed facilities resulted in a change in the level of visitation into the area or if the project would affect growth in Carbon and Emery counties, thus, changing the utilization of existing recreation facilities and other land uses.

## 4.12.1 Direct and Indirect Impacts

### 4.12.1.1 Alternative 1 — Proposed Action

The Proposed Action would be constructed and operated on public, state, and private lands in the North and South Areas and the Pipeline Corridor. The Proposed Action would impact dispersed recreational opportunities in the North and South Areas. The primary effect of the natural gas development in the North and South Areas would be the change of the recreational experience on trails and roads used for recreation. The solitude and natural setting now being experienced on these trails would be affected by construction activities during the five-year construction period. To a lesser degree, the loss in solitude could continue through the life of the project by the presence of facilities, the operational and periodic maintenance needed at well sites and CPFs, and the traffic to the facilities. The change in the natural setting would continue through the life of the project. The Carbon County Commission has proposed a trail system that includes some roads in the North Area. This trails system, shown on **Plate 3–10** has not been ratified by the Commission nor has it been coordinated with land owners and land managers. Nevertheless, it does represent, at the present, an informal trail system used by residents of Carbon County for recreational purposes. The informal trail system used by mountain bikers, horse riders, OHV users, hikers, cross-country skiers, and wildlife viewers could be altered by pad and road construction. In addition, the users would experience conflict with project vehicle traffic and experience more noise and airborne dust than is now encountered.

Short-term impacts to recreation within and adjacent to the Project Area would result from all phases of the construction process. Activities associated with the installation of the proposed wells, including construction of roads, gathering lines and water lines, and possibly aboveground electric lines, would temporarily alter the use of affected roads and trails for the duration of construction activities. Construction activities can be expected to occur over a period of five years over the entire Project Area. Activities typically take place seven days a week from April through November, depending on weather and soil conditions. During this time period, there would be disturbance to the existing landscape character. Noise and dust from construction activities would be evident. Traffic associated with moving equipment over public highways and local roads would potentially conflict with recreational uses as they would be visually and audibly apparent. However, since the construction activities would be spread out over a five-year period, approximately 20 percent of the Project Area would be affected by construction activities in any given year.

A total of 83.2 miles of new roads would be constructed in the South Area and 14.8 miles in the North Area. Road construction is expected to require 4 days per mile, or a total of approximately 333 days in the South Area and 59 days in the North Area. The road construction in the Project Area would occur over a five-year period as required to access wells, averaging 67 days of construction per year in the South Area and 12 days per year in the North Area. Generally, road construction would occur during the eight-month (240 days) annual construction period from April through November. Recreationists would encounter road construction during that period of time. The loss of solitude, the natural experience, and trail accessability would affect local users in the particular area of construction. Additionally, the muscle-propelled recreationists (bikers

and hikers) would be especially affected by temporary, but short-term, increased dust levels when riding behind vehicles or when vehicles pass them.

Pipeline and power line installation along existing road rights-of-way would temporarily inconvenience recreationists who use the roads to gain access to recreational activities in the area. Construction activities would also impede recreation use of existing roads and trails, as well as, degrade the visual quality of the recreational experience. The loss of solitude along these roads would continue through the construction period.

Project construction would result in increased, but temporary, noise levels in surrounding areas from blasting and heavy equipment. Construction-related noise could reduce the quality of the recreational experience in general. However, as discussed in the noise impacts section, construction-related increases would be short-term and, with the exception of blasting, generally restricted to the immediate vicinity of the work. Noise from blasting would be sporadic and of short duration. Potential long-term increases in noise levels would result from the operation of gas-powered pumping units. Noise from operation of proposed facilities is discussed in **Section 4.14.**

The general season dates for big game hunting occur from late August (archery) through early November. The hunting season occurs during the proposed construction period. Hunting activities would be affected primarily at project sites that are undergoing installation or construction activities. Because the construction activities would be evenly distributed over a five-year period, approximately 20 percent of hunting opportunities would be affected in any year.

State lands in the Lower Huntington Wildlife Management Area (WLMA) and the Upper Huntington WLMA (shown as state wildlife reserves on **Plate 2–1**) are hunted for upland game birds. One well is proposed for the Upper Huntington WLMA, which would impact hunting opportunities for pheasant, mourning dove, and quail.

In general, the quality of the recreational experience would decline in the Project Area for the local users. The nature of the experience would be changed in the immediate areas disturbed by the project activities because there would be less opportunity to experience an isolated and natural setting. Recreationists using the area may be displaced by facilities or change their patterns of use for the duration of the proposed activities. Recreationists who seek a primitive experience characterized by a high degree of natural integrity and appearance and solitude may seek them elsewhere within the Project Area or on other public lands in Carbon and Emery counties. These alternative opportunities would not be in close proximity to residential areas, as is the case currently.

#### *4.12.1.1.1 North Area*

The North Area consists of BLM, state, and private lands. Recreational uses consist of dispersed activities such as mountain bike riding, horse riding, hiking, wildlife viewing, and OHV use. There are no developed recreational areas within or near the North Area. As a result, the Proposed Action would have no effect on developed recreational areas.

The Proposed Action in the North Area would consist of 65 wells, one new CPF, three compressor stations, and associated transportation infrastructure, such as roads and pipelines, and possibly aboveground electric transmission lines. There are currently 15 existing wells located on state and BLM lands in the North Area. The BLM has inventoried public and private lands in the North Area with the Recreation Opportunity

Spectrum (ROS) system. The BLM manages federal lands in the North Area to meet the objectives of each ROS class. State and private lands are not managed to meet BLM objectives. However, the ROS inventory of these lands characterizes the setting and potential recreational opportunities. The total number of existing and proposed wells and other facilities in each ROS class on public and private lands in the North Area are summarized in **Table 4–18**.

BLM Recreation Management

There are 46 wells proposed for BLM lands in the North Area, as shown in **Table 4–18**. A total of 80 wells, including existing and proposed wells, would be operated in the North Area. The BLM ROS analysis was utilized to assess the significance of impacts to recreation resources on public lands. The public lands in the North Area are managed with the ROS classes Roaded Natural, Semi-primitive Motorized, and Urban. None of the proposed facilities would be in the Semi-primitive Motorized area.

**Table 4–18**
**North Area Facilities in ROS Classes**

| | ROS Classes | | | |
|---|---|---|---|---|
| **Facility** | **Roaded Natural** | **Urban** | **Semi-primitive Motorized** | **Total** |
| *Wells* | | | | |
| **BLM** | | | | |
| Proposed | 45 | 1 | 0 | 46 |
| Existing | 7 | 0 | 0 | 7 |
| **Private** | | | | |
| Proposed | 6 | 4 | 0 | 10 |
| Existing | 0 | 0 | 0 | 0 |
| **State** | | | | |
| Proposed | 9 | 0 | 0 | 9 |
| Existing | 8 | 0 | 0 | 8 |
| Total | 75 | 5 | 0 | 80 |
| *Roads (miles)* | | | | |
| Proposed | 13.0 | 1.8 | 0 | 14.8 |
| Existing | 72.9 | 4.6 | 0.7 | 78.2 |
| Total | 85.9 | 6.4 | 0.7 | 93.0 |

Most of the 46 wells on BLM lands would be on lands classified ROS Roaded Natural, which is characterized by a predominantly natural environment. Evidence of resource utilization should be moderate and in harmony with the natural environment. The addition of proposed facilities to the landscape would result in a modification of the natural environment. Aboveground power lines would be a visual intrusion into the natural setting. BLM objectives for Roaded Natural would be met if measures are taken to blend the facilities with the surrounding environment. There would be one well proposed for BLM lands in the ROS Urban area. This class is characterized by a highly-modified environment. The operation of one well on urban lands would be consistent with BLM ROS management objectives.

Private and State Lands

Recreation is not a significant use of most private lands in the North Area, but some roads across State and private lands provide access to BLM lands. Recreation on State-owned lands consists of dispersed trail-related activities similar to those described for BLM lands. Nineteen wells, or approximately 30 percent of the proposed wells, would be located on private and state lands. Currently, county roads that cross through private lands to reach public lands are part of the proposed Carbon County Trails Plan and the informal trail system. Access roads that cross private lands would be constructed or improved to accommodate project-related traffic. Any recreation use on roads across private and State roads would be affected similarly to roads across BLM lands.

Recreational Opportunities

The Kenilworth Trail forms a loop between Price and Kenilworth. Under the Proposed Action, there would be 13 wells within the foreground and middle ground views from the trail. The trails shown on **Plate 3–10** have historically been used by Carbon County residents for recreational opportunities. The Carbon County Commission has issued a the Carbon County Trails Plan that incorporates these trails as formally designated trails. However, the plan has not been ratified with individual land owners or land managers. The loss of solitude and the natural setting would be experienced along the Kenilworth Loop and the informal trail system, especially during the construction period. Some trail users who value the natural environment and solitude as integral to the recreation experience would probably seek recreational opportunities outside of the North Area, although it would result in less convenience to local users because these opportunities would be farther from their homes.

A sledding hill is located on private lands on a slope facing the south side of Kenilworth. The nearest well to the sledding hill is between ¼ to ½ mile north of the slope. The primary impact to sledders would be the sight and sound of the pumping unit.

The proposed access road improvements of existing roads in the North Area could be detrimental to some existing trail-related recreation activities. Mountain bikers generally prefer routes that provide a challenge to biking skills. Surface trail characteristics such as roughness, winding curves, and changes in gradients provide change and variety in the trail that challenge the mountain biker. However, the proposed road improvements may enhance other activities such as OHV use and hunting because public access into the area would be improved.

### *4.12.1.1.2 South Area*

The South Area contains BLM, National Forest, state, and private lands. The Proposed Action in the South Area would consist of 220 new wells, four new CPFs, and associated transportation infrastructure such as roads, pipelines, and possibly aboveground electric transmission lines. There are 53 existing wells in the South Area. The total field development including proposed and existing facilities would consist of 273 wells.

BLM Recreation Management

As shown in **Table 4–19**, 85 wells would be constructed on BLM lands, including existing and proposed wells. The BLM ROS was utilized to assess the impacts to recreation resources on public lands. The BLM

**Table 4–19**
**Proposed South Area Facilities in ROS Classes**

| Facility | ROS Classes | | | | Total |
|---|---|---|---|---|---|
| | Roaded Natural | Urban | Semi-primitive Motorized | Rural | |
| *Number of Wells* | | | | | |
| **BLM** | | | | | |
| Proposed | 18 | 0 | 67 | 0 | 85 |
| Existing | 4 | 0 | 19 | 0 | 23 |
| Total | 22 | 0 | 86 | 0 | 108 |
| **Private** | | | | | |
| Proposed | 38 | 0 | 1 | 5 | 44 |
| Existing | 21 | 0 | 2 | 0 | 23 |
| Total | 59 | 0 | 3 | 5 | 67 |
| **State** | | | | | |
| Proposed | 53 | 0 | 38 | 0 | 91 |
| Existing | 4 | 0 | 3 | 0 | 7 |
| Total | 57 | 0 | 41 | 0 | 98 |
| **Total** | 138 | 0 | 130 | 5 | 273 |
| *Roads (miles)* | | | | | |
| **New Roads** | | | | | |
| BLM | 5.8 | 0.0 | 33.0 | 0.0 | 38.9 |
| State | 16.7 | 0.0 | 16.3 | 0.3 | 33.4 |
| Private | 8.9 | 0.1 | 1.2 | 0.7 | 10.9 |
| Total | 31.5 | 0.1 | 50.5 | 1.0 | 83.2 |
| **Existing** | 140.2 | 9.4 | 48.0 | 27.7 | 225.3 |
| **Total** | 171.7 | 9.5 | 98.5 | 28.7 | 308.5 |

lands in the South Area are managed with the ROS classes Roaded Natural, Semi-primitive Motorized, Rural and Urban. There are no facilities proposed for BLM lands in the ROS classes of Urban and Rural.

On BLM lands identified as Semi-primitive for ROS, 67 wells and 33.0 miles of new access road would be constructed. Within ROS Roaded Natural, 18 wells and 5.8 miles of new access roads would be installed. Aboveground power lines also may be constructed and would generally parallel access routes. The proposed project would result in modification of the natural environment. Well sites and facilities, access roads and aboveground lines would result in visual intrusions to the natural setting and could affect the solitude sought by some recreationists. The levels of change to the environment would be moderate, but the Semi-primitive Motorized objectives would not be met, as opportunities for isolation from the sights and sounds of man would be affected in areas where development is concentrated. BLM objectives for the Roaded Natural areas would be met if measures are taken to blend the facilities with the surrounding landscape. **Section 4.14** describes measures proposed by the Companies and identifies mitigation that would reduce visual impacts of facilities.

Private and State Lands

Recreation is not a significant use of most private lands in the South Area. A portion of the Huntington Lake State Park is located within the South Area. The nearest proposed well to the park is approximately 1.3 miles to the west. The Proposed Action would not affect recreational opportunities in the park. The visual impact of proposed facilities to visitors in the park is assessed in **Section 4.13** and the noise impact is assessed in **Section 4.14**. The project would not affect recreational opportunities or public access to the Mill Site State Park, which is adjacent to the South Area. Recreation on other State-owned lands consists of dispersed activities similar to those described for BLM lands. Access roads that cross through private lands would be improved to accommodate project-related traffic.

The Bear Canyon Campground is an Emery County-owned facility in Huntington Canyon near the northwest boundary of the South Area. There is one well proposed for private land adjacent to the campground. The well would be visually and audibly evident to campers and picnickers. There is also potential that the well facilities would pose a danger to campground visitors in the small probability of a well explosion or fire.

Recreational Opportunities

Dispersed recreation is not a primary use of public or private lands in the South Area. Some groups, for example, the Southeast Utah OHV Club, have expressed an interest in developing an OHV access trails network using the existing roads and the roads that the Companies would construct. If the OHV network is fully developed, there could be an increase of OHV use in the South Area. There would be little change in existing levels of dispersed recreational activities on public lands surrounding the South Area as a result of the development under the Proposed Action. It is anticipated that similar levels of recreational activities, including hunting, would continue on these lands.

Hunting is the primary dispersed recreation opportunity available on public lands in the Project Area. There are an additional 83.2 miles of roads proposed for the South Area, which would increase the total miles of roads by 36 percent, from 225.3 miles (including jeep and foot trails) to 308.5 miles. The potential for illegal hunting activities may increase as public access opportunities increase as a result of the proposed access roads into the South Area.

The Castle Valley Pageant site is located on State lands seven miles west of Castle Dale within the South Area. The pageant would occur annually over a period of eight nights in late July and early August. More than 20,000 people attend the pageant to view a portrayal of the Mormon settlement of Castle Valley. The primary effects to the pageant would be visual and are analyzed in **Section 4.13**. There is also potential that the noise from the pumping units would be intrusive to the pageant experience during the eight-day event.

Any change in the water quality of the San Rafael river downstream of the proposed project could result in impacts to water-based and water-enhanced recreational uses of the river, such as rafting, fishing, hiking, and wildlife observation. However, it is not anticipated that downstream flows would vary significantly from existing flows or that water quality would be adversely impacted by project activities (see **Section 4.2**).

#### *4.12.1.1.3 Transmission Line Corridor*

The proposed gas transmission line would be constructed on public, State of Utah and private lands adjacent to the existing Questar right-of-way. There would be no long-term impacts to recreational uses within the

existing pipeline right-of-way. Once the pipeline is installed and the land within the right-of-way is reclaimed, recreational activities would return to pre-existing levels of use.

#### *4.12.1.1.4 Electric Power Option*

A description of impacts from electric power lines has been incorporated into the analysis presented in **Section 4.12.1**.

### 4.12.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Under Alternative 2, four fewer wells would be constructed and operated in the North Area and 14 fewer wells would be drilled in the South Area. This alternative differs from Alternative 1 in that protection measures have been developed for critical resources. The impacts to recreational opportunities from Alternative 2 would be similar as described in the Proposed Action, however, affects could be lessened if the agreement to study offsetting trails as identified in the Environmental Protection Measure would result in the development of additional trails. Visual Resource Environment Protection Measures would mitigate some of the concerns about the loss of the natural setting. The effects of the visual Environmental Protection Measures are described in **Section 4.13.**

Under Alternative 2, approximately 43 percent of the power lines would be buried. Therefore, the indirect impact to the natural setting and loss of solitude described for the Proposed Action would be proportionately less along the roads where power lines would be buried.

### 4.12.1.3 Alternative 3 — No Action Alternative

No direct or indirect impacts to existing developed and dispersed recreation resources on BLM lands would occur under this alternative. The existing condition of BLM lands in the Project Area would be maintained under the current management direction as defined in the BLM San Rafael RMP and the Price River MFP currently in effect. Natural gas development would continue on private lands within and adjacent to the Project Area. Rights-of-way may be issued across BLM lands to grant access to a private or state leases. Less than two miles of new roads would be constructed on BLM lands. Recreational opportunities would not be affected by changes in public access.

## 4.12.2 Impacts Summary

The main recreational uses in the Project Area is by local residents who use BLM lands for mountain bike riding, horse riding, OHV activities, hunting, cross-county skiing and hiking. The Proposed Action and Alternative 2 would result in similar localized adverse effects on the recreational experience through a loss in solitude and a change in the natural setting resulting from the construction and operation of natural gas facilities and roads. Noise and dust near construction activities and along roads, especially during the construction period, would also effect the recreational experience. The largest impact would be during the five-year construction period when vehicular traffic and construction activities would be at a maximum. After the construction period, the solitude factor would still be affected by the presence of well pads, pumping units and ancillary facilities. However, traffic would return to near pre-construction levels with the exception of pumpers' daily inspections and periodic maintenance activities. The natural setting would be altered by project facilities for the life of the project. The highest impact would be to the local residents of

Price and Kenilworth near the North Area because of the greater population and the immediate proximity of the North Area to their homes.

BLM management objectives for Semi-primitive Motorized ROS would not be met as opportunities for isolation from the sights and sounds of man would be affected in areas where development is concentrated. Roaded Natural ROS objectives would be met if measures are taken to blend the facilities with the surrounding environment. Reduction of the visual impacts of project facilities through Environmental Protection Measures and mitigation are described in **Section 4.13.**

### 4.12.3 Mitigation

Speed limits along project roads should be kept to a maximum of 25 miles per hour (unless otherwise posted) to reduce fugitive dust and minimize conflicts with recreationists utilizing project roads.

To diminish evidence of the sights and sounds of man in the Semi-primitive Motorized areas of the South Area (see **Plate 3–10**), any electric power lines to well sites should be buried, unless an exception is granted by the authorized officer. Exceptions would be considered for continuation of existing aboveground power lines to individual wells. In Semi-primitive Motorized areas, to reduce noise effects on recreationists, gas-powered pumping units should utilize sound-reducing technologies, such as mufflers, multi-cylinder muffled engines, or sound barriers.

During construction activities, the companies should install signs on access roads that are used for recreation to warn users of heavy equipment and truck traffic. Sign placement on BLM lands would be determined by the Authorizing Officer.

### 4.12.4 Unavoidable Adverse Effects

The loss of solitude and the change in natural setting in areas of concentrated development cannot be avoided with natural gas development. The construction of well pads, roads, and ancillary facilities would change the natural setting of the Project Area over the lifetime of the project and beyond until reclamation activities are complete. The loss of solitude for the recreational experience would be unavoidable during the construction period and remain to a lesser extent over the life of the project. In the South Area, Semi-primitive Motorized ROS objectives may not be met.

## 4.13 VISUAL RESOURCES

Development of natural gas in the Project Area would alter the physical setting and visual quality of the landscape, affect the landscape as experienced from sensitive viewpoints, including travel routes and popular use areas, and affect existing VRM designations. The landscape provides a scenic backdrop to recreational and residential uses of the area. The proposed facilities and associated access roads would introduce new elements into the landscape, and would alter the existing form, line, color, and texture which characterize the existing landscape.

Direct impacts to visual resources occur due to the disturbance of the landscape by project activities, and the addition to the landscape of proposed facilities, including the well pads, production facilities and associated pipelines, and access roads. Indirect impacts can be short or long term. Short-term impacts result from

temporary disturbances to visual resources, including construction and installation activities. Long-term impacts result from the addition of permanent structures to the landscape and the operation of facilities.

Impacts to visual resources are considered significant if they substantially change or degrade the character of the landscape as seen from sensitive viewpoints or if the allowable modification to the landscape prescribed for BLM VRM classifications cannot be met.

The analysis area for visual resources consists of the North and South Areas and the transmission line corridor located in the existing Questar Pipeline corridor between Ferron and the northern border of Emery County.

Key observation points (KOPs) were identified for the North and South Areas and are identified on **Plate 3–11**. The KOPs represent viewpoints from which proposed facilities and activities within the North and South Areas may be evident to the casual observer.

## 4.13.1 Direct and Indirect Impacts

### 4.13.1.1 Alternative 1 — Proposed Action

#### *4.13.1.1.1 Construction Disturbance*

During the five-year construction period, short-term impacts to the visual character of the landscape at each well site would result from well pad construction, gas well drilling and associated construction of ancillary facilities, such as well access roads and pipelines. Construction and installation of pipelines would immediately follow construction of access roads and well pads and coincide with well drilling. Power line construction would generally follow access road surfacing. The majority of gathering lines, water lines, high pressure gas lines and power lines would be located adjacent to road rights-of-way.

Well pad construction and well drilling activities would be accomplished using graders, drill rigs, dozers, and other heavy equipment. During the construction period, these activities would detract from the visual quality of the landscape. Construction activities would be spread over the five-year construction phase and generally occur in clusters. Therefore, approximately 20 percent of the Project Area would be affected in any one year. The visual intrusion of these activities would be site specific and not affect users outside of the viewshed of each construction site in the North and South areas.

Construction activities would primarily be evident to people using roads and trails within the North and South areas. Users of the areas would be impacted by the sight and dust of construction activities. In addition, the transportation of equipment, materials, and personnel to and from the North and South areas would be evident to other travelers on SR 10 and on local roads that would be used for access.

Drilling activities would typically be 24 hours per day for a one- to four-day period. Since drilling would be the only activity that would occur at night, lighting on drill rigs would be visible at residences with a direct line-of-sight to well sites.

#### *4.13.1.1.2 Permanent Disturbance*

The Proposed Action would constitute a change of the visual character of the existing rural landscape in the North and South areas. The addition of the well sites and associated access roads would result in a mixed

rural/industrial (mechanized) landscape. The components with the highest potential to adversely affect the visual character of the area are the well pad clearings, pumping units, and access roads. The operation of the proposed facilities would introduce new elements of form, line, color, and texture into the landscape and would essentially dominate foreground views and be obvious in some middle ground and background views.

Long-term impacts would result from the addition of the wells sites, facilities, and access roads to the landscape and any permanent disturbances associated with gathering lines or power lines. The most visible components of the proposed facilities are the pumping units at each well site.

Gathering and water lines would be buried adjacent to existing and new road rights-of-way. The combined right-of-way of each road and pipeline would be an average 78 feet in width. The pipeline right-of-way would be cleared of vegetation, resulting in an obvious clearing adjacent to each access road until revegetation is successful.

Electric power lines would be installed above ground on 30-foot tall poles every 300 feet. Power lines would generally parallel access roads and would result in a visual impact.

Each compressor would be lit at night with up to eight 250-watt, clear lamp lights. Each light would be mounted on a pole or building and directed downward to illuminate the facility. This type of night-lighting would minimize the night shine from each facility. However, the facilities nearest to residential areas would be visible at night.

#### 4.13.1.1.2.1 North Area

The North Area contains BLM, state and private lands. The proposed development would consist of 65 wells installed in a 160-acre well density pattern, three compressor stations, two CPFs, and associated a transportation infrastructure, such as roads, pipelines, and utilities. There are currently 15 existing wells in the North Area. The 160-acre density pattern consists of a maximum of four gas wells per square mile. Each well pad would require a construction area of 200 feet by 300 feet (1.4 acres). Once the facilities are installed, each well pad would be reclaimed back to the permanent well pad size of approximately 0.8 acres. The number of wells and other facilities in each VRM class in the North Area for each alternative is summarized in **Table 4–20**.

##### 4.13.1.1.2.1.1 BLM Lands

There are 46 wells proposed for BLM lands in the North Area. Lands affected by the Proposed Action are identified as VRM Classes III and IV (see **Plate 3–11**). Class III objectives provide for activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character. Activities may be visually evident, but should not be dominant. Class IV objectives provide for major modification of the landscape, and allow management activities to dominate the landscape.

There are 32 wells and two compressor stations proposed for BLM's VRM Class III lands, which occupy the central portion of the North Area. The proposed project in the North Area would change the existing rural landscape to a rural/industrial landscape primarily because the 160-acre spacing of the wells would result in a noticeable density of gas-producing facilities. There is potential that Class III objectives would not be met because the facilities would not be subordinate to the existing landscape character. BLM objectives for some Class III areas could be met if every attempt is made to minimize the adverse visual impacts through

**Table 4–20**
**Proposed and Existing North Area Facilities in VRM Classes**

| Facility | VRM Classes | | Total |
|---|---|---|---|
| | Class III | Class IV | |
| *Wells (number)* | | | |
| **BLM** | | | |
| Proposed | 32 | 14 | 46 |
| Existing | 1 | 7 | 8 |
| Total | 33 | 21 | 54 |
| **Private** | | | |
| Proposed | 4 | 6 | 10 |
| Existing | 0 | 0 | 0 |
| Total | 4 | 6 | 10 |
| **State** | | | |
| Proposed | 5 | 4 | 9 |
| Existing | 7 | 0 | 7 |
| Total | 12 | 4 | 16 |
| Total | 49 | 31 | 80 |
| *New Roads (miles)* | | | |
| **BLM** | 6.4 | 3.1 | 9.6 |
| **Private** | 1.1 | 1.6 | 2.7 |
| **State** | 1.4 | 1.1 | 2.5 |
| Total | 9.0 | 5.8 | 14.8 |

careful location of facilities, minimal disturbance of the site, and painting facilities so that they harmonize with the colors of the surrounding landscape.

Fourteen of the proposed wells are on BLM VRM Class IV lands in the northwest and northeast parts of the North Area. Class IV objectives provide for a level of change to the landscape that may be high and may be visually dominant. The construction and operation of each well and the ancillary facilities would be consistent with VRM Class IV management objectives and none of the disturbed acreage would be displaced from the existing BLM inventory of lands managed with VRM Class IV.

There would be a total of 14.8 miles of new well pad access roads constructed in the North Area. The access roads would be visible primarily in the foreground zones. Each road and the adjacent pipeline corridor would be constructed to an average width of 70 feet. Straight access roads that cut across the contours to the well pad, particularly on slopes, would have a greater visual impact than access roads that are aligned with the contours of the topography.

#### 4.13.1.1.2.1.2 Private/State Lands

There are 19 wells, two CPFs, and three compressor stations proposed for private and state lands in the North Area. Private and state lands are included in the BLM inventory of visual resources in the North Area. The proposed facilities located on private and state lands are included in the total acres summarized in **Table 4–20**, however, the BLM does not manage visual resources on private and state lands. Wells on private lands would be located adjacent to Kenilworth and would be visible from Key Observation Point 1. Wells on state lands would be located primarily in the south and west parts of the North Area and would be visible from existing roads.

#### 4.13.1.1.2.1.3 Key Observation Points (KOPs)

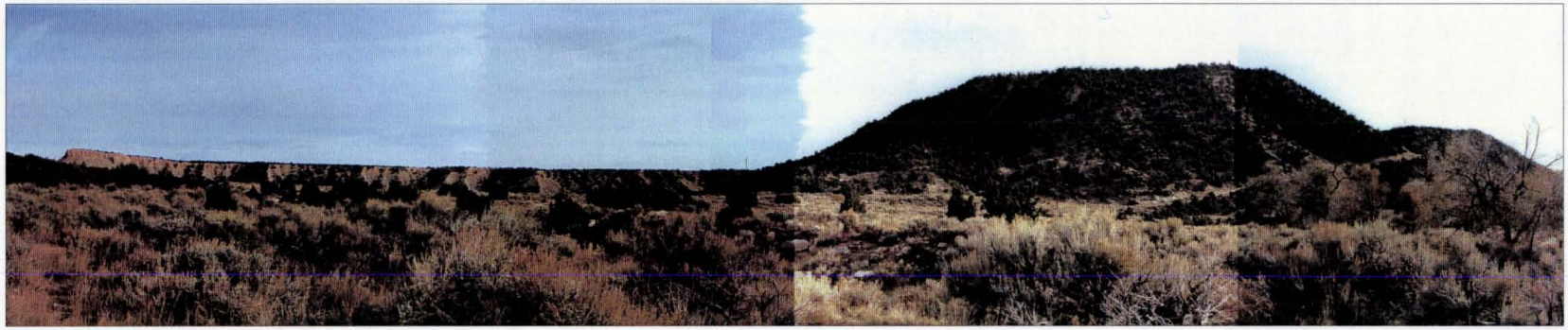
Key Observation Points (KOPs) were selected to simulate a representative, but not all inclusive, view of proposed natural gas facilities. KOPs were selected at key areas where the most people would view natural gas facilities from the most representative viewing angle. A 45- to 90-degree change in the viewing angle would obviously change the viewshed and the resulting visual simulation. The visual simulations were prepared to depict the most obvious and representative features of natural gas development. Other features may be visible in the background of these simulations, but features would be in the background and much less obvious to a casual viewer. Three KOPs located on roads or near residential areas have been selected for the North Area. Each KOP is representative of views similar to those seen from other locations in the North Area.

- KOP N1. The KOP is on a road at the south end of the town of Kenilworth. The simulation prepared for KOP N1 (**Figure 4–1**) provides a view to the southeast of the proposed well site nearest to Kenilworth. A well proposed for private lands on the south end of Kenilworth would dominate the view from the KOP and from other parts of Kenilworth. The visual impact of this well would be lessened if mitigation measures proposed for wells on BLM lands would be implemented for wells on private lands located near residential areas. Other wells proposed for BLM and private lands near Kenilworth would be screened by the topography.

- KOP N2. The viewpoint is on an improved, dirt-surfaced road that provides access to numerous proposed well sites. The road forms the east leg of the Kenilworth Loop recreation trail, and is a popular trail with local residents. The simulation (**Figure 4–2**) prepared for KOP N2 shows two proposed wells in the middleground zone of the view. The wells visible from KOP N2 are located on BLM lands managed with VRM Class III objectives.

- KOP N3. This viewpoint is located on a BLM road two miles southeast of Kenilworth. The road forms part of the Carbon County Trails network. The simulation in **Figure 4–3** shows one existing and one proposed well to the southwest of the KOP. The wells are on Class III managed lands.

Other viewpoints along the roads in the North Area would provide views of the CPF. The CPF would be located on private lands in the southeast part of the North Area. The site is located adjacent to a road that is part of the Carbon County Trails Network. The CPF would have a low profile and would not be easily visible in the middleground and background zones from viewpoints at similar or lower elevations. The CPF would be in the foreground zone as seen from adjacent roads and would be obvious to travelers on the roads. This can be mitigated somewhat by setting the CPF back from the road, leaving a buffer zone of the existing topography and vegetation. Mitigation measures such as painting facilities to harmonize with the surrounding landscape, and minimizing disturbance areas can be used to lessen the visual impact.



**EXISTING CONDITION**

Figure 4-1. KOP N1; The KOP is at the south side of Kenilworth in the North Area.

**PHOTO SIMULATION**

The proposed pumping unit is in the foreground of views from the community. Facilities should be located to utilize background topography and vegetation to minimize visibility.

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**EXISTING CONDITION**

Figure 4-2. KOP N2; The KOP is on an existing road that forms part of the Kenilwood Loop recreation trail in the North Area.

**PHOTO SIMULATION**

The KOP provides a view of two North Area proposed pumping units to the southeast that are back dropped by a ridge. The widened road including the pipeline right-of-way is shown in the foreground.

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**EXISTING CONDITION**

Figure 4-3. KOP N3; The KOP is in the North Area, and provides a view of an existing pumping unit in the foreground.

**PHOTO SIMULATION**

The KOP is in the North Area and provides a view of an existing pumping unit in the foreground. Two proposed pumping units to be southeast of the existing unit are visible in the middleground.

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#### 4.13.1.1.2.2 South Area

The South Area contains BLM, National Forest, state, and private lands. The proposed South Area development would consist of 220 proposed wells installed in a 160-acre well density pattern, seven CPFs, and associated transportation infrastructure, such as roads, pipelines, utilities, and power lines, if installed. Existing facilities consist of 53 wells, three compressors, and three disposal wells. The number of wells and other facilities in each VRM class in the South Area are summarized in **Table 4–21**.

##### 4.13.1.1.2.2.1 BLM Lands

There are a total of 84 wells proposed for BLM lands in the South Area. Lands affected by the Proposed Action are identified as VRM Classes III and IV (see **Plate 3–11**). Class III objectives are to provide for management activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character. Activities may be visually evident, but should not be dominant. Class IV objectives provide for major modification of the landscape, and allow management activities to dominate the landscape.

There are 42 wells proposed for VRM Class III BLM lands in the South Area. These Class III lands are within the foreground to middleground zones of views from the primary transportation routes through the area, including SRs 10 and 29. The proposed project in the South Area would change the existing rural landscape to a rural/industrial landscape primarily because the 160-acre spacing of the wells would result in a high density of facilities that would be obvious to viewers from the KOPs, local transportation routes, and residences. There is potential that Class III objectives would not be met. BLM objectives for some Class III areas could be met if every attempt is made to minimize the adverse visual impacts through careful location of facilities, minimal disturbance of the site, and painting facilities so that they harmonize with the colors of the surrounding landscape.

There are 42 wells proposed for VRM Class IV lands, which occupy most of the south half of the South Area. The construction and operation of each well site and the ancillary facilities would be consistent with VRM Class IV objectives. Visual impacts could be minimized through careful location of facilities, minimal disturbance of the site, and painting facilities so that they harmonize with the colors of the surrounding landscape.

There would be a total of 39 miles of new access roads constructed on BLM lands in the South Area. The access roads would be visible primarily in the foreground zones. Each road and the adjacent pipeline corridor would be constructed to the standard width of 40 feet. The visual impact of each road can be lessened by aligning the road with the contours of the topography instead of cutting across the contours to the well pad, particularly on slopes. However, this method of aligning the roads may result in a greater area of disturbance.

**Table 4–21**
**Proposed and Existing South Area Facilities in VRM Classes**

| Facility | VRM Class | | | Total |
|---|---|---|---|---|
| | Class II | Class III | Class IV | |
| *Wells* | | | | |
| **BLM** | | | | |
| Proposed | 0 | 42 | 42 | 84 |
| Existing | 0 | 13 | 10 | 23 |
| Total | 0 | 55 | 52 | 107 |
| **Private** | | | | |
| Proposed | 16 | 15 | 14 | 45 |
| Existing | 3 | 19 | 0 | 22 |
| Total | 19 | 34 | 14 | 67 |
| **State** | | | | |
| Proposed | 1 | 16 | 74 | 91 |
| Existing | 0 | 4 | 4 | 8 |
| Total | 1 | 20 | 78 | 99 |
| Total | 20 | 109 | 144 | 273 |
| *New Roads (miles)* | | | | |
| **BLM** | 0.0 | 18.8 | 20.0 | 38.8 |
| **Private** | 1.7 | 5.6 | 3.7 | 11.0 |
| **State** | 0.2 | 5.3 | 27.9 | 33.4 |
| Total | 2.0 | 29.7 | 51.5 | 83.2 |

#### 4.13.1.1.2.2.2 Private/State Lands

Private and State lands adjacent to the BLM lands in the South Area are inventoried with VRM Classes II, III, and IV, as shown on **Plate 3–11** and **Table 4–21**. The BLM does not have jurisdiction over the visual resources of private and state lands, although the inventory reveals that the capability of these lands to absorb project modifications to the visual character is similar to the adjoining BLM lands.

The Huntington Canyon Road is a scenic byway that provides access to popular recreational areas on Manti-La Sal Forest lands west of the Project Area. The proposed wells along the byway are on private lands and state lands. These lands are within the foreground and middleground viewing distance zones along the highway and are sensitive to public view. Surface disturbances and facilities would alter the visual characteristics of the landscape adjacent to the road and would not meet objectives of the VRM II classification. Measures identified for Federal lands could reduce visual impacts of wells seen by travelers on the byway, if they were implemented.

#### 4.13.1.1.2.2.3 Key Observation Points (KOPs)

- KOP S4. The KOP is located at the boat launch and other recreation facilities on the northeast side of Huntington Lake State Park. Views of the Project Area on the south and west sides of the park consist of the lake and surrounding parklands in the foreground zones, the flat to rolling terrain of the Project Area in the middle ground, and the steep rim of the dramatic Wasatch Plateau in the background. The simulation shown in **Figure 4–4** shows the lake in the foreground, and four proposed wells that are visible in the middleground zone beyond the southwest shore of the lake. The distance and the rugged topography would screen most of the wells from the KOP. The nearest well to the KOP is nearly two miles west of the Park. South Area wells in the middleground zone and the background zone would be screened from the KOP by the rolling hills of the area. The visible wells are on private lands and BLM has no jurisdiction over them.

- KOP S5. The KOP is on Huntington Canyon Scenic Byway (SR 31), which is part of a statewide system of scenic routes. KOP S5 is representative of views that would be seen by travelers along the entire byway through the South Area. There would be one well visible in the middle ground zone of the view from KOP S5. Most of the wells in the foreground and middleground distance zones are screened by vegetation along Huntington Creek and the road as seen from the KOP. Along the remainder of the road, the middleground zones are visible only to viewers along the east part of the road consisting in the three-mile segment west of Huntington. Wells in the background zone would be screened by the topography along the entire length of the road. In general, a maximum of three to four wells would be visible to viewers in a vehicle from any point along SR 31. Most viewers along the road would be traveling in a motorized vehicle, and the viewing zone would be a continually changing landscape limited to the area in front of and to the side of the vehicle visible to viewers at any point along the road, as shown in the simulation in **Figure 4–5**. Each well would be seen for a brief period of time before the moving vehicle moves beyond the line-of-sight to the well. All of the visible wells are on private and state-owned lands.

- KOP S6. This KOP is located on Huntington Canyon Scenic Byway (SR 31) near the west boundary of the South Area, approximately 10 miles west of Huntington. The nearest wells to the KOP are one mile to the southeast. However, the winding nature of the road and the steep canyon walls obstruct any views of the wells from this viewpoint, as shown on **Figure 4–6**. In general, any wells located along this portion of the byway on the west side of the South Area are very obvious to travelers on the road. The road is enclosed on either side by canyon walls, and wells must be sited close to the road, potentially dominating the surrounding landscape. These wells could be mitigated by siting each well to take advantage of the existing groves of trees along the Huntington Creek riparian zone to provide screening. The KOP is also representative of views seen from the nearby Bear Canyon Campground. There is one well proposed for the foreground distance zone on private land adjacent to the campground. The well would be visually and audibly intrusive to campers and picnickers.

- KOP S7. The KOP is located on SR 10 approximately 4.5 miles north of Castle Dale. The view is representative of views seen by travelers along the length of the highway adjacent to the east side of the South Area. There are no wells proposed for the foreground zone as seen from KOP S7 and from most of the length of the highway along the South Area. There are 4 wells that would be located on private lands north of Clawson that would be visible within foreground zone as viewed from SR 10, as shown on **Figure 4–7**. Most of the wells in the middleground and background zones would be screened from viewers along SR 10 by the rolling terrain characteristic of the South Area. The wells located on BLM lands managed with VRM Class IV. The well pad disturbances would be visible from the highway as a distinct, linear contrast between the light-colored tan bare soils and green vegetation.

- KOP S8. The Castle Valley Pageant site is located on State lands seven miles west of Castle Dale. The KOP is located on a ridge that provides panoramic views to the north, east, and south. There would be seven wells within foreground views of the KOP in all directions. The terrain is rugged surrounding the KOP and wells within the middleground are screened from view. **Figure 4–8** provides views of seven wells to the northeast of the KOP. This simulation from KOP S8 shows the view overlooking the proposed development to the northeast of the pageant site. The simulation also shows the power poles that would be constructed under the electric power option. The wells that are visible from the pageant site are on State lands designated with VRM Class IV objectives. The BLM objectives for VRM Class IV would be met by the development of most of the proposed facilities in the viewshed of the pageant site. However, the pageant is a spectacle that draws an estimated 20,000 visitors to the area every year. The area is therefore sensitive to any modification of the existing scenic landscape that provides a backdrop to the pageant. Although these lands are not managed by the BLM, the impacts could be reduced if the orientation of each well relative to KOP S8 would be evaluated prior to installation and appropriate mitigating measures would be implemented.

- KOP S9. This viewpoint is on SR 29 on the north side of Orangeville. The views of the South Area are to the west along Cottonwood Creek, and of agricultural lands to the north and south of the KOP. There are no wells within the foreground zone of views from KOP S9. shown in **Figure 4–9**. Wells in the middleground distances zone are screened by vegetation.

- KOP S10. This viewpoint is at a radio tower on a Wasatch Plateau escarpment within the Manti-LaSal National Forest. The site provides a vista of the Castle Valley, including the South Area, and is representative of the views seen by users of the four-wheel drive roads and trails along the rim of the plateau. The KOP is located at a higher elevation that the South Area. **Figures 4–10a and 4–10b** are a simulation of the panoramic view of the proposed South Area development from KOP S10. Most of the facilities would be within the background zone of views from this KOP. The facilities in the background zones over 4 miles in distance appear to be too small to attract the attention of the casual observer. Existing modifications consisting of portions of SR 10 and the Huntington Power Plant are visible in the background zone. Three of the visible wells are proposed for BLM lands managed with VRM Class IV objectives. The wells in the middleground zone would be an obvious modification of the existing rural landscape, and BLM Class III objectives may not be met. BLM Class IV lands are the closest BLM lands to KOP S10. There would be nine wells visible at the KOP within Class IV lands.

#### 4.13.1.1.2.2.4 National Forest

There are no wells proposed for public lands in the Manti-La Sal National Forest. The management of visual resources by the FS would not be affected by the proposed project.

Manti-La Sal National Forest lands on the east rim of the Wasatch Plateau overlook the South Area. Proposed facilities would be visible in the background zone of views from trails and roads along the rim. KOP 10S, discussed above, has been selected to represent views of the South area facilities and activities from the rim.

### 4.13.1.1.2.3 Transmission Line Corridor

The transmission line corridor would be located in an existing and new pipeline right-of-way on public and private lands in Emery County. Impacts to the characteristic landscape along the proposed pipeline route would be construction related and temporary. Once the pipeline construction disturbance is reclaimed and

**EXISTING CONDITION**

Figure 4-4. KOP S4; The KOP is at the boat launch area at Huntington Lake State Park.

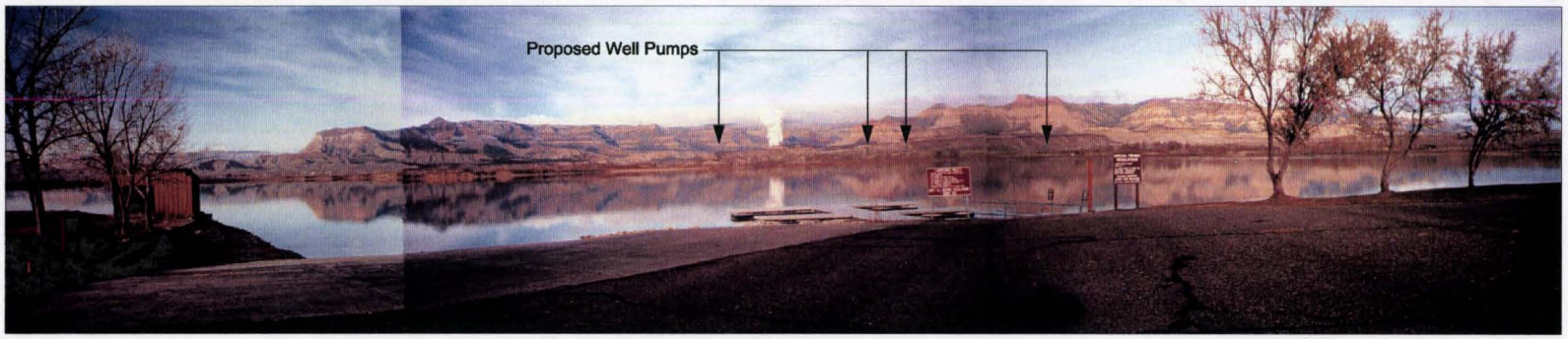


**PHOTO SIMULATION**

Proposed pumping units in the South Area are visible to the west on the far side of the lake.

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**EXISTING CONDITION**

Figure 4-5. KOP S5; The KOP provides a view to the north (up Fish Creek) from scenic byway S.R. 31, which is visible on the left side of the picture.

**PHOTO SIMULATION**

The proposed pumping unit, located approximately 0.3 miles north of S.R. 31, will be visible to travelers on the road.

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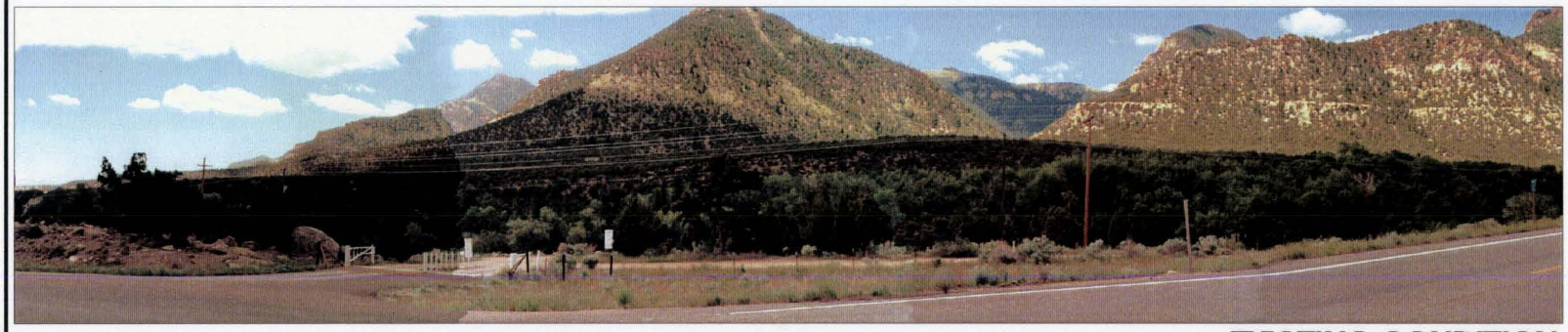

**EXISTING CONDITION**

Figure 4-6. KOP S6; The KOP is on S.R. 31 (Huntington Canyon Scenic Byway) nearly 10 miles west of Huntington.

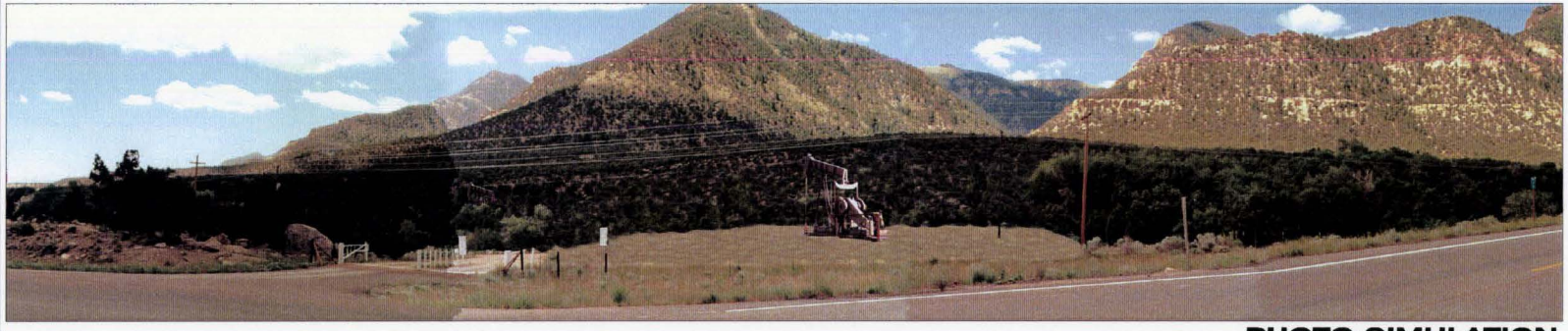

**PHOTO SIMULATION**

Two pumping units will be visible on the south side of the road. Other units will be screened from view by trees along Huntington Creek.

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**EXISTING CONDITION**

Figure 4-7. KOP S7; The view is of the South Area to the northwest from S.R. 10 about 4.5 miles north of Castledale.

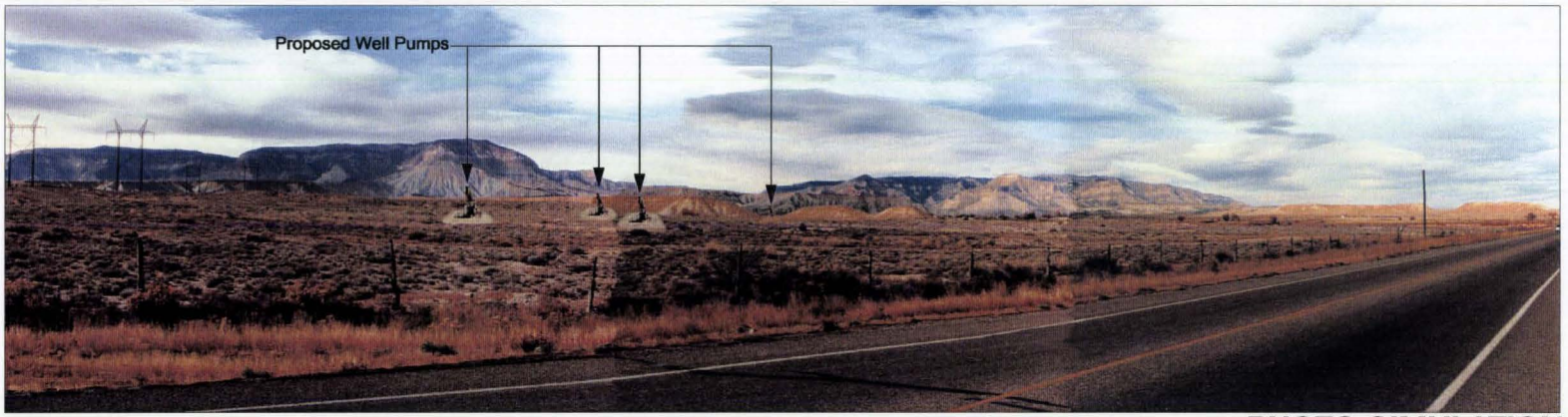


**PHOTO SIMULATION**

Proposed pumping units are visible in the middleground distance zone from the KOP. Pumps should be sited so that the long axis is parallel to the road.

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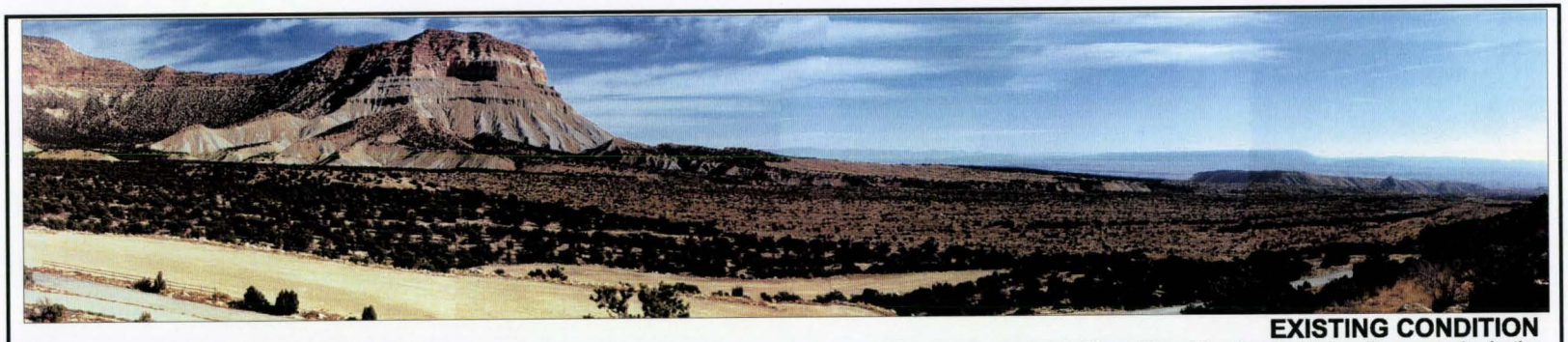

**EXISTING CONDITION**

Figure 4-8. KOP S8; The KOP at the Castle Valley Pageant site in the South Area provides a panoramic view to the southeast.

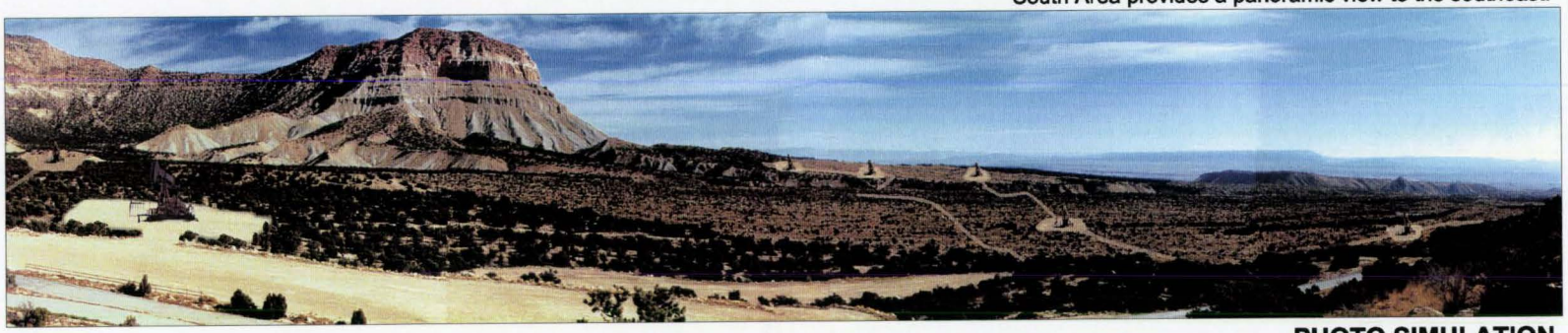

**PHOTO SIMULATION**

Pumping units are visible in the foreground and middleground zones. Pumps should be sited so that the long axis is in-line with the view from the KOP.

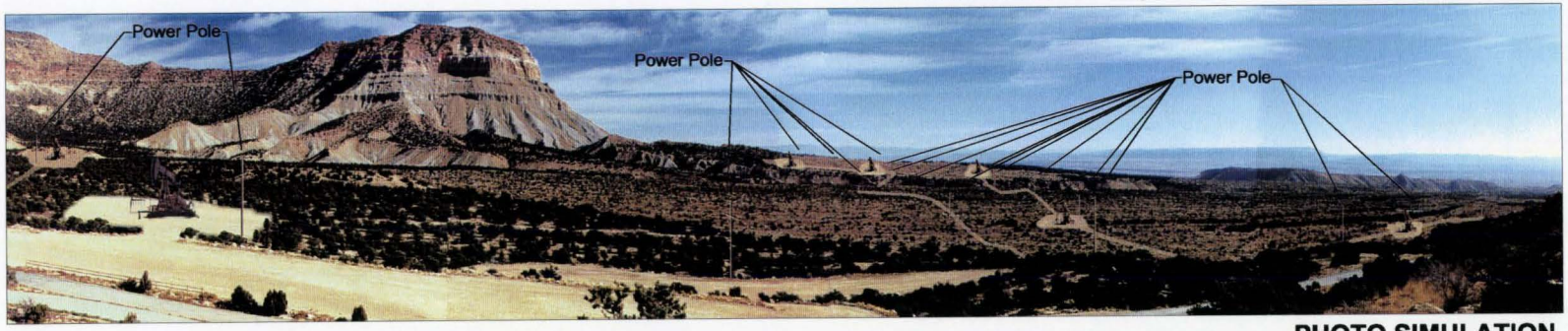


**PHOTO SIMULATION**

The above ground powerline is visible in the foreground zone adjacent to the road and on each well pad and access road. The wood pole structures are approximately 30 feet in height with a 300 foot span.

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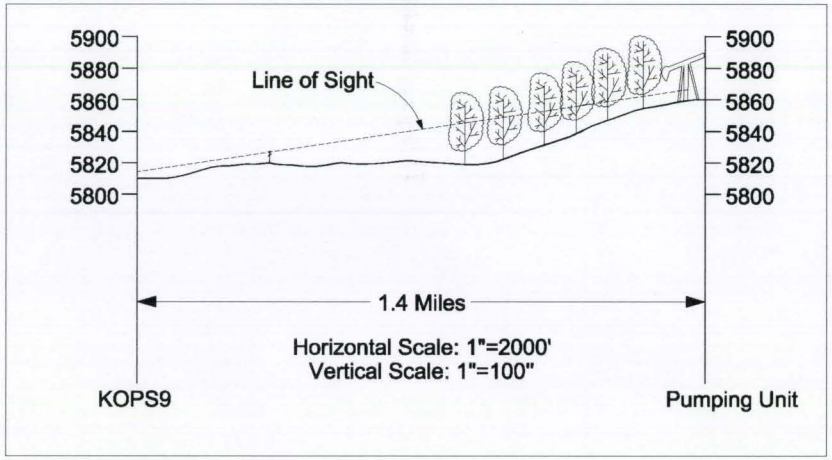
**EXISTING AND PROPOSED CONDITION**

Figure 4-9. KOP S9; The KOP is on the east side of Orangeville, and represents views of the South Area from the town. Proposed pumping units are obscured by distance and stands of trees.



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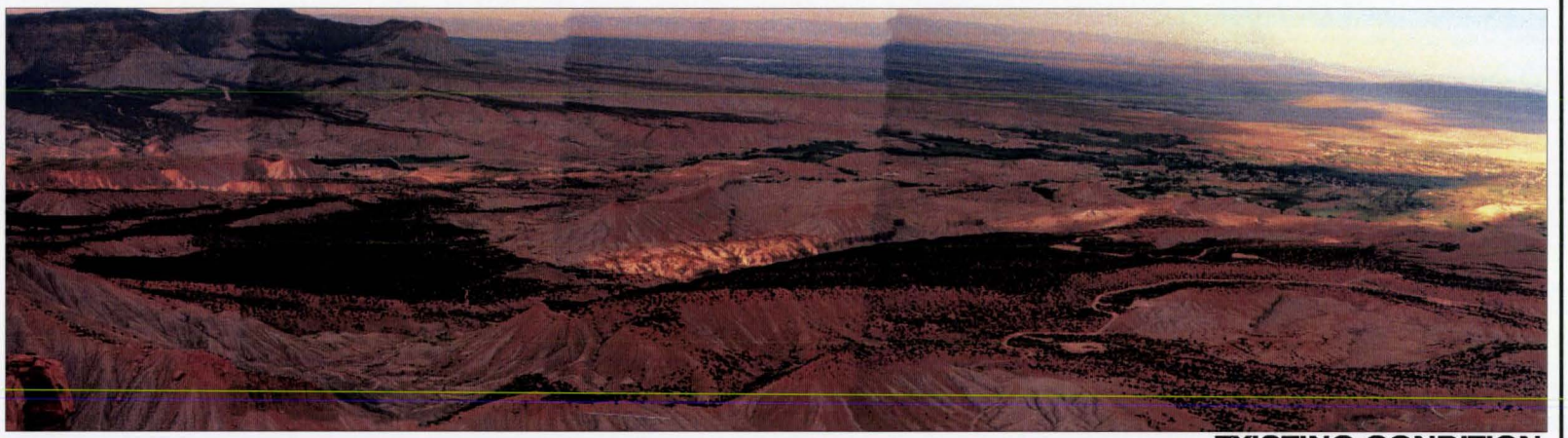

**EXISTING CONDITION**

Figure 4-10a. KOP S10a; The KOP overlooks the South Area from a radio tower site on Forest Service lands. (north half of view)

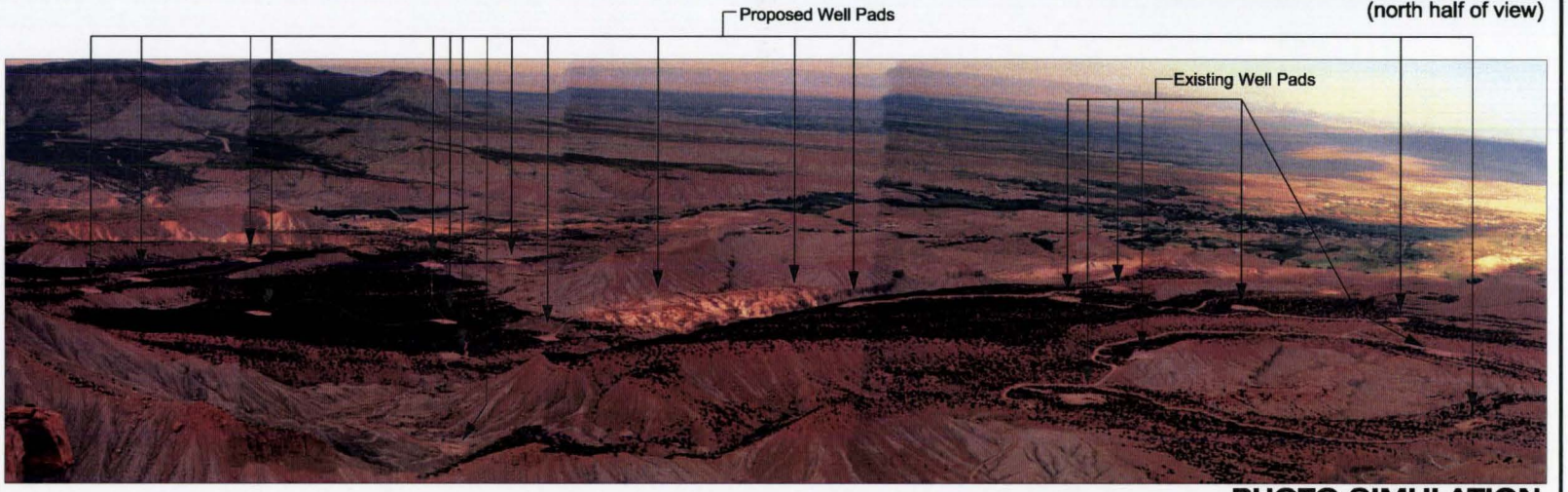


**PHOTO SIMULATION**

Proposed pumping units and associated access roads are visible from the KOP. The Hunter power plant is obvious in the background.

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**EXISTING CONDITION**

Figure 4-10b. KOP S10b; The KOP overlooks the South Area from a radio tower site on Forest Service lands. (south half of view)

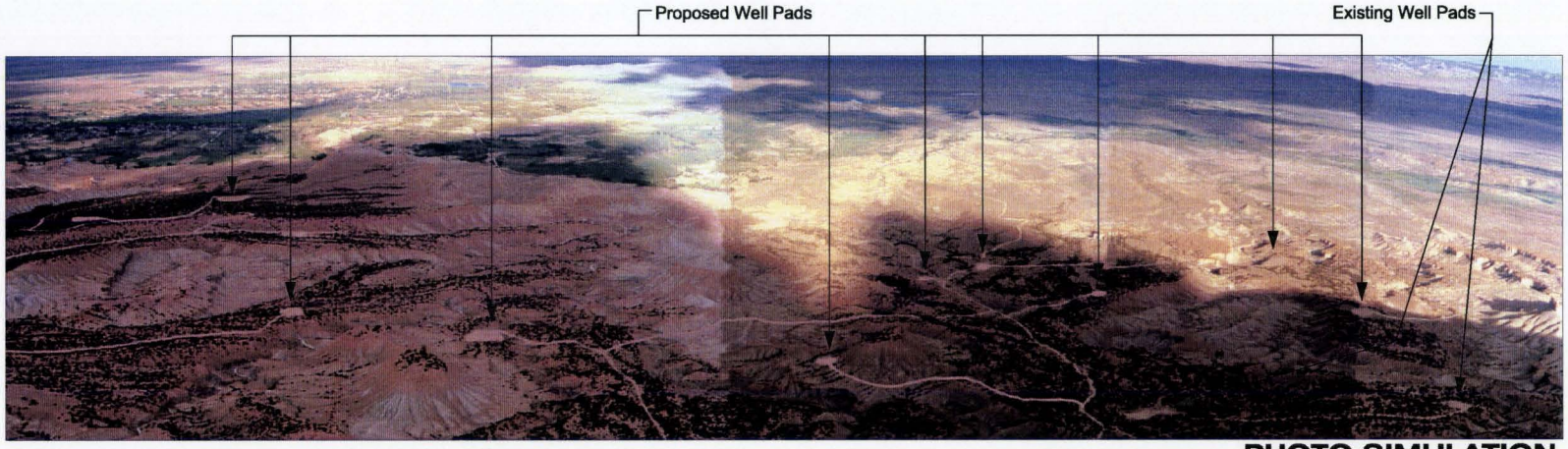


**PHOTO SIMULATION**

Proposed pumping units and associated access roads are visible from the KOP. The Hunter power plant is obvious in the background.

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revegetated, the corridor would return to pre-project conditions. Most of the land along the pipeline right-of-way has a low potential for reclamation because of soil type. As a result, the construction right-of-way would be visible until reclamation is complete. There would be no long-term visual impacts from locating the route adjacent to an existing rights-of-way.

#### 4.13.1.1.2.4 Electric Power Option

Under the Proposed Action, electric power would be supplied to Project facilities by aboveground power lines. The distribution of power lines, shown on **Plate 2–2**, was calculated in the manner described in **Section 2.1.1.1.1.4**. In the North Area, up to 43.3 miles of aboveground power lines would be installed on poles every 300 feet resulting in the addition of 762 poles. In the South Area, 144.3 miles of power lines could be installed along with 2,540 poles. Typically, the poles would be 30 feet high and similar to commonly seen telephone poles. Most of these power lines would parallel existing or newly constructed access roads, but, as described in the introduction to this chapter, aboveground power lines commonly follow relatively straight lines. They would not follow every curve in the access roads closely. Thus, parts of these aboveground power lines would extend away from the access roads' ROWs. As much as 50 percent of the ROW for the power lines could be away from the access roads' ROWs. Additionally, a few power lines may traverse cross country.

**Table 4–22** shows the distribution of aboveground power lines for each VRM classification and land ownership in the Project Area.

Power lines would be visible to the casual observer, and would constitute a slight visual impact to BLM VRM III classifications. The poles would be the most visible intrusion but they would be placed 300 feet apart generally on the same side of the road along any given stretch of road. The most visible effect would be for an observer to view a long stretch of poles looking down a road or power line right-of-way. In this case, the series of poles would be a visual intrusion. Looking from this viewpoint, some segments of the

**Table 4–22**
**Ferron Natural Gas Proposed Action**
**Distribution of Aboveground Power Lines by VRM Class and Land Ownership**

| | Miles of Power Lines | | | | Number of Poles | | | |
|---|---|---|---|---|---|---|---|---|
| Location | BLM | State | Private | Total | BLM | State | Private | Total |
| North Area | | | | | | | | |
| VRM II | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 |
| VRM III | 21.8 | 9.0 | 1.3 | 32.2 | 384 | 159 | 23 | 566 |
| VRM IV | 8.0 | 1.3 | 1.8 | 11.1 | 141 | 23 | 32 | 196 |
| Total | 29.8 | 10.3 | 3.1 | 43.3 | 525 | 182 | 55 | 762 |
| South Area | | | | | | | | |
| VRM II | 0.0 | 0.8 | 5.1 | 5.9 | 0 | 15 | 89 | 104 |
| VRM III | 28.3 | 9.3 | 17.2 | 54.9 | 499 | 164 | 304 | 966 |
| VRM IV | 30.5 | 46.3 | 6.7 | 83.5 | 537 | 815 | 117 | 1,470 |
| Total | 58.9 | 56.4 | 29.0 | 144.3 | 1,036 | 993 | 510 | 2,540 |
| Total | 88.7 | 66.8 | 32.1 | 187.6 | 1,561 | 1,175 | 566 | 3,302 |

32.2 miles (21.8 miles on BLM land) in the North Area may not meet the VRM Class III that is managed for activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character and may be visually evident, but should not be dominant. Looking from a viewpoint directly off the road, individual poles separated by 300 feet would be considerably less noticeable but the power lines would be noticeable. Therefore, the impact to visual resources would depend on the viewpoint. Visual impacts would not conflict with management objectives for the 11.1 miles (8.0 on BLM lands) of power lines across lands that are classified as VRM Class IV where the objective is to provide for management activities that may require major modifications to the existing landscape and the level of change to the landscape can be high and may be visually dominant.

In the South Area, 5.9 miles of power lines and 104 poles would be constructed on State and private lands identified as VRM Class II. Installation of power lines on these lands would not meet objectives for VRM Class II that provide for activities that would not be evident in the characteristic landscape and contrasts that are seen but must not attract attention.

The visual impacts for viewpoints along the 54.9 miles and 966 poles (28.3 miles of power lines and 499 poles on BLM lands) that would be installed on Class III VRM lands would be similar to those described for the North Area. Visual impacts would not conflict with VRM management objectives along the 83.5 miles of power lines and 1,470 poles (30.5 miles and 537 poles on BLM lands) on lands that are classified as VRM Class IV.

### 4.13.1.2 Alternative 2 — Proposed Action with Environmental Protection Measures

Alternative 2 is similar to Alternative 1 in the siting of project facilities and the acreage of land to be disturbed for each facility. This alternative differs from Alternative 1 in that environmental protection measures have been developed for critical resources, as described in **Section 2.2** and about one half of any power lines would be buried. Critical resources that may pose constraints to the siting of some proposed wells, roads, and facilities consist of water resources, soils, wetlands/riparian, wildlife habitat, and visual resources. Implementation of Alternative 2 would result in the development of 18 fewer wells. Many well locations also would be moved to areas where wells could be accessed without crossing slopes greater than 25 percent or be permanently located within ½ mile of an active raptor nest. These wells would be in locations generally unseen by the public.

The impacts to the existing landscape character of the Project Area would be less than the impacts described for the Proposed Action with implementation of Visual Resource Environmental Protection Measures. These measures would diminish the visual impacts through careful location of sites and facilities to blend with natural features, minimal disturbance of the site, and painting facilities so they harmonize with the colors of the surrounding landscape. Class III objectives could be met in the area as a whole, but there would be many localized areas where facilities would not be subordinate to the character of the landscape. Also, with the 160-acre well density pattern, clusters of wells, facilities, and roads would result in a noticeable change to the landscape. Therefore, in some areas, Class III VRM objectives would not be met. In Class IV VRM areas, activities would be consistent with management objectives.

#### *4.13.1.2.1 Electric Power Impacts*

Under Alternative 2, electric power would be supplied to project facilities by aboveground and buried power lines. The distribution of power lines shown on **Plate 2-5** was calculated in the manner described in **Section 2.2.1**. Since buried power lines would have effects similar to those previously described for pipelines, this

analysis focuses on aboveground power lines. In the North Area, 10.7 miles of aboveground power lines would be installed on poles every 300 feet resulting in the addition of 189 poles. This would be 32.6 fewer miles and 573 fewer poles than for the Proposed Action. In the South Area, 86.1 miles of aboveground power lines would be installed along with 1,515 poles. This would be 58.2 fewer miles and 1,025 fewer poles than for the Proposed Action. Most of the reduction would occur on BLM land in the southern portion of the South Area. **Table 4–23** shows the distribution of aboveground power lines for each VRM classification and land ownership in the Project Area.

Visual impacts to VRM Class III lands from aboveground power lines would be similar to those described for the Proposed Action, but proportionately less due to the reduced length and number of poles. Looking from the viewpoint down a road, some of the 7.3 miles (4.2 miles on BLM lands) of aboveground power lines in the North Area may not meet the VRM III classification objectives. Looking from a viewpoint directly adjacent to the road or power line ROW, individual poles separated by 300 feet would be considerably less noticeable. Therefore, the impact to visual resources would depend on the viewpoint. No conflicts to VRM management objectives for the 3.4 miles (2.2 miles on BLM lands) of lands that are classified as Class IV would occur.

In the South Area, 5.9 miles of power lines and 104 poles would be constructed on State and private lands identified as VRM Class II. Installation of power lines on these lands would affect VRM Class II visual management objectives that provide for activities that would not be evident in the characteristic landscape and contrasts are seen but must not attract attention. For viewpoints along the 24 miles (12.3 on BLM lands) of power lines that would be installed on BLM lands identified as VRM Class III, the visual impacts would be similar to those described for the North Area and may not meet the Class III objectives. No conflicts would be expected with management objectives for the rest of lands in the South Area that are classified as VRM Class IV.

**Table 4–23**
**Ferron Natural Gas Alternative 2**
**Distribution of Aboveground Power Lines by VRM Class and Land Ownership**

| | Miles of Power Lines | | | | Number of Poles | | | |
|---|---|---|---|---|---|---|---|---|
| Location | BLM | State | Private | Total | BLM | State | Private | Total |
| North Area | | | | | | | | |
| VRM II | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 |
| VRM III | 4.2 | 2.7 | 0.4 | 7.3 | 75 | 48 | 7 | 130 |
| VRM IV | 2.2 | 0.0 | 1.2 | 3.4 | 38 | 0 | 21 | 59 |
| Total | 6.4 | 2.7 | 1.6 | 10.7 | 113 | 48 | 28 | 189 |
| South Area | | | | | | | | |
| VRM II | 0.0 | 0.8 | 5.1 | 5.9 | 0 | 15 | 89 | 104 |
| VRM III | 12.3 | 6.5 | 5.2 | 24.0 | 216 | 115 | 91 | 422 |
| VRM IV | 10.9 | 39.5 | 5.8 | 56.2 | 192 | 695 | 102 | 989 |
| Total | 23.2 | 46.8 | 16.1 | 86.1 | 408 | 825 | 282 | 1,515 |
| Total | 29.6 | 49.5 | 17.7 | 96.8 | 521 | 873 | 310 | 1,704 |

Note: The differences of aboveground power line distances and numbers of poles on State and private lands between this table and Table 4–21 resulted from analysis assumptions that continuation of buried power lines would occur in several cases.

#### 4.13.1.3 Alternative 3 — No Action

No impacts to existing visual resources on BLM lands would occur under this alternative. Visual impacts of activities on state and private leases would be similar to those described for the Proposed Action. Wells and facilities developed on State and private lands would not meet Class II and III VRM objectives.

### 4.13.2 Impacts Summary

The Proposed Action would result in a change of the visual character of the existing landscape since the construction of well pads, facilities, and roads would result in a mixed rural/industrial landscape. After the construction period, the visible components of the project would be well pads, pumping units, and access roads. Pumping units would be the most visible component of the project.

The 285 wells under the Proposed Action would be in areas identified as VRM Classes II, III, and IV. All wells in Huntington Canyon are on State and private lands and would not meet the VRM Class II objectives. VRM Class III areas on BLM lands are managed for activities that may contrast with the basic landscape, but should remain subordinate to the existing landscape character. Seventy-four wells on BLM lands and 40 on State and private lands would be constructed on Class III lands. Without mitigation, the VRM objectives would not be met for these wells. VRM Class IV lands are managed for major modifications of the landscape and management activities can dominate the landscape. The 56 wells proposed for BLM lands and the 98 proposed for State and private lands would meet the objectives of VRM Class IV.

Approximately 187 miles of power lines and 3,302 poles would be installed aboveground under the Proposed Action. Slight impacts to visual resources would occur on Class II and III VRM lands with the installation of 93 miles of line and 1,636 poles. The remaining 95 miles of power lines and 1,666 poles on VRM Class IV would not result in conflicts with visual management objectives.

The wells proposed under Alternative 2 would have visual protection measures applied. These measures would include: 1) positioning wells off ridgetops to prevent "sky lining"; 2) using existing vegetation and topographic features to screen wells, facilities, and roads; 3) position pumping units to be "in line" with Key Observation Points; 4) position pumping units that are visible from KOPs on roads parallel to the road, so that pumping units are in line with viewpoints of travelers on the road; 5) use non-reflective material on chain link fences that would be highlighted by sunshine glare from a distance; 6) avoid straight line-of-sight road construction; 7) design roads through wooded areas to take a curvilinear path; and 8) align roads with the contours of the topography rather than cutting straight across contours to the well pad. Application of these measures would reduce visual impacts, but in some areas, VRM Class III objectives would not be met.

Under Alternative 2, the amount of aboveground power lines would be about one-half of the level of the Proposed Action and the impacts to visual resources would be proportionately less. These impacts would occur on BLM lands identified as VRM Class III and IV. On Class III lands, visual resource objectives may not be met. Power lines and poles on BLM lands identified as VRM Class IV would not result in conflicts with visual management objectives.

## 4.13.3 Mitigation

Effects to visual resources could be reduced by completing the following measures where possible: minimizing pumping unit heights, using vegetative and topographic screening when siting well locations, avoiding highwall cuts, and shielding drilling rig lights.

The alignment of individual pumping units with respect to KOPs or other viewpoints along transportation routes and from residences or recreation areas should be reviewed during the pre-installation phase of well development. In general, each pumping unit should be aligned parallel to a road unless it has been determined that this type of alignment is not feasible. Facilities would be the most visible to travelers on the road during that period of time when the facility is within the line of sight as they travel towards the facility. Aligning pumping units parallel to roads would present travelers with a smaller surface area as the traveler approaches the pumping unit.

Burying power lines in areas designated Semi-primitive Motorized, as identified in **Section 4.12.3**, would reduce visual impacts and meet VRM III objectives.

Any power poles installed should be selected to blend in with the surroundings.

## 4.13.4 Unavoidable Adverse Impacts

Installation of as many as 74 wells on BLM land and 57 on State and private land identified as VRM Classes II and III would be an unavoidable impact on visual resources. Application of Visual Resource Environmental Protection Measures and recommended mitigation would lessen the impact. Mitigation and protection measures voluntarily applied by the Companies on the State and private land would lessen the impact on these lands.

# 4.14 NOISE

The noise impact assessment estimates noise levels resulting from construction activities, drilling, and the operation of pumping units and compressors. The EPA (Galloway et al. 1974) has established an average 24-hour noise level ($L_{dn}$) of 55 dBA as the maximum noise level that does not adversely affect public health and welfare. No definitive data have been established concerning noise levels that affect animals. However, no laws concerning quantitative noise levels have been established by the State of Utah, the BLM, or Carbon and Emery counties. Qualitative statutes concerning noise as a "nuisance factor" have been established by Carbon County. Although not specifically related to noise issues, Carbon County also has proposed a statute that no wells would be drilled within 660 feet of a private residence. Therefore, lacking any quantitative statutory guidelines, noise levels above 55 dBA are considered a noise impact for this analysis.

The ambient noise level at a given distance from a noise source can be estimated using the Inverse Square Law of Noise Propagation, stated that noise would decrease by 6 dBA with every doubling of distance from the source (Harris 1991). This methodology of estimating noise propagation is represented by:

$L_2 = L_1 - 20 \log (R_2/R_1)$

where:

$L_2$ = noise level at a selected distance $R_2$ from the source

$L_1$ = noise level measured at a distance $R_1$ from the source.

## 4.14.1 Direct and Indirect Impacts

### 4.14.1.1 Alternative 1 — Proposed Action

#### *4.14.1.1.1 Construction Noise Impacts*

Noise impacts during the construction phase would be temporary at any given location and would result from vehicles and the operation of construction equipment. The noise levels of various construction equipment are shown in **Table 4–24** along with the expected noise levels at 50, 500, 100, 1500, and 2000 feet from the equipment.

Not all construction equipment would operate continuously, so an average construction site noise level is assumed to be 85 dBA. Using the noise propagation formulation, noise levels would fall below 55 dBA at approximately 1,500 feet from the construction activities. Any residences within 1,500 feet of construction activities would experience temporary noise levels above 55 dBA during daylight hours. Nighttime noise levels would remain at existing levels.

**Table 4–24**
**Noise Impacts of Various Types of Construction Equipment**

| | Noise Level (dBA) at: | | | | |
|---|---|---|---|---|---|
| Equipment | 50 feet | 500 feet | 1,000 feet | 1,500 feet | 2,000 feet |
| Crane | 88 | 68 | 62 | 58 | 56 |
| Backhoe | 85 | 65 | 59 | 55 | 53 |
| Pan Loader | 87 | 67 | 61 | 57 | 55 |
| Bulldozer | 89 | 69 | 63 | 59 | 57 |
| Fuel and Lubrication Truck | 88 | 68 | 62 | 58 | 56 |
| Water Truck | 88 | 68 | 62 | 58 | 56 |
| Motor Grader | 85 | 65 | 59 | 55 | 53 |
| Vibrator/Roller | 80 | 60 | 54 | 50 | 48 |
| Mechanic Truck | 88 | 68 | 62 | 58 | 56 |
| Flat Bed Truck | 88 | 68 | 62 | 58 | 56 |
| Dump Truck | 88 | 68 | 62 | 58 | 56 |
| Flat Bed Trailer | 88 | 68 | 62 | 58 | 56 |
| Tractor | 80 | 60 | 54 | 50 | 48 |
| Concrete Truck | 86 | 66 | 60 | 56 | 54 |
| Concrete Pump | 82 | 62 | 56 | 52 | 50 |
| Front End Loader | 83 | 63 | 57 | 53 | 51 |
| Road Scraper | 87 | 67 | 61 | 57 | 55 |
| Air Compressor | 82 | 62 | 56 | 52 | 50 |
| Average Construction Site | 85 | 65 | 59 | 55 | 53 |

#### 4.14.1.1.2 Drilling Noise Impacts

Noise levels during the drilling phase would also be elevated above pre-existing levels. Typically, the noise from a drilling rig is 74 dBA at 200 feet from the rig (Kruger 1981). Noise emanating from drilling rigs would decrease to 60 dBA at 1,000 feet, to 57 dBA at 1,500 feet, and to 54 dBA at 2,000 feet. Any residences within 1,500 feet of a drilling rig would experience noise above 55 dBA for the one to four days anticipated to drill the natural gas wells. **Table 4–25** shows the residences that would be within 1,500 feet of proposed well pads and may therefore experience temporary noise levels greater than 55 dBA when well pads and roads are constructed and the well is drilled. Most of the wells would be constructed on private land. Only five wells would be constructed on BLM land within 1,500 feet of an existing residence. Wells would be constructed on private lands that would result in excessive noise during the drilling and construction phase for 14 residences in the South Area and most residences in Kenilworth. However, the construction and drilling noise impacts would be short term and would only occur when the particular well or a series of closely located wells is constructed and drilled.

#### 4.14.1.1.3 Operational Noise Impacts

Noise levels would decrease substantially after the well pads, roads and pipelines have been constructed and the wells have been drilled. Sources of noise would be periodic vehicle trips to the well sites and the pumping units. Typical noise from a pumping unit operating 24 hours per day would be 61 dBA at 100 feet (Kruger 1981). Noise emanating from pumping units would decrease to 55 dBA at 200 feet, and 47 dBA at 500 feet and to 41 dBA at 1,000 feet. Since no residences would be within 500 feet of a pumping unit, the

**Table 4–25**
**Residences Within 1,500 Feet of Proposed Wells**

| | Number of Residences | | |
|---|---|---|---|
| Legal Location of Residence | BLM | Private | State |
| **South Area** | | | |
| T17S, R8E, S14 | 1 | - | - |
| T17S, R8E, S14 | - | 2 | - |
| T17S, R8E, S15 | - | 2 | - |
| T17S, R8E, S9 | 1 | - | - |
| T17S, R8E, S9 | - | 2 | - |
| T17S, R8E, S8 | - | 3 | - |
| T17S, R8E, S5 | - | 1 | - |
| T17S, R8E, S6 | - | 3 | - |
| T17S, R8E, S24 | - | 1 | - |
| T19S, R7E, S14 | 1 | - | - |
| Total | 3 | 14 | 0 |
| **North Area** | | | |
| T13S, R10E, S21 | - | Numerous in Kenilworth | - |
| T13S, R10E, S32 | 2 | - | - |
| Total | 2 | Numerous in Kenilworth | 0 |

noise impacts from all project pumping units would be below 55 dBA. However, the noise from a pumping unit would be rhythmic in nature rather than a steady noise level from smoothly running equipment. Therefore, while the noise level would be well below the 55 dBA criterion for significance, it may be as noticeable as higher noise levels for some people.

Noise levels from CPFs and compressor stations are expected to be about 87 dBA at 50 feet (Kruger 1981). However, the enclosed building in which the compressor would operate would reduce noise by about 30 dBA. Therefore, the effective noise level would be 57 dBA at 50 feet and decrease to 51 dBA at 100 feet. Since a distance of 100 feet would be within the enclosed fence boundary of a typical compressor station, the noise levels that the public may experience near compressor stations would always be below 55 dBA.

The noise effects from pumping units were evaluated for the Huntington State Park to determine the effects on developed recreational areas. As shown on **Plate 2–1**, nine wells would be within 2.2 miles of the recreation area (the east side of the lake) of Huntington State Park on the eastern edge of the South Area near Huntington, Utah. The closest four wells would be 1.75 miles west of the park, and the other five would be from 1.8 to 2.2 miles west. Each pumping unit would produce a noise of 20 to 22 dBA at the park. The noise produced at a given location by multiple sources is not a simple addition, but rather a logarithmic factor in the form:

$$L_{eq} = 10 * LOG\ (10^{L1/10} + 10^{L2/10} + ..... + 10^{Ln/10})$$

where: $L_{eq}$ is the average noise level for a given period, and
L1, L2, ..., Ln are the sound levels of individual co-located sources.

Based upon this formulation, the average noise level at the park would be 30.7 dBA, a level that is below a typical rural night level of 35 dBA. Therefore, it can be concluded that the noise from pumping units would not be heard above normal conversation levels at Huntington State Park.

#### *4.14.1.1.4 Electric Power Option*

Under the electric power option, compressor engines and pumping units would all be powered by electricity rather than natural gas combustion. Electric motors powering these types of equipment are inherently quieter than those powered by natural gas internal combustion. Since the noise analysis for the Proposed Action has demonstrated that no adverse noise impacts would occur from natural gas-powered facilities, it follows that no adverse noise impacts would occur from the quieter electrical equipment.

### 4.14.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Under Alternative 2, the same number of wells and roads would be constructed and operated in the North Area. Because of other environmental restraints, four and 14 fewer wells would be drilled in the North Area and South Area, respectively. However, it is anticipated that the same number of CPFs and compressor stations would be constructed and operated. The wells drilled on BLM lands may be moved slightly to reduce the impacts on other resources. The relocation of these wells could reduce or increase the construction and drilling noise impacts depending upon where the well would be relocated. No wells can be drilled with 660 feet of a residence in the North Area because of Carbon County proposed restrictions. In the South Area, the three wells on BLM land that could be within 1,500 feet of a residence would not be eliminated as part of environmental protection measures. The BLM would not have jurisdiction over the

location of the private wells proposed to be within 1,500 feet of residences. As a result, noise impacts would be the same as the Proposed Action.

#### 4.14.1.2.1 Electric Power Option

Under the electric power option, compressor engines and pumping units would all be powered by electricity rather than natural gas combustion. Electric motors powering these types of equipment are inherently quieter than those powered by natural gas internal combustion. Since the noise analysis for Alternative 2 has demonstrated that no adverse noise impacts would occur from natural gas-powered facilities, it follows that no adverse noise impacts would occur from the quieter electrical equipment.

### 4.14.1.3 Alternative 3 — No Action

No additional wells would be drilled on BLM lands under the No Action Alternative. Therefore, the residences that may experience excessive construction and drilling noise levels would not be affected by the No Action Alternative. However, a maximum of 155 new wells may be constructed on State and private lands. Therefore, the construction and drilling noise impacts could still occur at the previously described 14 residences in the South Area and in Kenilworth in the North Area.

## 4.14.2 Summary of Impacts

Noise impacts from construction activities would be above 55 dBA out to 1,500 feet from construction activities. Under alternatives 1 and 2, three wells in the South Area and two wells in the North Area would be constructed on BLM lands within 1,500 feet of a residence. Another 14 wells would be constructed on private lands in the South Area and one in the North Area within 1,500 feet of at least one residence. These people would experience noise levels at and above 55 dBA for the duration of the construction for the particular well. This activity would typically be about one to two weeks. However, construction activities would not occur at night. These residents would also experience noise levels above 55 dBA during the one to four days of drilling activities. This noise would probably be the most intrusive since drilling would occur 24 hours per day for a maximum of four days. Residences close to roads would also experience elevated noise levels from construction vehicles. This noise would be the loudest during the morning and evening times when workers and equipment are being transported to the sites.

During operations, noise from pumping units would exceed 55 dBA within 200 feet of a pumping unit. Noise from pumping units would not be significant since no residents would be within 200 of a well location. Incidental and recreation users would experience temporary increased noise as they would pass by pumping units.

Under the electric power options for both alternatives 1 and 2, no adverse noise impacts would occur because the electrical equipment would be quieter than the gas-fired equipment.

## 4.14.3 Mitigation

No mitigation is recommended.

## 4.14.4 Unavoidable Adverse Impacts

The noise disturbance from individual drilling operations would be a very short-term (one to four days) and unavoidable noise impact. Once drilling activities begin, the drilling must be continuous until the targeted reservoir is reached. This unavoidable impact would be most noticeable at night for residents close to drilling operations.

# 4.15 SOCIOECONOMICS

## 4.15.1 Direct and Indirect Impacts

### 4.15.1.1 Alternative 1 — Proposed Action

The following paragraphs provide an assessment of potential impacts on social and economic resources that may be experienced with the implementation of the Proposed Action and alternatives. The analysis focused on Carbon and Emery counties. For each socioeconomic element, standards have been utilized to measure the significance of impacts. These standards are defined in the discussion of each element.

#### *4.15.1.1.1 Population*

The proposed project is not expected to result in a significant short- or long-term impact to local population conditions. An estimate of the population increase anticipated with the project is demonstrated below. It is anticipated that the majority of new full-time workers would be recruited from communities within the Project Area and that construction employment and contractors also would be available in the region. Further description of project employment is provided in **Section 4.15.1.2**.

Significant gas exploration and development activities are currently ongoing in the Carbon and Emery counties. To the extent that additional non-local contractors or permanent employees are needed, they may relocate to the area for a limited period of time (2 to 5 years) during the major construction phase of the project. Therefore, it is expected that only a small to moderate increase in population growth would occur. Considering new permanent employment and using an average of 2.8 dependants per employee (average county household size), a population increase of 23 could be expected, equating to 0.1 percent of the current population of Carbon County and 0.2 percent of the Emery County population.

It is not anticipated that this project employment would significantly effect demographic characteristics of either Carbon or Emery counties.

#### *4.15.1.1.2 Employment, Wages, and Local Economy*

The proposal would be considered to have a significant effect if it would result in a negative change in local economic conditions or wages, result in a short- or long-term reduction in employment, or create the potential for a boom/bust employment cycle.

#### 4.15.1.1.2.1 Natural Gas Employment

Implementation of the proposed project would create some additional employment opportunities in the Carbon and Emery counties region. Due to the long-term nature of the project, coupled with fluctuation in natural gas economics and the three Companies involved in the leases, developing exact projections of employment is difficult. Therefore, the following paragraphs provide a reasonable estimate of what can employment impacts can likely be expected with project implementation. While drilling activities would occur in both the North and South Areas, it is assumed that employee recruitment and other coordination activities would be handled in Price, the population and economic center of the region.

Both direct project employment (e.g. positions with one of the three Companies or contractors hired for construction for construction, production, and decommissioning) and indirect or secondary employment (jobs that become available in support industries as a result of project activities, such as parts and materials production, equipment refueling, etc.) would arise as a result of project activities.

Development of the FNG Project would be completed in approximately five years from project initiation and the production lifetime of the wells is expected to be in the range of 20 years. In the North Area, it is anticipated that about 13 wells would be constructed annually from 1999 through 2003, while projections for the South area suggest about 44 wells would be installed annually from 1999 through 2003 (**Table 2–1**). In addition, 68 wells have already been installed, 30 of which are located on federal land.

The primary influx of employment opportunities associated with the proposed project is expected to occur in the first five years of the project, during the development phase of the project. Once the natural gas wells have been installed, some level of sustained permanent employment (as described below) would be required for operation and maintenance of the wells and pipelines. The final stage of the project life cycle involves the reclamation and abandonment of facilities, which may also trigger 32 jobs (**Table 2–3**) for a period of two years, during which the various facilities would be dismantled and removed or abandoned in place and surface areas are reclaimed.

Projected work categories and associated man hours are provided in **Table 2–3**. A variety of labor categories would be utilized for project implementation. The percentage of workers hired from the local areas and those from outside the local area is shown on **Table 4–26**.

Employment opportunities are expected to be greatest in the first two years of the project, as construction activities kick-off. Employees and contractors would be hired by the applicants to construct and maintain roads and well pads, construct utility trenches, and install underground gas pipelines, water pipelines, and utility lines. Local contractor jobs would include gravel and water truck drivers, heavy equipment operators,

**Table 4–26**
**Comparison of Local and Outside Project Area Employment**

| | Number of Workers Hired: | | |
|---|---|---|---|
| Project Phase | Locally | From Outside Local Area | Total |
| Construction | 39 | 59 | 98 |
| Operations | 37 | 6 | 43 |
| Reclamation | 13 | 19 | 32 |

and pipeline workers, comprised primarily of workers currently located within the Project Area (BLM 1997c). Additionally, some permanent employees would be necessary to perform operation and maintenance activities.

Some component of the project workforce would be non-local transient construction workers with specialized expertise required to drill and complete wells. It is assumed that these workers would reside in the Project Area for about six months each year (May through November) during the construction season. It is assumed that the majority of these workers would reside in motels while they are working in the area and would not bring families with them (BLM 1997c). Many of these contractors would leave the Project Area once the construction and development phase of the project is finished.

It is estimated that an average of 98 employees would be required annually during the first five years of development. Approximately 40 percent would be local hires and 60 percent would be hired from outside the area. However, all construction would be performed by third party contractors who would have ultimate control over employment decisions (Cox 1998). The average peak employment of 98 workers represents about 8 percent of 1995 employment in the mining/oil and gas/construction sectors in Carbon County and 9 percent of these sectors in Emery County. This figure represents one percent and two percent of the total non-agricultural labor employment for 1995 for Carbon and Emery counties, respectively. It should be noted that these employment numbers are estimates intended to present some representation of the impacts associated with the project, considering potential cumulative employment with other gas development projects in the area (BLM 1997c) more or fewer employees may be needed. Factors that would influence employment include timing of development, use of contractors, geographic location of concurrent development, as well as other factors.

Necessary skills would include: pump and pipeline maintenance, compressor and electric motor maintenance, and production monitoring. Many of these positions would likely be filled by former power plant and coal mine workers currently underemployed in service or trade sector jobs. Some jobs that require a higher or different level of expertise may be filled by non-local workers.

After the five-year well field development phase, employment would be related to maintenance and operation of the fields, as well as gradual reclamation of the inactive wells, and associated access roads. Only a small number of workers would be required to perform these functions. Approximately 43 workers would be required for the operation and maintenance phase and 32 for the reclamation and abandonment phase. Of this permanent employment, about 85 percent would be local hires and 15 percent would be hired from outside the area.

#### 4.15.1.1.2.2 Questar Pipeline Construction Employment

Construction of the 27-mile long transmission pipeline would require a workforce of 75 persons, comprised of equipment operators, welders, and laborers. Questar expects that about 25 percent of the total work force would be hired locally (i.e., the Price area). It is expected that installation of the pipeline would be completed within 2 to 4 months. The anticipated operational life of the pipeline is 50 years; at that time the pipeline would be decommissioned and abandoned in place.

The 56 non-local employees required for pipeline construction would probably not affect population or have any significant impact to regional employment, considering the short-term nature of pipeline construction (two to four months). Either Questar employees or a contractor specializing in pipelines would be retained

for installation, completing the pipeline in a single spread and moving on to other contracts. It is assumed that these workers would reside in local motels or recreational vehicles.

#### 4.15.1.1.3 Wages and Local Economy

The proposed project also would contribute to the local economy through the generation of earnings that would be spent on items such as housing, food, goods and services. In addition, economic benefits would occur as a result of the Companies spending on purchases of equipment and supplies from local area vendors. The Price CBM analysis utilized a regional input/output model developed by Utah Office of Planning and Budget to project economic and secondary impacts. This modeling effort has not been conducted for this project, so specific, long-term monetary projections are not available for this study.

It is estimated that the combined payrolls of the three gas development companies would amount to $914,400 annually (nominal dollars) in the first several years of the development stage. This payroll equates to 0.5 percent and 0.8 percent of total annual payrolls for Carbon and Emery counties, respectively. **Table 4–27** presents the estimated combined expenditures and production costs for the project. Included are annual payroll for permanent employees (non-contractors), operating costs excluding payroll, and construction costs. All construction would be performed by third party contractors and construction costs include labor, equipment rental, and materials (Cox 1998). Project payroll earnings would gradually increase to the peak level of employment and then start to decline as project activities slow, until all project earnings cease as the anticipated life span of the project comes to an end. As the project life expectancy nears completion, additional costs and expenditures would occur as wells are plugged and decommissioned. It is expected that this phase would occur sometime after 2020. Projections of these costs are unavailable at this time.

Direct project employment and associated earnings would also create new jobs in local area communities during the construction phase of the project. Secondary job creation would occur primarily in the service and trade sectors, with a few additional jobs in finance, insurance, and real estate, as well as transportation and public utilities. It is projected that about 25 secondary employment positions would be created as a result of project activities during peak employment. This calculation is based on the assumptions utilized in the Price CBM EIS (BLM 1997c). Since the vast majority of service and retail trade activity occurs in the Price area, it is assumed that most of these jobs would be created in Price or nearby communities in Carbon County.

Both expansion of existing businesses and creation of new business can be anticipated. However, once the development phase of the project is completed, a reduction in service and trade sector employment can be anticipated. Some additional earning from the indirect employment also can be expected and these earning would be spent in, and contribute to, the local economy. Once the development phase of the project is completed, indirect earnings from secondary employment would eventually be reduced.

#### 4.15.1.1.4 Tourism, Recreation and Hunting

Another concern expressed during scoping related to the project's potential effect on tourism, in terms of tourism's economic impact on the region. Certain community groups have expressed an interest in diversifying the region's economy, and increasing the economic importance of tourism.

While the proposed project may reduce the attractiveness of the immediate development area for tourists, none of the major tourist attractions in the region (Ninemile Canyon, San Rafael Swell, Cleveland Lloyd Dinosaur Quarry, CEU Prehistoric Museum, etc.) would be impacted by the project because they are not

## Table 4–27
## Estimated Combined[1] Expenditures and Production Costs

| Year | Annual Payroll[2] | Operating Costs[3] | Construction Costs[4] | Reclamation Costs | Total |
|---|---|---|---|---|---|
| 1999 | $640,000 | $6,779,000 | $28,744,000 | | $36,163,000 |
| 2000 | $824,000 | $7,838,000 | $28,744,000 | | $37,406,000 |
| 2001 | $966,000 | $8,777,000 | $18,372,000 | | $28,115,000 |
| 2002 | $1,050,000 | $9,395,000 | $18,372,000 | | $28,817,000 |
| 2003 | $1,092,000 | $9,466,000 | $18,372,000 | | $28,930,000 |
| 2004 | $1,176,000 | $9,997,000 | $10,372,000 | | $21,545,000 |
| 2005 | $1,176,000 | $9,963,000 | $10,372,000 | | $21,511,000 |
| 2006 | $1,176,000 | $9,830,000 | | | $11,006,000 |
| 2007 | $1,176,000 | $9,315,000 | | | $10,491,000 |
| 2008 | $1,176,000 | $8,341,000 | | | $9,517,000 |
| 2009 | $1,176,000 | $7,271,000 | | | $8,447,000 |
| 2010 | $1,176,000 | $6,303,000 | | | $7,479,000 |
| 2011 | $1,176,000 | $5,440,000 | | | $6,616,000 |
| 2012 | $1,176,000 | $4,678,000 | | | $5,854,000 |
| 2013 | $1,176,000 | $4,006,000 | | | $5,182,000 |
| 2014 | $1,176,000 | $3,398,000 | | | $4,574,000 |
| 2015 | $1,176,000 | $2,841,000 | | | $4,017,000 |
| 2016 | $1,054,000 | $2,391,000 | | | $3,445,000 |
| 2017 | $1,054,000 | $1,791,000 | | | $2,845,000 |
| 2018 | $932,000 | $1,401,000 | | | $2,333,000 |
| 2019 | $932,000 | $1,090,000 | | | $2,022,000 |
| 2020 | $810,000 | $908,000 | | | $1,718,000 |
| 2021 | $810,000 | $707,000 | | | $1,517,000 |
| 2022 | $688,000 | $687,000 | | | $1,375,000 |
| 2023 | $688,000 | $629,000 | | | $1,317,000 |
| 2024 | $646,000 | $589,000 | | | $1,235,000 |
| 2025 | $364,000 | | | $606,000 | $970,000 |
| 2026 | $364,000 | | | $606,000 | $970,000 |
| 2027 | $364,000 | | | $606,000 | $970,000 |
| 2028 | $364,000 | | | $606,000 | $970,000 |
| 2029 | $364,000 | | | $606,000 | $970,000 |

Notes:
1. Anadarko, Chandler, and Texaco.
2. Only includes permanent employees.
3. Excludes payroll.
4. Third-party contractor labor, equipment rental, and materials costs.

Source: Cox 1998

located in or near proposed development areas. It is unlikely that visitation at these sites would be affected. It is unlikely that the economy of Price, the center for tourist activity in the region, would experience any significant impact resulting from the project. Additional analysis of the potential affect on tourism has been provided in the Price CBM Project EIS (BLM 1997c).

Additionally, project activities and subsequent hotel stays and spending in restaurants would result in some increase in revenues generated from the transient occupancy tax and restaurant tax in both Carbon and Emery counties. These revenues received over a 20-year period would provide additional revenues available for the promotion of recreation and tourism in the region.

Project activities have the potential to impact recreational hunting in the region. **Section 4.12** and **Section 4.7** discuss these impacts. **Section 4.12** describes how big game hunting may be affected by construction activities. **Section 4.7** identifies the principal impacts to terrestrial wildlife and how displacement caused by construction would affect the species. **Section 4.7** states that displacement would be of greatest concern in the crucial and high priority winter ranges. A reduction of available habitat in winter months due to project activities would potentially lower the population of mule deer and elk resulting in a decrease of hunter success.

This reduction in success may result in some economic effect in Carbon and Emery counties, including decreased purchasing of goods and services, including fuel, ammunition, other hunting equipment, motel rooms, and meals. This economic loss would be experienced over the lifespan of the project, but the overall amount of this loss cannot be estimated.

#### *4.15.1.1.5 Potential for Boom/Bust Cycle*

Implementation of the proposed project would create both primary and secondary employment opportunities, contribute to the local economy, and provide a significant source of revenues for local agencies through the collection of royalty taxes. If current estimates and plans are realized by each of the three Companies involved in the proposal, employment opportunities would occur primarily in the first five years of the project, while revenues may extend for as long as 20 to 30 years. At this time, project activities and gas production would slow or cease and so would the associated economic benefits. Some concern was expressed during scoping related to the potential of project activities to create a boom/bust economic cycle similar to what was experienced in the area in the early 1980s.

The potential for the project to result in a significant economic boom/bust cycle is low. While this project, in conjunction with other CBM development activities (e.g., the Price CBM Project), would increase the importance of these sectors in the local economy, when compared to the overall economy these activities represent a relatively small share of the economy. Project activities are expected to begin and end in a gradual fashion, and a major lay-off or royalty reduction is not anticipated. Historically, the economies of Carbon and Emery counties have been subject to the fluctuations associated with resource extraction and are probably less sensitive to this phenomenon than other areas. In addition, there are a number of other ongoing economic activities and concerted efforts by local authorities to diversify the local economy. These factors all lead to the conclusion that while the conclusion of project activities would create a gap in employment and the economy, it is not expected that this gap would equate to the overall collapse of the region or a significant localized depression cycle. Although there is a risk for the oil and gas industry, there would be no risk to the overall economy.

### 4.15.1.1.6 Housing

To the extent that project-created employment results in a concentrated housing demand or shortage, either short or long term, the effect of the proposal would be considered to be significant. Effects shall be measured on both a local and regional level. If transient housing, e.g. man camps or motel rooms, would be required for short-term accommodations for construction or other laborers that are currently not available, the effect is deemed significant.

Because 39 of the 98 workers recruited for project development are expected to be local, existing residents, it is not expected that a marked demand for housing would be experienced. Also, project activities would be spread out over a two-county area and workers and their families would likely choose homes close to work sites. Therefore, it is unlikely that the 59 workers hired from outside the local area would be seeking homes in one particular location simultaneously.

Use of non-local contract workers for specialized construction activities may increase the demand for, and availability of, temporary housing. It is not expected that this demand would represent a significant impact as most of these workers would not have dependants accompanying them and they would most likely stay in motels, recreational vehicles, and mobile homes. Many of these workers may already be in the Project Area constructing wells on state and private lands, reducing the likelihood of a major influx of workers all seeking temporary housing at one time.

### 4.15.1.1.7 Community Facilities and Services

The proposal may affect local community facilities and services in two ways. The project may have utility and service requirements directly that may affect capacity. Second, project-generated employment and their dependants may increase demands on local community facilities and services, affecting capacity of the local service provider.

#### 4.15.1.1.7.1 Roads, Water and Wastewater Systems, and Solid Waste Disposal

Access to portions of the Project Area from state and federal highways would require the use of certain county roads. Project activities could potentially result in increased traffic and use of roads, including additional wear and tear from heavy vehicles. The increased use of county roads may increase maintenance costs to county special districts. Both paved and non-paved roads may be affected. The project's effects on roads and the subsequent financial consequences to Carbon and Emery counties are described in further detail in **Section 4.15.1.1.8**.

Water would be required for construction and operation of the proposed project. Water requirements are detailed on **Table 2–4.** Total water requirements would equal 84 acre-feet/year. The Companies would purchase water from a variety of sources, resulting in very minor shifts in water consumption from existing uses to this project. The potential effects of the use of this amount of water are described in **Section 4.2**.

Because there is only a small population increase and subsequent housing demand expected with project implementation, a significant effect on domestic water service provision (in terms of supply and conveyance systems) is not expected. In addition, neither the proposed project itself or subsequent development resulting from project employment (if any) is expected to have any impact on local wastewater facilities.

Project activities would generate solid waste, as described in **Section 2.1.1.1.3.8**. Certain wastes would be disposed of onsite or recycled and other waste products would be disposed of at the local landfill. It is not anticipated that the addition of this waste stream would significantly affect the local landfills or their capacities.

#### 4.15.1.1.7.2 Public Schools, Law Enforcement, Fire Protection, and Medical Facilities

Public schools in the region are not anticipated to experience significant increases in student enrollment as a result of the proposed project. Due to the limited population increases expected and the long-term time frame associated with the project, public schools are not anticipated to experience the potential effects of significant growth resulting from the project. If current plans change, resulting in a significant number of project workers being recruited from outside the local area who bring school-aged children with them, existing over-crowded conditions may be exacerbated.

Law enforcement and fire protection services are not expected to experience significant impacts as a result of project implementation. While there is the potential for some unquantifiable increase in calls for service related to vandalism and/or emergency fire calls, comments contained in the Price CBM EIS indicate that the agencies would not patrol Project Areas or provide routine security services. The Carbon County Sheriff's Office indicated it would respond to calls for service on an as-needed basis, if vandalism or other criminal activity is reported. No increase in staffing at the Sheriff's Office is foreseen as a result of the proposed project (BLM 1997c).

Medical facilities are not anticipated to experience significant effects due to project implementation.

### *4.15.1.1.8 Public Finance*

The project would be considered to have a significant effect on public finance if local government fiscal conditions were impacted in such a way that revenues would not adequately provide public facilities and services at established levels.

Implementation of the Proposed Action would result in some level of both costs and benefits for the counties in the Project Area. Regarding financial costs, the primary project-related impact is related to the use of county roads. In Carbon County, the Carbon County Roads Special Service District has responsibility for building, improving, and maintaining roads. The County Special Service District #1 is charged with road maintenance for Emery County. Revenues used by these districts is generated through federal mineral lease royalties, state payments in lieu of taxes, and interest earned on unanticipated funds. Additional project-related costs to the Counties may arise from administrative services. Examples of these costs include mapping, naming, and signing of new roads developed in the Project Area for emergency access, as well as other staff and administrative costs.

#### 4.15.1.1.8.1 Federal Mineral Royalties

Mineral lease royalties are collected by the Mineral Management Service, U.S. Department of the Interior, for gas produced by wells completed on federal lands. It is estimated that about 46 new wells would be completed on federal land in the project's North area and 84 new wells completed on federal lands in the South Area through the end of the estimated project life. Substantial revenues would be generated through these mineral royalty payments. Federal mineral royalties are collected at a rate of 12.5 percent and are split evenly between the federal government and the state of origin. The largest shares (91 percent) of Utah's

portion of the royalties is distributed in the following manner: 32.5 percent to the Permanent Community Impact Fund (PCIF), 33.5 percent to the Regents of the University of Utah, 25 percent back to the county of origin, and 9 percent to others.

**Table 4–28** presents the estimated combined annual natural gas production and royalties associated with the project. Annual gas production rates for wells developed on federal lands have been estimated to range from 452 million cubic feet (MMCF) to as high as 27,487 MMCF at peak production. Forty-six percent of the project's annual gas production would originate from federal wells. Based on these rates, the annual federal mineral royalties have been projected at $78,541 to $4,775,790, equating to a total of $53,897,421 over the life of the project. Of this total amount, $26,948,710 would be paid to the State of Utah during the 25 years of production. Approximately $8,758,331 would be distributed to the PCIF, $9,027,818 to the Regents of the University of Utah, and $6,737,178 to Carbon and Emery counties. For both Carbon and Emery counties, the 25-percent share of the state's federal royalty funds are dedicated to the County Roads Special Service District. It is estimated that these revenues would amount to $1,684,294 for Carbon County and Emery County.

The values shown on **Table 4–28** are projections intended only to present a general sense of the federal, state, and local funds generated by the project. The production rate and natural gas price used to calculate the annual royalties are only estimates and in actuality could vary substantially over the life of the project. A natural gas price of $1.39 per thousand cubic feet (MCF) was used to calculate the federal mineral royalties. This price is an average of the 1992 to 1996 annual natural gas wellhead prices for the state of Utah, as provided by the EIA's 1996 Natural Gas Annual Report (EIA 1996b).

#### 4.15.1.1.8.2 Permanent Community Impact Fund

The PCIF is another source of revenue funds related to mineral royalty payments. This fund, administered by the State of Utah, was established to provide rural communities with a means of funding major infrastructure projects. Cities within the Project Area can apply for grants and low-interest loans to fund projects such as roads, sewers, and educational and recreational facilities. Royalty payments generated from the proposed project are estimated to contribute about $8,758,331 to the PCIF over the life of the project, benefitting cities in Carbon and Emery counties, as well as other cities throughout Utah (**Table 4–28**).

#### 4.15.1.1.8.3 Local Ad Valorem Tax Revenue

Additional project revenues would be generated throughout the collection of an ad valorem/property tax levied on improvements constructed by the Companies. Since this tax assessment is based on value added to property, revenues would increase based upon the number and location of wells. No estimate of the assessment of improvements associated with well development was available, however, assessed value would be determined as a percentage of the actual cost of the facilities (Ferderber 1998). Ad valorem tax revenues in Carbon County are distributed to the Carbon School District and the General Fund and in Emery County revenues would be used primarily for schools. Theoretically, revenues would gradually increase over the first five years in both counties, provide a steady revenue stream for a period of years, and then decline as facilities are dismantled and reclaimed. These projections are subject to the number, location, and life span of facilities and gas production.

## Table 4–28
## Projected Combined[1] Annual Production and Federal, State and Local Royalties for Alternative 1

| Year | Projected Annual Production (MMCF)[2] | Estimated Value of Natural Gas Produced by the Project[3] | Federal Mineral Royalties[4] | State Portion of Federal Royalties[5] | PCIF[6] | Regents of University of Utah | County of Origin Total | County Roads Special Service District Portion of County of Origin Total |
|---|---|---|---|---|---|---|---|---|
| 1999 | 2,278 | $3,167,005 | $395,876 | $197,938 | $64,330 | $66,309 | $49,484 | $12,371 |
| 2000 | 5,077 | $7,057,445 | $882,181 | $441,090 | $143,354 | $147,765 | $110,273 | $27,568 |
| 2001 | 12,514 | $17,394,753 | $2,174,344 | $1,087,172 | $353,331 | $364,203 | $271,793 | $67,948 |
| 2002 | 16,611 | $23,089,656 | $2,886,207 | $1,443,103 | $469,009 | $483,440 | $360,776 | $90,194 |
| 2003 | 20,299 | $28,215,829 | $3,526,979 | $1,763,489 | $573,134 | $590,769 | $440,872 | $110,218 |
| 2004 | 24,330 | $33,818,164 | $4,227,270 | $2,113,635 | $686,931 | $708,068 | $528,409 | $132,102 |
| 2005 | 27,091 | $37,656,612 | $4,707,076 | $2,353,538 | $764,900 | $788,435 | $588,385 | $147,096 |
| 2006 | 27,487 | $38,206,320 | $4,775,790 | $2,387,895 | $776,066 | $799,945 | $596,974 | $149,243 |
| 2007 | 26,522 | $36,865,970 | $4,608,246 | $2,304,123 | $748,840 | $771,881 | $576,031 | $144,008 |
| 2008 | 24,080 | $33,471,346 | $4,183,918 | $2,091,959 | $679,887 | $700,806 | $522,990 | $130,747 |
| 2009 | 21,485 | $29,863,687 | $3,732,961 | $1,866,480 | $606,606 | $625,271 | $466,620 | $116,655 |
| 2010 | 18,135 | $25,207,333 | $3,150,917 | $1,575,458 | $512,024 | $527,779 | $393,865 | $98,466 |
| 2011 | 15,329 | $21,306,749 | $2,663,344 | $1,331,672 | $432,793 | $446,110 | $332,918 | $83,229 |
| 2012 | 12,969 | $18,027,520 | $2,253,440 | $1,126,720 | $366,184 | $377,451 | $281,680 | $70,420 |
| 2013 | 10,984 | $15,267,565 | $1,908,446 | $954,223 | $310,122 | $319,665 | $238,556 | $59,639 |
| 2014 | 9,311 | $12,941,924 | $1,617,741 | $808,870 | $262,883 | $270,972 | $202,218 | $50,554 |
| 2015 | 7,900 | $10,980,854 | $1,372,607 | $686,303 | $223,049 | $229,912 | $171,576 | $42,894 |
| 2016 | 6,708 | $9,324,754 | $1,165,594 | $582,797 | $189,409 | $195,237 | $145,699 | $36,425 |
| 2017 | 5,583 | $7,759,955 | $969,994 | $484,997 | $157,624 | $162,474 | $121,249 | $30,312 |
| 2018 | 4,546 | $6,318,794 | $789,849 | $394,925 | $128,350 | $132,300 | $98,731 | $24,683 |
| 2019 | 3,649 | $5,072,281 | $634,035 | $317,018 | $103,031 | $106,201 | $79,254 | $19,814 |
| 2020 | 2,767 | $3,846,691 | $480,836 | $240,418 | $78,136 | $80,540 | $60,105 | $15,026 |
| 2021 | 1,950 | $2,709,866 | $338,733 | $169,367 | $55,044 | $56,738 | $42,342 | $10,585 |
| 2022 | 1,296 | $1,801,294 | $225,162 | $112,581 | $36,589 | $37,715 | $28,145 | $7,036 |
| 2023 | 848 | $1,178,671 | $147,334 | $73,667 | $23,942 | $24,678 | $18,417 | $4,604 |
| 2024 | 452 | $628,329 | $78,541 | $39,271 | $12,763 | $13,156 | $9,818 | $2,454 |
| Total | 310,201 | $431,179,366 | $53,897,421 | $26,948,710 | $8,758,331 | $9,027,818 | $6,737,178 | $1,684,294 |

Notes:

1 Anadarko, Chandler, and Texaco combined.

2 Source: Cox 1998. MMCF = million cubic feet; Annual production shown for federal lands only representing 46 percent of projected production.

3 Value of Gas equals estimated annual production multiplied by the assumed natural gas price of $1.39 per MCF (EIA, 1996b).

4. (50% Federal Funds, 50% State Funds) Does not include administrative fees.

5 State funds are divided between PCIF (32.5 percent), Regents of University of Utah (33.5 percent), and County of Origin (25 percent).

6. PCIF=Permanent Community Impact Fund. Carbon and Emery Counties are guaranteed PCIF Funds. Counties would apply for grants or loans from PCIF to collect these monies.

#### 4.15.1.1.8.4 Sales and Use Tax Revenues

Sales and use tax revenues would be generated throughout Carbon and Emery counties as a direct result of spending on goods and services in various cities throughout the Project Area. Gross taxable sales generated in Carbon and Emery counties are $270,180,000 and $63,934,000, respectively (GOPB 1997b). Based on the current sales tax rates, total annual sales and use tax revenues generated in Carbon and Emery counties are $15,616,404 and $3,695,385, respectively. Although precise purchasing amounts for the project are not available, it is estimated that about $412,300 to $6,997,900 would be spent annually by the Companies over the life of the project (Cox 1998). The current sales tax rate is 5.78 percent, which includes a one percent local tax. It is assumed that sales and use tax revenues would be captured primarily by Carbon County. Based on these assumptions, it is estimated that sales and use tax revenues generated annually by the project would range from $23,830 to $404,478, which would represent between 0.2 and 10.9 percent of the total annual sales tax revenues generated in Carbon and Emery counties. This would not represent a significant impact.

### *4.15.1.1.9 Quality of Life*

Project-related changes in existing ways of life that cause community discontent sufficient to raise conflict and organized response/opposition would be considered to represent a significant impact on quality of life. The perception of a "quality of life" is a very subjective and personal idea, which varies significantly by individual, location, and interests. Quality-of-life issues were raised as part of scoping for this project, however, little or no information regarding a definition of this issue was provided by respondents. It is clear that no one would be in favor of a "poor" quality of life, but it is difficult to assess what specific aspects of a long-term project may cause an individual's perception of quality of life to change in a negative manner. Additionally, many of the factors that would be considered by most to improve a quality of life (e.g., employment opportunities, municipal services, and vital economy) may or may not be achievable without some increase in factors seen to mar a quality-of-life perception (e.g., traffic increase, visual impairment, use of federal lands for resource extraction, or influx of transient workers). Each of these factors is discussed in the following paragraphs.

#### 4.15.1.1.9.1 Local Economy

Over time, the proposed project would result in effects that would be considered to both aid and deter from a common perception of a desirable quality of life. All of the social and economic topics described in this section would factor into a "quality of life". It has been concluded that over the 25-year expected life span of the project, increased employment in certain sectors would be realized. These opportunities (primarily within the first five years of project development) would require skilled as well as unskilled labor. Many of these jobs could be filled by workers with similar skills who are currently residing in the Project Area. Employment opportunities and economic stability are a positive factor in the quality of life.

#### 4.15.1.1.9.2 Open Space and Visual Effects

Project development would noticeably increase activities on federal lands throughout the Project Area. During the five-year development phase, it is expected that there would be numerous ongoing drilling operations that would increase noise and dust and pose local visual impairment. Once wells are completed, well pad and pumping units would dot the landscape in certain areas. New road and pipeline corridors also would be noticeable. These effects are a necessary part of resource extraction activities in the area. These features may affect one's perception of quality of life in terms of a visual impact experienced primarily

during outdoor recreational activities in the Project Area. Localized visual impacts, while unavoidable with project implementation, can be lessened by some extent through mitigation, such as screening and painting (see **Section 4.13**).

Regarding open space, one of the factors identified in previous surveys (BLM 1997c) as being perceived as a one component of quality of life was the availability and access to wilderness and open space areas. The project would create a road network that would allow vehicular and recreational access to areas previously unaccessible. At the same time, increased access could be perceived as a negative impact in that it would reduce the secluded and undisturbed quality of currently isolated areas.

#### 4.15.1.1.9.3 Traffic Congestion

Implementation of the project would result in an increase in traffic on federal, state, and local roads (see **Section 4.10**). Truck and heavy equipment traffic on federal lands, state highways, and county roads would increase. Some additional traffic on local community roads also may occur over time as new employees and project activities create additional trips. The major traffic congestion would occur at locations along U.S. 6 and SR 10 where vehicles and construction equipment would enter and exit the Project Area.

#### 4.15.1.1.9.4 Climate and Air Quality

Climate and air quality are generally perceived as a factor in a definition of quality of life. The Proposed Action would have no effect on the regional climate. Furthermore, implementation of the Proposed Action is not anticipated to have significant impacts to regional air quality (see **Section 4.3**). Since there are no changes to climate or significant impacts or degradation to air quality anticipated, neither of these factors would affect quality of life.

#### 4.15.1.1.9.5 Community Facilities and Services, Community Values

As described in previous sections, the proposed project would generate revenues currently not available to both Carbon and Emery counties. These revenues would likely be used for a variety of purposes, including funding for additional community facilities and services. While there may be a moderate increase in demand on existing services over time as project activities proceed, these affects have not been determined to be significant. Careful planning and budgeting of revenue would allow municipalities to consider such things as school additions, parks, recreational facilities, additional law enforcement officers, and other services and facilities.

It would be highly speculative and very difficult to predict the project's long-term impact on community values. Likewise, it would be difficult to assess whether or not implementation of the project would have any effect on religion in the area.

#### 4.15.1.1.9.6 Crime

There is no information available that links natural gas development to increases in crime in a particular area. It would be impossible to predict increases or decreases in rates of crime resulting directly from project implementation.

#### 4.15.1.10 Electric Power Option

Under the electric power option, the only effect on socioeconomicswould be the extra number of workers required to install the aboveground electric power lines and poles. For the five-year construction period, an additional 3,760 workdays, or an average of three workers per day, would be needed to install 187 miles of power lines. This increase would be approximately three percent of the projected total average of 98 workers needed to construct the rest of the Proposed Action. The projected annual payroll for the Proposed Action is $914,000 during the early stage of development. A three-percent increase in workers required to construct the power lines would increase the annual payroll by $27,000 to at total of $942,000. These extra workers would lead to an attendent three-percent increase in all the other factors analyzed for the socioeconomic resource.

### 4.15.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Implementation of Alternative 2 would result in effects that only slightly vary from those described for Alternative 1. It is estimated that an average of 92 employees (98 employees under Alternative 1) would be required annually during the first five years of development. Approximately 37 would be local hires and 55 would be hired from outside the area. Employment for operations and reclamation would remain the same as for Alternative 1 (43 and 32 employees for operations and reclamation, respectively). Expenditures made by the Companies and local tax revenues would be reduced slightly (about 6 percent) because 18 fewer wells would be drilled under this alternative. The Environmental Protection Measures included in Alternative 2 that specifically relate to visual measures would aid in offsetting the project's effects on "quality of life".

**Table 4–29** presents the estimated combined annual natural gas production and royalties associated with Alternative 2. Annual gas production rates for wells developed on federal lands have been estimated to range from 416 million cubic feet (MMCF) to as high as 25,277 MMCF at peak production. Forty-two percent of the project's annual gas production would originate from federal wells. Based on these rates, the annual federal mineral royalties have been projected at $72,228 to $4,391,911, equating to a total of $49,565,130 over the life of the project. Of this total amount, $24,782,565 would be paid to the State of Utah during the 25 years of production. Approximately $8,054,334 would be distributed to the PCIF, $8,302,159 to the Regents of the University of Utah, and $6,195,641 to Carbon and Emery counties. For both Carbon and Emery counties, the 25-percent share of the state's federal royalty funds are dedicated to the County Roads Special Service District. It is estimated that these revenues would amount to $1,548,910 for Carbon County and Emery County.

#### 4.15.1.2.1 Electric Power Option

Under the electric power option, the only effect on socioeconomicswould be the extra number of workers required to install the aboveground electric power lines and poles. For the five-year construction period, an additional 3,400 workdays, or an average of three workers per day, would be needed to install 170 miles of power lines. This increase would be similar to the Proposed Action resulting in a similar three percent of the projected total average of 92 workers needed to construct the rest of the project under Alternative 2. Therefore, the socioeconomic impacts would be similar to the Proposed Action.

## Table 4–29
## Projected Combined[1] Annual Production and Federal, State and Local Royalties for Alternative 2

| Year | Projected Annual Production (MMCF)[2] | Estimated Value of Natural Gas Produced by the Project[3] | Federal Mineral Royalties[4] | State Portion of Federal Royalties[5] | PCIF[6] | Regents of University of Utah | County of Origin Total | County Roads Special Service District Portion of County of Origin Total |
|---|---|---|---|---|---|---|---|---|
| 1999 | 2,095 | $2,912,440 | $364,055 | $182,028 | $59,159 | $60,979 | $45,507 | $11,377 |
| 2000 | 4,669 | $6,490,165 | $811,271 | $405,635 | $131,831 | $135,888 | $101,409 | $25,352 |
| 2001 | 11,508 | $15,996,557 | $1,999,570 | $999,785 | $324,930 | $334,928 | $249,946 | $62,487 |
| 2002 | 15,276 | $21,233,702 | $2,654,213 | $1,327,106 | $431,310 | $444,581 | $331,777 | $82,944 |
| 2003 | 18,668 | $25,947,833 | $3,243,479 | $1,621,740 | $527,065 | $543,283 | $405,435 | $101,359 |
| 2004 | 22,374 | $31,099,850 | $3,887,481 | $1,943,741 | $631,716 | $651,153 | $485,935 | $121,484 |
| 2005 | 24,913 | $34,629,762 | $4,328,720 | $2,164,360 | $703,417 | $725,061 | $541,090 | $135,273 |
| 2006 | 25,277 | $35,135,285 | $4,391,911 | $2,195,955 | $713,685 | $735,645 | $548,989 | $137,247 |
| 2007 | 24,390 | $33,902,673 | $4,237,834 | $2,118,917 | $688,648 | $709,837 | $529,729 | $132,432 |
| 2008 | 22,145 | $30,780,910 | $3,847,614 | $1,923,807 | $625,237 | $644,475 | $480,952 | $120,238 |
| 2009 | 19,758 | $27,463,235 | $3,432,904 | $1,716,452 | $557,847 | $575,011 | $429,113 | $107,278 |
| 2010 | 16,677 | $23,181,160 | $2,897,645 | $1,448,823 | $470,867 | $485,356 | $362,206 | $90,551 |
| 2011 | 14,096 | $19,594,106 | $2,449,263 | $1,224,632 | $398,005 | $410,252 | $306,158 | $76,539 |
| 2012 | 11,927 | $16,578,462 | $2,072,308 | $1,036,154 | $336,750 | $347,112 | $259,038 | $64,760 |
| 2013 | 10,101 | $14,040,354 | $1,755,044 | $877,522 | $285,195 | $293,970 | $219,381 | $54,845 |
| 2014 | 8,562 | $11,901,649 | $1,487,706 | $743,853 | $241,752 | $249,191 | $185,963 | $46,491 |
| 2015 | 7,265 | $10,098,209 | $1,262,276 | $631,138 | $205,120 | $211,431 | $157,785 | $39,446 |
| 2016 | 6,169 | $8,575,228 | $1,071,903 | $535,952 | $174,184 | $179,544 | $133,988 | $33,497 |
| 2017 | 5,134 | $7,136,208 | $892,026 | $446,013 | $144,954 | $149,414 | $111,503 | $27,876 |
| 2018 | 4,180 | $5,810,887 | $726,361 | $363,180 | $118,034 | $121,665 | $90,795 | $22,699 |
| 2019 | 3,356 | $4,664,569 | $583,071 | $291,536 | $94,749 | $97,664 | $72,884 | $18,221 |
| 2020 | 2,545 | $3,537,493 | $442,187 | $221,093 | $71,855 | $74,066 | $55,273 | $13,818 |
| 2021 | 1,793 | $2,492,046 | $311,506 | $155,753 | $50,620 | $52,177 | $38,938 | $9,735 |
| 2022 | 1,192 | $1,656,505 | $207,063 | $103,532 | $33,648 | $34,683 | $25,883 | $6,471 |
| 2023 | 780 | $1,083,929 | $135,491 | $67,746 | $22,017 | $22,695 | $16,936 | $4,234 |
| 2024 | 416 | $577,824 | $72,228 | $36,114 | $11,737 | $12,098 | $9,028 | $2,257 |
| Total | 285,267 | $396,521,041 | $49,565,130 | $24,782,565 | $8,054,334 | $8,302,159 | $6,195,641 | $1,548,910 |

Notes:

1 Anadarko, Chandler, and Texaco combined.

2 Source: Cox 1998. MMCF = million cubic feet; Annual production shown for federal lands only representing 42 percent of projected production.

3 Value of Gas equals estimated annual production multiplied by the assumed natural gas price of $1.39 per MCF (EIA 1996b).

4. (50% Federal Funds, 50% State Funds) Does not include administrative fees.

5 State funds are divided between PCIF (32.5 percent), Regents of University of Utah (33.5 percent), and County of Origin (25 percent).

6. PCIF=Permanent Community Impact Fund. Carbon and Emery Counties are guaranteed PCIF Funds. Counties would apply for grants or loans from PCIF to collect these monies.

### 4.15.1.3 Alternative 3 — No Action

Under the No Action Alternative, no natural gas drilling would take place on federal lands. However, drilling could still occur on state and private land. Compared with the Proposed Action and Alternative 2, the No Action Alternative would create fewer jobs in the Project Area over the life of the project. An average of 49 employees (98 employees under Alternative 1) would be required annually during the first five years of development. Approximately 20 would be local hires and 29 would be hired from outside the area. Employment for operations would remain the same as for Alternatives 1 and 2 (43 employees). However, the number of employees needed for reclamation would decrease to about 20. Expenditures made by the Companies and local tax revenues would be reduced substantially because 131 fewer wells would be drilled under this alternative. In addition, the costs and benefits of the project directed to Carbon and Emery counties would be reduced relative to the Proposed Action and Alternative 2. With no additional federal wells, there would be no additional federal royalties available and no associated distribution of those royalties to the counties.

## 4.15.2 Summary of Impacts

During the construction phase, approximately 98 new jobs would be created under Alternative 1. It is assumed that 39 of the new construction jobs would be local hires. These jobs would be seasonable through the expected 8-month (May through November) construction period. The operational phase of the project is expected to generate 43 jobs, about 37 of which would be local hires. People hired for the construction phase would be hired by third-party contractors to perform the required labor. Expenses incurred during the construction period (labor, equipment rental, and materials) would range from $28.7 million during the first two years, decrease to $18.7 million during the third through fifth years, and drop to $10.3 million during the last two years. The annual payroll of the Companies' permanent employees would range from $640,000 to $966,000 during the initial construction and then level off at about $1.1 million during the operational phase. Approximately 35 of the permanent employees would be local hires, whose annual salaries would total about $990,000.

The influx of non-local hires during the construction phase would not significantly impact the local housing, schools, medical facilities, or other community services because the increase would only be about 40 people.

In addition to salaries generated by the project, extra revenue would filter to county levels through federal royalties, local ad valorem taxes, and sales and use taxes. Based on projected natural gas market prices, it is estimated that federal royalties would total $53 million over the life of the project. Approximately half would be paid to the State of Utah and $6.7 million would be distributed to Carbon and Emery counties. Both counties would dedicate 25 percent ($1.7 million) to maintenance and construction of county roads. Another $8.8 million would be dedicated to Utah's PCIF, a means to provide rural communities for infrastructure projects. Communities in Carbon and Emery counties would have the right to apply for grants and low-interest loans in competition with other rural communities in Utah.

Approximately 92 new construction jobs would be created under Alternative 2. It is assumed that 37 of the new construction jobs would be local hires. These jobs would be seasonable through the expected 8-month (May through November) construction period. The operational phase of the project is expected to generate 43 jobs, about 37 of which would be local hires.

Based on projected natural gas market prices, it is estimated that federal royalties would total almost $50 million over the life of the project. Approximately half would be paid to the State of Utah and $6.2 million

would be distributed to Carbon and Emery counties. Both counties would dedicate 25 percent ($1.5 million) to maintenance and construction of county roads. Another $8.1 million would be dedicated to Utah's PCIF, a means to provide rural communities for infrastructure projects.

Under the No Action alternative, no additional wells would be drilled on federal lands. Approximately 49 new construction jobs would be created under Alternative 3. It is assumed that 20 of the new construction jobs would be local hires. The operational phase of the project is expected to generate 43 jobs, about 37 of which would be local hires. Implementation of Alternative 3 would result in a complete loss of all the federally-related benefits and costs described in the Proposed Action because no federal royalties would be collected and the associated distribution of these royalties would not occur.

## 4.15.3 Mitigation

There is no mitigation applicable.

## 4.15.4 Unavoidable Adverse Impacts

Impacts to quality of life may occur depending on an individual's point of view. For those that prefer the solitude and natural setting, their quality of life would be affected for the life of the project.

# 4.16 HEALTH AND SAFETY

## 4.16.1 Direct and Indirect Impacts

### 4.16.1.1 Alternative 1 — Proposed Action

#### *4.16.1.1.1 Hazardous Materials*

BLM policy (Instruction Memorandum 93–244, 9/9/93) on hazardous materials requires the identification of the following:

(A) any chemical or chemicals from the EPA's Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986, 10,000 pounds of which will be used, produced, stored, transported, or disposed of annually in association with the Proposed Action (regardless of exemption status) and

(B) are extremely hazardous substances, as defined in 40 CFR 355, which will be used, produced stored, transported, or disposed of in association with the proposed (action regardless or exemption status).

The Hazardous Substances Management Plan (**Appendix A**), lists the chemicals that would be used, stored, and produced during construction and operations and the methods that the Companies would use to ensure safety and efficiency with the chemicals. No materials incorporating a component listed as extremely hazardous would be used during operations.

The Companies have Emergency Plans in place that cover potential emergencies, including fires, employee injuries, chemical releases, hydrogen sulfide releases, and many others. The Emergency Plans include phone numbers for all medical and emergency services along with a list of responsible personnel to contact in the

event of an emergency. The Plans would be posted at all emergency facilities. All employees would be trained in emergency response upon being hired.

Several measures would be utilized to prevent pollution. All chemicals in the Project Area would be properly stored in accordance with state and federal guidelines. Areas containing chemicals would be periodically inspected by personnel who have emergency response training. The Companies' internal procedures include measures that would be taken in the event of a chemical release in excess of reportable quantities as outlined in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. BLM standard approval for oil and gas operations would require the Companies' activities involving the generation, storage, or transport of hazardous materials be subject to required coordination and/or permitting from applicable local and state agencies and otherwise conform to applicable state and federal laws and regulations. Additionally, Federal and State operating and reporting requirements include provisions to cleanup and mitigate chemical, product, or waste releases.

According to local authorities, there have been no known incidents of hazardous materials released in the area as a result of natural gas development. The Carbon/Emery area has infrastructure in place to handle releases of hazardous materials.

The discussion of the Proposed Action in Chapter 2 identifies wastes generated during the various phases of gas development. Wastes would be disposed at approved facilities including regional landfills in accordance with State and Federal requirements. The Companies have identified in the Hazardous Substance Management Plan (**Appendix A**) that they would comply with regulations promulgated for the Resource Conservation and Recovery Act (RCRA), which covers transportation and disposal of hazardous wastes. Proper handling and disposal of wastes associated with the project would pose minimal risk to public health and safety and should not pose any adverse impacts.

Information concerning produced water disposal and hydrology and water quality is discussed in the **Section 4.2**. Specific information on spill impacts to surface and groundwater is contained in **Sections 4.2.1.1.4** and **4.2.1.2.4**.

### *4.16.1.1.2 Health and Safety*

Potential risks associated with the Proposed Action and alternatives would be geologic hazards (methane gas seepage, $H_2S$ releases, abnormal high pressure, seismic activity), fires and explosions (gas flowline leakage or rupture, well fires, human-caused fires), and public and employee safety. The following sections describe these risks and the measures that would to taken to minimize the risk factor to health and safety.

#### **4.16.1.1.2.1 Methane Seepage**

There are two potential avenues for methane gas reaching the surface. One is gas migration up the well bore annuli. This will be prevented by the cementing and casing program, which will isolate or protect all zones containing a fluid (gas or liquid) with the potential to migrate. The second is through the natural fractures and conduits of the formations leading to venting at the surface. The geologic setting (a thick layer of shale above the productive gas bearing zone) does not lend itself to vertical migration and recent studies have confirmed that horizontal gas migration is not currently occurring.

The USGS and UDOGM have been monitoring methane concentrations in soil and shallow groundwater since 1995. This study encompasses the area of current and proposed coalbed methane production from the

Ferron Sandstone. Approximately 80 percent of 121 soil samples had a methane concentration below the detectable limit. Samples containing detectable concentrations were taken immediately adjacent to producing coalbed methane or conventional gas wells.

Fourteen samples were taken from springs, wells, and drains. One sample, taken from a pond, contained a detectable level of methane. This is most likely the result of decomposition of organic material at the bottom of the pond. The USGS and UDOGM will continue to monitor shallow ground water and soil gas in this area.

Additionally, the BLM recently conducted a soil gas survey (**Appendix D**) sampling along the Ferron Sandstone outcrop. The outcrop is located 6 to 10 miles east of the FNG Project Area. Samples were taken approximately 1,312 feet (400 meters) apart. Sample sites were permanently marked to allow for future analysis, if necessary. Of the 70 samples taken, none had detectable levels of either methane, hydrogen sulfide, or carbon monoxide.

#### 4.16.1.1.2.2 Hydrogen Sulfide Releases

$H_2S$ has not been encountered to date in any of the more than 100 CBM wells drilled in the Price area. Therefore, $H_2S$ would not be expected during the extraction of natural gas in the Project Area. However, $H_2S$ has been detected in produced water from some of the CBM wells in small amounts (80 to 90 ppm below the minimum level of 100 ppm at which it is regulated under Onshore Order No. 6). Solution $H_2S$ also was recently encountered in the drilling of a disposal well to a depth of approximately 6,000 feet into the Navajo Formation. As a result, the Companies would prepare an $H_2S$ contingency plan in accordance with UDOGM's requirements.

#### 4.16.1.1.2.3 Abnormal High Pressure

Encountering high pressures while drilling is always a possibility. However, offset well information can be used to anticipate subsurface pressure. More than 100 wells have been drilled in the Price CBM Project Area without experiencing abnormally-high pressure. One well outside of the Price Project Area experienced high formation pressure, but that situation was safely and effectively controlled by the approved blowout preventer.

All wells drilled would be required to have Blowout Prevention Equipment (BOPE) that would safely control any abnormally-high pressures encountered. Onshore Oil and Gas Order No. 2 (Drilling Operations) established the minimum equipment necessary to safely drill and handle specific pressure situations. All wells drilled on federal mineral leases would adhere to this Order. Wells drilled on private and State leases have similar requirements administered by UDOGM. Pressure equipment is prescribed on a site-specific basis during APD approval and the Companies would be required to maintain the equipment in good condition. In addition, all drilling companies employed by the Companies would be required to be certified with blowout prevention training. BLM and UDOGM would make inspections during drilling activities to verify compliance with these requirements. Therefore, blowouts are considered unlikely in the Project Area because of the shallow well depths, low gas pressures, experience in the area, and the BLM and UDOGM's requirements to install BOPE during drilling activities.

#### 4.16.1.1.2.4 Seismic Activity

Risks to facilities during seismic events are described in **Section 4.1.**

#### 4.16.1.1.2.5 Gas Flowline Leakage or Ruptures

A potential for gas flowlines or ruptures exists for the proposed project. According to the U.S. Department of Transportation (Office of Pipeline Safety 1997), an average of one rupture annually could be expected for every 5,000 miles of pipeline. More than 50 percent of pipeline ruptures occur as a result of heavy equipment striking the pipeline. Such ruptures could lead to a fire or explosion if a spark or open flame would ignite methane being released from the pipeline.

Pipeline design, materials, maintenance, and abandonment practices would be conducted in accordance with safe and proven engineering procedures and would meet or exceed the standards set forth in U.S. Department of Transportation (DOT) regulations (49 CFR Part 192, Transportation of Natural Gas by Pipelines) and standards construction specifications recommended by the American Society of Mechanical Engineers (ASME–31.8) and the American Petroleum Institute (API Standard 1004). Frequent signing of buried pipelines would minimize the risk of heavy equipment damaging the pipelines. The Companies' monitoring of the pipeline flow by either remote sensors or daily inspections of the flow meters would minimize the risks of pipeline ruptures by early detection of potential leaks.

Approximately 100 miles of pipelines would be constructed for the Proposed Action and these pipelines would be in service for more than 20 years. Applying the DOT statistic of one rupture annually for every 5,000 miles of pipeline, there is a potential for only one rupture in a pipeline over the lifetime of the project.

#### 4.16.1.1.2.6 Well Fires and Explosions

Well fires are very rare but could occur under certain conditions. A well fire could result from a blowout during drilling activities or a gas leak during operations. Gas would have to accumulate, such as in a confined space, and there would have to be a spark to start the fire. Because a blowout is unlikely for the reasons listed above, and signage and monitoring would reduce the likelihood of pipeline damage and undetected leaks, it is unlikely that the conditions for a well fire would occur. However, in the unlikely event of a well fire, the Companies would immediately contact one of the service companies specializing in controlling well fires for extinguishing the fire.

#### 4.16.1.1.2.7 Human-Caused Fires

Increased use of the Project Area by the Companies and increased public access could result in a higher potential for fires. Human-caused wildfire resulting from unsafe well control practices can be averted by implementing UDOGM's measures for fire hazards on the surface. The well site would be kept free of vegetation and trash in order to minimize the potential for wild fires to cause well fires. The UDOGM R649–3 Drilling and Operating Practices (from the Oil and Gas Conservation General Rules) requires the following measure for fire hazards on the surface:

- All rubbish or debris shall be contained in a trash cage during drilling and removed from the site subsequently.

- All rubbish or debris shall be placed in trash cages.

There is always a possibility that fires could be caused by vandalism. During daily inspections, pumpers would inspect facilities to determine whether unauthorized trespass has occurred overnight. Any damage to facilities would be immediately addressed, especially if safety or efficient operations would be a factor.

#### 4.16.1.1.3 Public and Employee Safety

Risks associated with the construction of natural gas facilities would approximate the impacts associated with the oil and gas industry. During 1996, OSHA (1996) reported that the injury rate per 100 workers was about nine injuries per year. Based on the average level of employment for the Ferron construction and operational phases (see **Table 2–3**), approximately 10 injuries could occur annually in the construction phase and five injuries could occur annually during the operational phase. This potential injury rate would be limited to employees and subcontractors and would not affect the general public. Issues concerning the potential for safety concerns associated with increased traffic are addressed in **Section 4.10.**

Potential related hazards to public and employee safety are described in **Section 4.16**. The Companies and their subcontractors would comply with all applicable federal laws and regulations to minimize the potential risks to the safety of the public and the company employees.

UDOGM's Drilling and Operating Practices require the operator to carry on all operations and maintain the property at all times in a safe and workmanlike manner having due regard for the preservation and conservation of the property and for the health and safety of employees and people residing in close proximity to those operations (R649–3–15). At a minimum, the operator shall:

- Take reasonable steps to prevent and remove accumulations of materials deemed to be fire hazards from the vicinity of well locations, lease tanks and pits.
- Remove from the property, or store in an orderly manner, all scrap or other materials not in use.
- Provide secure workmanlike storage for chemical containers, barrels, solvents, hydraulic fluid, and other non-exempt materials.
- Maintain tanks in a workmanlike manner that will preclude leakage and provide for all applicable safety measures, and construct berms of sufficient height and width to contain the quantity of the largest tank at the storage facility. The use of crude or produced water storage tanks without tops is strictly prohibited except during well testing operations.
- Catch leaks and drips, contain spills, and cleanup promptly. Waste reduction and recycling should be practiced in order to help reduce disposal volumes. Produced water, tank bottoms and other miscellaneous waste should be disposed of in a manner which is in compliance with these rules and other state, federal, or local regulations or ordinances. In general, good housekeeping practices should be used.

Safety requirements for well operations are regulated under 43 CFR Ch. II, Subpart 3162.5 — Environmental Obligations. Safety precaution require that the operator shall perform operations and maintain equipment in a safe and workmanlike manner. The operator shall take all precautions necessary to provide adequate protection for the health and safety of life and the protection of property. Compliance with health and safety requirements prescribed by the authorized officer shall not relieve the operator of the responsibility for compliance with other pertinent health and safety requirements under applicable laws or regulations. Environmental obligations require that all spills or leakages of oil, gas, produced water, toxic liquid , or waste materials, blowouts, fires, personal injuries, and fatalities shall be reported by the operator in accordance with these regulations and as prescribed in applicable order or notices. The operator shall

exercise due diligence in taking necessary measures, subject to approval by the authorized officer, to control and remove pollutants and to extinguish fires.

All of the above listed items would be covered in the Emergency Plans that are being developed by the Companies. In addition, the Companies' Operational Plans list safety measures that are incorporated in the construction, drilling, operational, and vehicle operation phase of the project. The Emergency Plans cover all potential emergencies including fires, employee injuries, chemical releases, and others. The Plans include phone contacts for medical and emergency services and a list of personnel to contact in any emergency situation. The Plans would be posted in all Company facilities and in all Company vehicles. All employees would be trained on the contents of the Plan and refresher training would be conducted periodically.

#### *4.16.1.1.4 Electric Power Option*

The only potential effect to health and safety associated with installing electric power would be a slight, but imperceptible, increase in the potential for injuries to workers. As previously described in this analysis, OSHA predicts an injury rate of about nine injuries per 100 workers for installation of facilities in the oil and gas industry. Since the average increase of workers for installation of electrical facilities would be three workers per year, the predicted injury rate could increase by three percent.

### 4.16.1.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Under this alternative, the measures to handle hazardous materials, ensure safe operations, and respond to emergency situations would apply in the same manner as to the Proposed Action. With 18 fewer wells to be drilled, the probability of accidents and vandalism should decrease slightly.

#### *4.16.1.2.1 Electric Power Option*

Under Alternative 2, approximately the same number of extra workers would be required to install electrical power. Therefore, the potential effects would be similar to the Proposed Action.

### 4.16.1.3 Alterative 3 — No Action

Under the No Action alternative, a maximum of 155 wells could be drilled on State and private leases. The level of activity would be about 54 percent of the Proposed Action. Therefore, potential risks to the pubic through increased traffic would decrease. However, the measures to handle hazardous materials, ensure safe operations, and respond to emergency situations would apply in the same manner as to the Proposed Action even though fewer wells, roads, and facilities would be constructed and operated.

## 4.16.2 Summary of Impacts

No hazardous chemicals above the reportable quantity limits would be stored, produced, or used by the Companies. The Companies' adherence to the provisions of the Hazardous Substances Management Plan would ensure the safe and efficient handling and storage of all chemicals.

No significant geological hazards would occur. No hydrogen sulfide has been encountered in any CBM wells drilled in and near the Project Area. Although abnormally-high pressures have not been encountered,

the Companies would be required to use BOPE during all drilling activities. USGS and BLM studies concerning methane seepage have determined that seepage would not occur even at the Ferron Outcrop to the east of the Project Area. Therefore, it can be concluded that seepage would not occur around drilling activities where the Ferron coal seem is at depths from 1,400 to 3,500 feet. $H_2S$ has been detected in produced water from some of the CBM wells in small amounts (80 to 90 ppm below the minimum level of 100 ppm at which it is regulated under Onshore Order No. 6). Solution $H_2S$ was also recently encountered in the drilling of a disposal well to a depth of approximately 6,000 feet into the Navajo Formation. As a result, the Companies would prepare an $H_2S$ contingency plan in accordance with UDOGM's requirements.

According to past statistics compiled by the DOT, a gas line rupture occurs annually for every 5,000 miles of pipelines. Applying this statistical record to the FNG Project, one pipeline rupture would occur over the life of the project. Well fires are very rare and unlikely to occur with the FNG Project because pumpers would check the well sites and equipment daily. Any potential safety problems would be corrected immediately. The likelihood of human-caused fires would be reduced by good housekeeping practices around the well sites and facilities. Daily inspections by pumpers would note and correct the presence of any debris. However, fires caused by vandalism, especially on the remote wells, cannot be ruled out. The daily inspections would alleviate these potential problems by noting any vandalism that might have occurred overnight.

Public and employee health and safety would be protected by the Companies' compliance with all applicable federal laws concerning the safe operation of natural gas facilities. All employees and subcontractors would be trained concerning the safe operation of equipment and vehicles.

### 4.16.3 Mitigation

No extra mitigation is required concerning health and safety measures.

### 4.16.4 Unavoidable Adverse Impacts

There are no unavoidable adverse impacts associated with health and safety matters.

## 4.17 RECLAMATION

The potential for successful reclamation of lands that would be disturbed by the three alternatives has been evaluated using data from the Carbon County Soils Survey, The Emery County Soils Survey and the 1997/98 NRCS survey commissioned by BLM. Soils mapping units were categorized into one of five basic classes for reclamation potential. There are four classes of reclamation potential identified for the North Area; variable, fair, poor, and unsuitable. The four classes of reclamation potential identified for the South Area are good, fair, poor, and unsuitable.

The reclamation potential shown on **Plate 4–4** represent the potential of the soils to support vegetation. The information is presented for analysis purposes only, as the characteristics of the soils were primarily developed for agricultural purposes. Soils classified as having a good or fair potential for reclamation commonly lie at the lowest elevations in the Project Area and occur in areas with the lowest slopes. Good and fair potential soils also tend to occur along streams.

## 4.17.1 Alternative 1 — Proposed Action

Under this alternative, about 1,633 acres of soils would be disturbed during construction of the wells, roads, and pipelines. As shown on **Table 4–29**, most (>80 percent) of this disturbance would involve soils classified as unsuitable for reclamation. About 69 percent of the transmission line right-of-way would have a reclamation potential of poor or unsuitable. Reclamation of these soils is expected to require many growing seasons and multiple efforts to reseed and successfully generate a vegetative cover similar to that which presently exists. The portions of the Project Area with a good or fair potential for reclamation are expected to return to pre-project conditions following a much shorter period of time after completion of initial reclamation activities.

**Table 4–29**
**Reclamation Potential for Project Facilities Under Alternative 1**

| Facility | Areal Extent of Reclamation Potential (acres) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Variable | | Good | | Fair | | Poor | | Unsuitable | | Total |
| | PUB | PVT STATE | PUB | PVT STATE | PUB | PVT STATE | PUB | PVT STATE | PUB | PVT STATE | |
| NORTH AREA | | | | | | | | | | | |
| Wells | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | 1.4 | 6.9 | 5.5 | 53.7 | 19.3 | 89.6 |
| Roads | 0.0 | 2.5 | 0.0 | 0.0 | 4.2 | 4.4 | 3.7 | 7.4 | 82.5 | 35.1 | 139.8 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.6 | 0.0 | 15.6 |
| Subtotal | 0.0 | 2.5 | 0.0 | 0.0 | 7.0 | 5.8 | 10.6 | 12.9 | 151.8 | 54.4 | 245.0 |
| SOUTH AREA | | | | | | | | | | | |
| Wells | 0.0 | 0.0 | 0.0 | 1.4 | 1.4 | 13.7 | 13.8 | 28.9 | 100.6 | 143.3 | 303.1 |
| Roads | 0.0 | 0.0 | 0.0 | 1.2 | 3.0 | 32.0 | 29.8 | 37.6 | 334.4 | 348.0 | 786.0 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.3 | 6.3 | 12.6 | 12.6 | 0.0 | 37.8 |
| Subtotal | 0.0 | 0.0 | 0.0 | 2.6 | 4.4 | 52.0 | 49.9 | 79.1 | 447.6 | 491.3 | 1,126.9 |
| PIPELINE | | | | | | | | | | | |
| Pipeline | 0.3 | 5.9 | 5.2 | 6.7 | 12.4 | 50.6 | 34.9 | 32.7 | 9.5 | 103.2 | 261.4 |
| TOTAL | 0.3 | 8.4 | 5.2 | 9.3 | 23.8 | 108.4 | 95.4 | 124.7 | 608.9 | 648.9 | 1,633.3 |
| Portion of total disturb. (percent) | 0.0 | 0.5 | 0.3 | 0.6 | 1.5 | 6.6 | 5.8 | 7.6 | 37.3 | 39.7 | 100.0 |

Bonds are required for oil and gas operations on Federal leases by Title 43 Code of Federal Regulations Parts 3104.1 and 3162.3 to protect the environment; ensure downhole plugging and surface reclamation following drilling or other exploration or development; and to cover unpaid Federal royalty obligations. The State of Utah (UDOGM) also requires bonds for State leases. Bonding for oil and gas operations is a risk management tool used by the BLM. It is not intended to cover 100 percent of the reclamation costs and royalty income. The historical default rate is 0.15 percent nationwide (BLM Bonding Liability of the Oil and Gas Program, March, 1995). Historically, the BLM has not seen oil and gas operators walk away from their responsibilities. Currently Texaco and Anadarko have $150,000 nationwide bonds. Chandler has a $25,000 statewide bond for activities on Federal lands in Utah. The State of Utah has similar bonding requirements. State bonds for private and State wells are established by UDOGM or SITLA.

The cost to plug and reclaim the surface associated with a single well and its associated access road has been estimated, in 1996 dollars, at $15,000. **Table 4–30** shows the amount of Federal reclamation liability each company would have for each year of the project. The analysis assumes that 20 percent of the proposed Federal wells would be drilled in each year of the five year construction period, and the production lifetime of each well would be 20 years. The 131 wells that would be drilled on Federal leases would accrue and estimated reclamation liability of $1,965,000, in 1996 dollars. The amount of liability at the end of production assumes that reclamation activities would take two years for reclamation.

**Table 4–30**
**Ferron Natural Gas Project Reclamation Liability**

| | Anadarko | | Texaco | | Chandler | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Number Federal Wells | Company Liability | Number Federal Wells | Company Liability | Number Federal Wells | Company Liability | Total Federal Wells | Total Liability |
| 1999 | 9 | $135,000 | 8 | $120,000 | 9 | $135,000 | 26 | $390,000 |
| 2000 | 18 | $270,000 | 16 | $240,000 | 18 | $270,000 | 52 | $780,000 |
| 2001 | 27 | $405,000 | 24 | $360,000 | 27 | $405,000 | 78 | $1,170,000 |
| 2002 | 36 | $540,000 | 32 | $480,000 | 36 | $540,000 | 104 | $1,560,000 |
| 2003 | 46 | $690,000 | 41 | $615,000 | 44 | $660,000 | 131 | $1,965,000 |
| 2004–2023 | 46 | $690,000 | 41 | $615,000 | 44 | $660,000 | 131 | $1,965,000 |
| 2024 | 36 | $540,000 | 32 | $480,000 | 36 | $540,000 | 104 | $1,560,000 |
| 2025 | 27 | $405,000 | 24 | $360,000 | 27 | $405,000 | 78 | $1,170,000 |
| 2026 | 18 | $270,000 | 16 | $240,000 | 18 | $270,000 | 52 | $780,000 |
| 2027 | 9 | $135,000 | 8 | $120,000 | 9 | $135,000 | 26 | $390,000 |
| 2028 | 0 | $0 | 0 | $0 | 0 | $0 | 0 | $195,000 |
| 2029 | | | | | | | | $97,500 |
| 2030 | | | | | | | | $0 |

## 4.17.2 Alternative 2 — Proposed Action with Additional Environmental Protection Measures

Under this alternative, about 1,473 acres of soils would be disturbed during construction of the wells, roads, and pipelines. As with Alternative 1, most (>80 percent) of this disturbance would involve soils classified as unsuitable for reclamation (**Table 4–31**). Reclamation of these soils is expected to require many growing seasons and multiple efforts to reseed and successfully generate a vegetative cover similar to that which presently exists. The portions of the Project Area with a good or fair potential for reclamation are expected to return to pre-project conditions following a much shorter period of time after completion of initial reclamation activities.

Eighteen fewer Federal wells would be drilled under this alternative. Therefore, the reclamation liability would be 86 percent of the Proposed Action or $1,689,900 in 1996 dollars.

**Table 4–31**
**Reclamation Potential for Project Facilities Under Alternative 2**

| Facility | Areal Extent of Reclamation Potential (acres) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Variable | | Good | | Fair | | Poor | | Unsuitable | | Total |
| | PUB | PVT STATE | PUB | PVT STATE | PUB | PVT STATE | PUB | PVT STATE | PUB | PVT STATE | |
| NORTH AREA | | | | | | | | | | | |
| Wells | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | 1.4 | 4.1 | 5.5 | 51.0 | 19.3 | 84.1 |
| Roads | 0.0 | 2.5 | 0.0 | 0.0 | 2.5 | 4.4 | 2.5 | 8.1 | 65.7 | 31.1 | 116.8 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.6 | 0.0 | 15.6 |
| Subtotal | 0.0 | 2.5 | 0.0 | 0.0 | 5.3 | 5.8 | 6.6 | 13.6 | 132.3 | 50.4 | 216.5 |
| SOUTH AREA | | | | | | | | | | | |
| Wells | 0.0 | 0.0 | 0.0 | 1.4 | 0.0 | 13.7 | 15.2 | 28.9 | 81.3 | 143.3 | 283.8 |
| Roads | 0.0 | 0.0 | 0.7 | 1.2 | 3.0 | 34.9 | 28.2 | 39.4 | 238.4 | 327.7 | 673.5 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.3 | 6.3 | 12.6 | 12.6 | 0.0 | 37.8 |
| Subtotal | 0.0 | 0.0 | 0.7 | 2.6 | 3.0 | 54.9 | 49.7 | 80.9 | 332.3 | 471.0 | 995.1 |
| PIPELINE | | | | | | | | | | | |
| Pipeline | 0.3 | 5.9 | 5.2 | 6.7 | 12.4 | 50.6 | 34.9 | 32.7 | 9.5 | 103.2 | 261.4 |
| TOTAL | 0.3 | 8.4 | 5.9 | 9.3 | 20.7 | 111.3 | 91.2 | 127.2 | 474.1 | 624.6 | 1,473.0 |
| Portion of total disturb. (percent) | 0.0 | 0.6 | 0.4 | 0.6 | 1.4 | 7.6 | 6.2 | 8.6 | 32.2 | 42.4 | 100.0 |

## 4.17.3 Alternative 3 — No Action

Under this alternative, about 917 acres of soils would be disturbed during construction of the wells, roads, and pipelines. Like the other two alternatives, most (>80 percent) of this disturbance would involve soils classified as unsuitable for reclamation (**Table 4–32**). Reclamation of these soils is expected to require many growing seasons and multiple efforts to reseed and successfully generate a vegetative cover similar to that which presently exists. Reclamation requirements would be specified by the State of Utah or private landowner.

## 4.17.4 Summary of Impacts

Although the three alternatives vary in the areal extent of disturbances (917 to 1,633 acres), most of the disturbances under each alternative would involve soils with a reclamation potential classified as poor or unsuitable. While the cost estimates for reclamation is high for Alternatives 1 and 2, Federal bonding policies and requirements would be adequate to assure reclamation is complete.

**Table 4–32**
**Reclamation Potential for Project Facilities Under Alternative 3**

| Facility | Areal Extent of Reclamation Potential (acres) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Variable | | Good | | Fair | | Poor | | Unsuitable | | Total |
| | PUB | PVT STATE | PUB | PVT STATE | PUB | PVT STATE | PUB | PVT STATE | PUB | PVT STATE | |
| NORTH AREA | | | | | | | | | | | |
| Wells | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.9 | 1.4 | 6.9 | 26.2 |
| Roads | 0.0 | 2.5 | 0.0 | 0.0 | 0.0 | 4.4 | 0.6 | 6.6 | 0.5 | 25.9 | 40.5 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 0.0 | 2.5 | 0.0 | 0.0 | 0.0 | 4.4 | 0.6 | 24.5 | 1.9 | 32.8 | 66.7 |
| SOUTH AREA | | | | | | | | | | | |
| Wells | 0.0 | 0.0 | 0.0 | 1.4 | 0.0 | 12.4 | 0.0 | 28.9 | 0.0 | 143.3 | 186.0 |
| Roads | 0.0 | 0.0 | 0.0 | 1.2 | 0.4 | 29.5 | 0.0 | 31.3 | 2.2 | 313.0 | 377.6 |
| CPFs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.3 | 0.0 | 0.0 | 18.9 | 25.2 |
| Subtotal | 0.0 | 0.0 | 0.0 | 2.6 | 0.4 | 41.9 | 6.3 | 60.2 | 2.2 | 475.2 | 588.8 |
| PIPELINE | | | | | | | | | | | |
| Pipeline | 0.3 | 5.9 | 5.2 | 6.7 | 12.4 | 50.6 | 34.9 | 32.7 | 9.5 | 103.2 | 261.4 |
| TOTAL | 0.3 | 8.4 | 5.2 | 9.3 | 12.8 | 96.9 | 41.8 | 117.4 | 13.6 | 611.2 | 916.9 |
| Portion of total disturb. (percent) | 0.0 | 0.9 | 0.6 | 1.0 | 1.4 | 10.6 | 4.6 | 12.8 | 1.5 | 66.7 | 100.0 |

## 4.17.5 Mitigation

Reclamation operations should use the following measures as prescribed by the Authorizing Officer.

Site Preparation

1. The entire roadbed and drill site should be obliterated and brought back to the approximate original contour. Drainage control should be reestablished as necessary. All areas affected by road construction should be recontoured to blend in with the existing topography. All berms should be removed unless determined to be beneficial by the Authorizing Officer. In recontouring the disturbed areas, care should be taken to not disturb additional vegetation.

2. Water bars should be installed at all alignment changes (curves), significant grade changes, and as determined necessary by an approved engineer. Water bars should be sloped with the grade and cut to a minimum 12-inch depth below the surface. The grade of the water bar should be 2 percent greater than the grade of the road.

Seedbed Preparation

3. An adequate seedbed should be prepared for all sites to be seeded. Areas to be revegetated should be chiseled or disked to a depth of at least 12 inches unless restrained by bedrock.

4. Ripping of fill materials should be completed by a bulldozer equipped with single or a twin set of ripper shanks. Ripping should be done on 4-foot centers to a depth of 12 inches. Ripping should be followed by final grading and precede seedbed material application. Ripping should be completed at a speed that maximizes ripper shank action and promotes soil material disruption to the specified depth. Ripping should be repeated until the compacted area is loose and friable.

5. Seedbed preparation would be considered complete when the soil surface is completely roughened, the number of rocks (if present) on the site would be sufficient to cause the site to match the surrounding terrain, and topsoil is redistributed.

Fertilization

6. Commercial fertilizer with a formula of 16–16–8 should be applied at a rate of 200 pounds per acre. The rate may be adjusted depending on soil test results.

7. Fertilizer should be applied not more than 48 hours before seeding and cultivated into the upper 3 inches of soil.

8. Fertilizer should be broadcast over the soil using hand-operated "cyclone-type" seeders or rotary broadcast equipment attached to construction or revegetation machinery as appropriate to slope. All equipment should be equipped with a metering device. Fertilizer application should to take place before the final seeding preparation treatment. Fertilizer broadcasting operations should not be conducted when wind velocities would interfere with even distribution of the material.

Mulching

9. Mulching should be conducted. The type of mulch should meet the following requirements: Wood cellulose fiber should be natural or cooked, should disperse readily in water, and should be nontoxic. Mulch should be thermally produced and air dried. The homogeneous slurry or mixture should be capable of application with power spray equipment. A colored dye that is noninjurious to plant growth may be required. Wood cellulose fiber should be packaged in new, labeled containers. A minimum application of 1,500 pounds per acre should be applied. A suitable tackifier should also be applied with the mulch at a rate of 60 to 80 pounds per acre.

   An alternative method of mulching on small sites would be the application of straw or hay mulch at a rate of 2,000 pounds per acre. Hay or straw should be certified weed free. Following the application of straw or hay, crimping should occur to ensure retention.

Reseeding

10. All disturbed areas should be seeded with the seed mixture required by the authorizing agency. The seed mixture(s) should be planted in the fall of the year (September through November), in the amounts specified in pounds of pure live seed (PLS)/acre. There should be no noxious weed seed in the seed mixture. Seeds would be tested. The viability testing of seeds should be done in accordance with State

law(s) and within 12 months prior to planting. Commercial seed would be either certified or registered seed. The seed mixture container should be tagged in accordance with State law(s) and available for inspection by the authorized officer. Seed is to be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture should be evenly and uniformly planted over the disturbed area. (Smaller/heavier seeds tend to drop to the bottom of the drill and are planted first. Appropriate measures should be taken to ensure this does not occur.) Where drilling is not possible, seed should be broadcast and the area raked or chained to cover the seed. Woody species with seeds that are too large for the drill would be broadcast. When broadcasting the seed, the pounds per acre are to be increased by 50 percent. Reseeding may be required if a satisfactory stand is not established to specifications. Evaluation of the seeding's success will not be made before completion of the second growing season after the vegetation becomes established. The Authorized Officer should be notified a minimum of seven (7) days before seeding of a project.

11. Seed mixes would be specified by the authorizing agency and distributed immediately after the topsoil is replaced.

### 4.17.6 Unavoidable Adverse Impacts

With the alternatives considered in detail, at least 917 acres of land within the Project Area would be disturbed. Additionally, most (>80 percent) of this disturbance would involve soil mapping units with a potential for reclamation that is poor or unsuitable. Due to these characteristics, reclamation of disturbances would take several years (probably at least 5 to 10 years) before vegetative cover returns to pre-project conditions.

## 4.18 IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

An irreversible or irretrievable commitment of resources would occur when resources would be consumed, committed, or lost as a result of the project. The commitment of resources would be irreversible if the project stated a process (chemical, biological, or physical) that could not be stopped. As a result, the resource or its productivity or its utility would be consumed, committed, or lost forever. Commitment of a resource would be considered irretrievable when the project would directly eliminate the resource, its productivity, or its utility for the life of the project and possibly beyond.

No irreversible or irretrievable effects would occur to air quality, visual or noise resources. The following is a listing of the effects that would occur to the other resources analyzed in this EIS.

### 4.18.1 Irreversible Effects

- Removal of natural gas
- Transfer of groundwater from the Ferron Sandstone aquifer to the Navajo aquifer
- Road kill of big game
- Accidental death of a sensitive species
- Destruction of a significant cultural resource
- Loss of a natural recreational setting
- Road kill of livestock

## 4.18.2 Irretrievable Effects

- Loss of vegetative cover for several years until reclamation is successful
- Loss of riparian vegetation over life of Project
- Loss of portions of big game winter range over life of Project
- Loss of sensitive species habitat
- Loss of livestock forage for several years until reclamation is successful
- Loss of natural recreation setting

# CHAPTER 5

# CUMULATIVE IMPACTS

# *CHAPTER 5*
# *CUMULATIVE IMPACTS*

## 5.1 INTRODUCTION

Compliance with NEPA requires analysis of the cumulative effects of each alternative. Cumulative effects are the impacts on the environment that result from the incremental impacts of an alternative when added to other past, present and reasonably foreseeable future actions, regardless of who undertakes those actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Humans have altered the Project Area's environment through various actions undertaken since people first began settling the general area. In combination with natural processes, these past and present actions have resulted in the affected environment described in Chapter 3. Because the effects of past and present actions have been incorporated into the description of the affected environment, they also were incorporated into the analysis of environmental effects discussed in Chapter 4, which evaluated the environmental effects of the alternatives on the affected environment. Consequently, the effects of these past and present actions have already been considered and the Chapter 5 discussion focuses on cumulative effects with future actions.

Several reasonably foreseeable future actions that may contribute to significant cumulative effects when combined with the alternatives' direct and indirect effects described in Chapter 4 were identified for use in the cumulative effects analysis. For the reasonably foreseeable future actions (RFFAs), it is important to note these are projections made only for the purpose of predicting future impacts. RFFAs items are assumptions for this analysis and are not part of the Proposed Action or alternatives. Inclusion in the RFFAs does not constitute a decision nor a commitment of resources.

The area considered for the cumulative effects analysis was derived from an analysis of geological characteristics of the area. The geologic report concerning the Reasonable Foreseeable Development (RFD) is on file at the Price and Moab BLM Field Offices, and the BLM State Office in Salt Lake City. However, the area considered for the cumulative effect analysis for some resources extended beyond the RFD area due to resource-specific characteristics. In the discussion of cumulative effects for each resource, the area considered for the analysis was the RFD area, unless specifically stated otherwise in the discussion.

## 5.2 REASONABLY FORESEEABLE FUTURE ACTIONS

The following sections describe the various reasonably foreseeable future actions considered in the cumulative effects analysis. Each description, including the identification of the action's key components and activities, reflects the amount information that was available for the analysis. Future development of previously-approved and proposed CBM projects are considered to be most likely to cause cumulative impacts, and therefore, are described and evaluated in detail. The other projects are less well defined by their proponents and, consequently, are described and evaluated in less detail. The projects evaluated for the air quality cumulative analysis were determined by the BLM in consultation with the EPA and UDAQ and are discussed in **Section 5.3.3**.

## 5.2.1 Natural Gas Development

Natural gas development has occurred and is occurring in the Ferron Sandstone Member of the Mancos Shale (Ferron). Although this development primarily consists of CBM wells, some conventional natural gas also is being produced. The Price CBM Project is the primary CBM project currently being developed. The Ferron Natural Gas Project would be the second CBM project in the area. Potential also exists for additional CBM development in the Ferron in the reasonably foreseeable future (Reasonable Foreseeable Development Scenario). Consequently, natural gas development from the Ferron consists of these three components. The Price CBM Project and Reasonable Foreseeable Development Scenario are described below. The previous chapters of this EIS focus on the Ferron Natural Gas Project. **Table 5–1** shows the distribution of wells among the primary natural gas projects of the reasonably foreseeable future actions.

**Table 5–1**
**Distribution of Natural Gas Wells Among Natural Gas Projects Comprising the Reasonably Foreseeable Future Actions**

| Component | Number of Wells | | |
|---|---|---|---|
| | Existing | Proposed | Total |
| Price CBM Project | 125 | 396 | 521 |
| Ferron Natural Gas Project | | | |
| Anadarko | 15 | 65 | 80 |
| Chandler | 10 | 83 | 93 |
| Texaco | 43 | 137 | 180 |
| Total | 68 | 285 | 353 |
| Other Wells in the Cumulative Analysis Area | 12 | 0 | 12 |
| Price CBM Project's Reasonable Foreseeable Development Scenario | 0 | 576 | 576 |
| Ferron Natural Gas Project Reasonable Foreseeable Development Scenario | 0 | 335 | 335 |
| Total | | | 1,797 |

### 5.2.1.1 Price CBM Project

In 1997, the Price CBM Project was approved through the BLM's NEPA compliance process. Currently, it is in the early stages of development. The alternative selected by the BLM for the Price CBM Project includes the following level of development:

- 521 wells (**Table 5–1**);
- 313 miles of transportation corridors, which include roads, gas and water gathering pipelines/flowlines, and electrical utilities;
- 48 miles of pipelines and utility lines adjacent to existing roads;
- Five natural gas-fired compressors;
- Six disposal wells; and
- Six evaporation ponds.

The distribution of Price CBM Project's wells is shown on Plate 28 in the Price CBM Project's Final EIS and included in the reasonable foreseeable development (RFD) scenario for the Price area.

#### 5.2.1.2 Reasonable Foreseeable Development Scenario

To define potential future development of oil and gas for this cumulative effects analysis, the BLM developed an RFD scenario for oil and gas. This RFD scenario, which is primarily based on known resources and geologic rationale, involves potential oil and gas resources within and adjacent to the Project Area. Specifically, it includes both CBM and conventional gas resources from the Ferron Sandstone Member of the Mancos Shale (Ferron). The complete RFD scenario report, which is only summarized here, is on file at BLM's Price Field Office in Price, Utah and State Office in Salt Lake City, Utah.

A potential for natural gas reserves exists throughout the entire Project Area. Because portions of the Project Area are unproven, exploratory drilling activity may be expected throughout portions of the Project Area that are undeveloped currently. All available well spacing windows within the confines of potential development, as defined in this EIS, could be occupied by potential well sites. Several of these sites would be difficult or impossible to drill due to topographic constraints and/or resource restrictions. **Plate 5–1** shows the distribution of potential wells that could be reasonably expected, given various restrictions and constraints. It is important to note these are projections made only for the purpose of predicting future impacts. RFD items are assumptions for the cumulative effects analysis and are not part of the Proposed Action or alternatives. Inclusion in the RFD scenario does not constitute a decision nor a commitment of resources.

An area with high potential for conventional gas resources is located in the South Area. The Ferron Fairway is an area with a high potential for CBM. Both these areas extend beyond the Project Area's boundary. Initial drilling activity is expected to concentrate in the Ferron Fairway for the first 2 to 3 years. As these areas are developed, activity could extend into areas with high potential for conventional gas reserves. Eventually, the remainder of the Project Area could be explored and possibly developed. Outside the high potential areas, a lower probability exists for conventional gas resources. These areas are untested, but have favorable stratigraphy for potential gas reserves.

A large measure of the cumulative effects analysis centers on the amount of total disturbance resulting from the future actions. **Table 5–2** shows the disturbance associated with the natural gas development considered in the cumulative analysis to quantify the effects analyzed for many of the resources. The long-term disturbance was gathered from the Ferron Natural Gas Project, the selected alternative of the Price CBM Project, and the RFD scenario. Disturbance associated with the RFD was based on the assumption that each well would result in a disturbance of five acres including the access roads and facilities.

### 5.2.2 Proposed and Potential Coal Mines

Eight coal mines were identified for inclusion in the cumulative effects analysis. They include new mines, reopened mines, and the expansion of an existing mine. The locations of these mines are shown on **Figure 5–1**. Five mines are along the Book Cliffs north and east of the Project Area, two are located northwest of the Project Area, and one is located immediately adjacent to the western edge of the South Area. Available information about each mine is summarized below:

**Table 5–2**
**Cumulative Impacts Disturbance for Natural Gas Activities**

| Component | Number of Wells | Long-Term Disturbance (acres) | Project Area Size (acres) | Portion of Project Area Disturbed (percent) |
|---|---|---|---|---|
| Ferron Natural Gas Project Alternative 1 | 353 | 763 | 111,520 | 0.68 |
| Ferron Natural Gas Project Alternative 2 | 335 | 678 | 111,520 | 0.61 |
| Ferron Natural Gas Project Alternative 3 | 222 | 367 | 111,520 | 0.33 |
| Price CBM Project | 521 | 1,519 | 188,242 | 0.81 |
| RFD | 923 | 4,615 | 299,762 | 1.53 |
| Total with Ferron Alternative 1 | 1,797 | 6,897 | | 2.30 |
| Total with Ferron Alternative 2 | 1,779 | 6,812 | | 2.27 |
| Total with Ferron Alternative 3 | 1,666 | 6,501 | | 2.17 |

#### 5.2.2.1 Willow Creek Mine

The Willow Creek Mine would be a new underground mine constructed adjacent to the site of the closed Castlegate mine. Cyprus Plateau Mining Company is operating the mine currently. Construction of the mine would disturb about 20 acres of privately-owned lands. Existing roads provide access to the mine site from Highways 6 and 191. No new employment is expected because workers would transfer from the Companies' other mines.

#### 5.2.2.2 Dugout Canyon Mine

The Dugout Canyon Mine would be a new mine constructed by the Soldier Creek Mining Company. This underground mine, which would require the construction of eight miles of new access road, would disturb approximately 140 acres for the road and ancillary facilities. About ten acres would be disturbed for the mine. The surface land ownership is private. Access roads would consist of existing state roads with new access roads across federal lands and private property. No new employment is expected because workers would transfer from the Company's other mine.

#### 5.2.2.3 C Canyon Mine

The proponent is the Anadlex Resources, Inc.. This underground mine would require 3.5 miles of upgraded access road disturbing approximately 62 acres. An estimated ten acres would be disturbed for the mine. No new employment is expected because workers would transfer from the Company's other mine. The surface land ownership is a mixture of public land managed by BLM and fee lands.

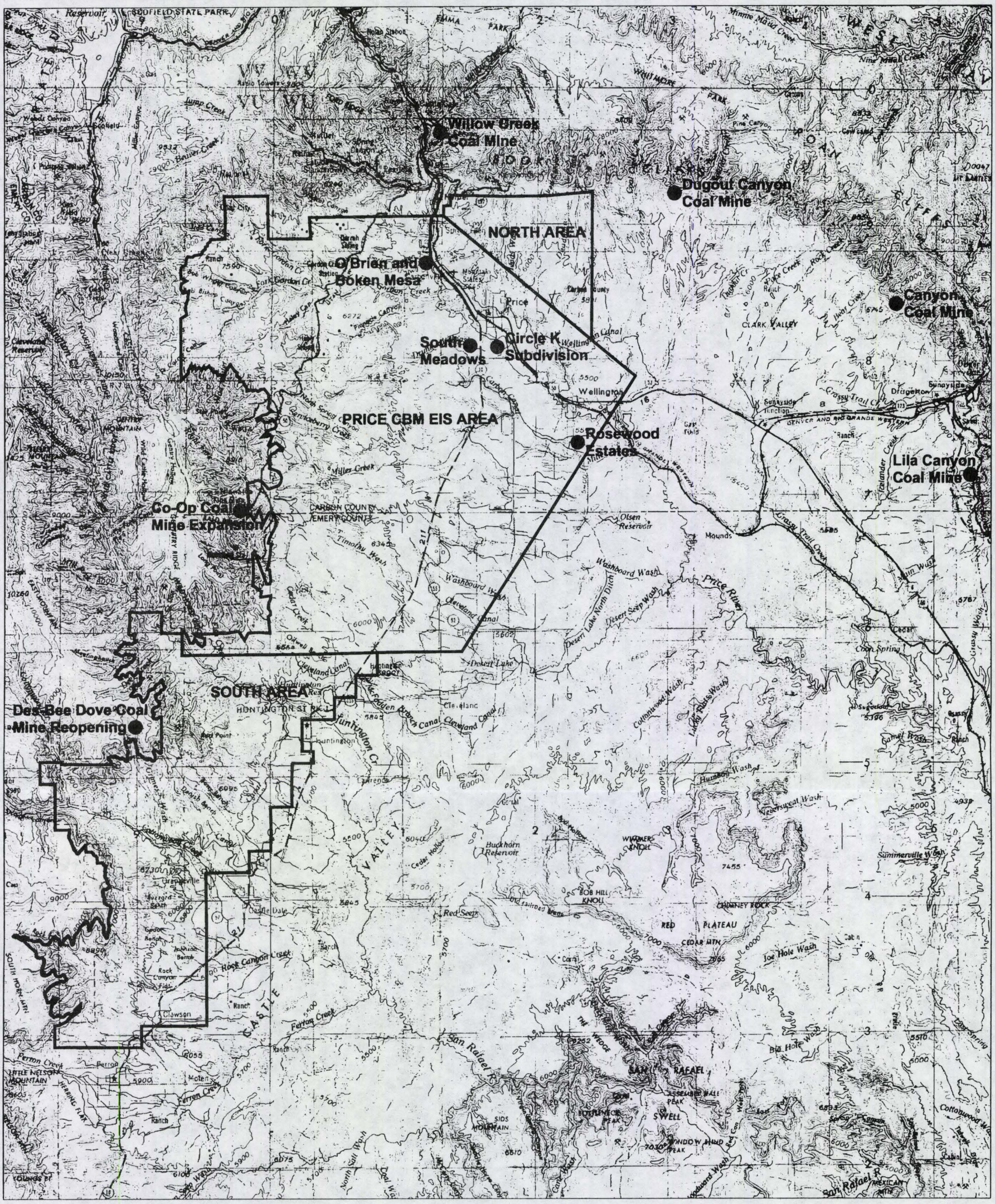


Figure5-1
Cumulative Analyses Locations

#### 5.2.2.4 Horizon Mine

The proponent is the Horizon Coal Corporation. This underground mine currently has an access road. Approximately 10 to 20 acres would be disturbed for the mine. Approximately 40 to 50 new employees would be hired. The surface land ownership is private.

#### 5.2.2.5 Lila Canyon Mine

This new underground coal mine would be on the property of the Horse Canyon Mine, which closed around 1984. The case lease is still valid and ROW applications have been submitted. However, no mine plan has been submitted. If this mine were to become active again, it is assumed that approximately 20 to 30 acres of the former mine site would be redisturbed, approximately 70 to 80 employees would be hired, and the existing roads would be upgraded. The surface land ownership is federal.

#### 5.2.2.6 Columbia Mine Reopening

This new mine would be on the property of the Sunnyside Mine. Although a mine plan has not been submitted, ROW applications have been submitted. Coke ovens may be built, however, not specific plans have been submitted. If this mine proceeds, approximately 70 to 80 employees would be hired.

#### 5.2.2.7 Des-Bee Dove Mine Reopening

This mine would be located between the Cottonwood/Wilberg and the Deer Creek Mine, both located on the western edge of the South Area. However, there is no information currently submitted for this coal mine.

#### 5.2.2.8 Co-op Mine Expansion

This mine would be located on the Moreland leases near Hiawatha and would be an expansion of the existing mine. However, no proposal has been submitted.

### 5.2.3 Other Proposed and Potential Mines

#### 5.2.3.1 Chalk Hills Mine

Gypsum Resource Development has a 5-acre, inactive gypsum mine east of Castle Dale approximately 12 miles, in Emery County.

#### 5.2.3.2 BJ Mine

Diamond K actively operates this 71-acre gypsum mine located approximately 12 miles east-southeast of Ferron, Utah, in Emery County. Three workers produce 20,000 to 30,000 tons per year.

#### 5.2.3.3 Eagle Canyon Mine

Georgia Pacific Corporation is producing approximately 60,000 tons per year of gypsum with a workforce of six. The site has disturbed approximately 30 acres and is located south of Ferron, Utah approximately 12 miles.

#### 5.2.3.4 Kimball Draw Mine

U.S. Gypsum has proposed a 107-acre disturbance associated with a gypsum mine approximately 18 miles south and 6 miles east of Ferron, Utah, in Emery County. An EIS is in progress.

#### 5.2.3.5 San Rafael Desert Mine

Sutherland Brothers have an intermittently active one-acre property which produces less than 500 tons per year of gypsum using a workforce of two. The site is located approximately 24 miles southeast of Ferron, Utah, in Emery County.

#### 5.2.3.6 Lone Tree Wedge (Hebe) Mine

Western Clay produces approximately 20,000 tons of gypsum per year from a 5-acre site operated by four workers. The site is located approximately 24 miles south of Ferron, Utah, in Emery County.

#### 5.2.3.7 Last Chance Mine

Western Clay has a clay mine located approximately 6 miles southwest of the Lone Tree Wedge Mine, and 30 miles south of Ferron, Utah, in Emery County. This operation produces approximately 20,000 tons of clay per year using a workforce of three, on four-to-five acres.

### 5.2.4 Community Expansion

Seven subdivisions in or near the EIS Project Area have been approved in Carbon County, but have not yet been developed. Available information provided by Carbon County Building and Planning Department about these areas is presented below.

- **Rosewood Estates**. South of Wellington. Approved in 1996. Nine lots, 65 acres.
- **Circle K Subdivision Phase IIIA**. South of Price. Approved in 1996. 17 lots, 28 acres.
- **South Meadows**. South of Price. Approved in 1996. Plat A: nine lots, 13 acres. Plat B: 27 lots, 30 acres.
- **Leavitt's**. Near Price. Approved in 1996. Eight lots, 40 acres.
- **Westwood Phase IIIA**. Near Price. Approved in 1982. Six lots, 25 acres.
- **Broken Mesa**. Near Price, Approved in 1995. Nine lots, six acres.
- **O'Brien**. Near Price. Approved in 1996. 12 lots, two acres.

### 5.2.5 Logging

Logging could take place in the future on state and private land near the EIS Project Area. Potential logging areas that could impact resources also affected by the Price CBM Project include: private, state, and federal lands on the Wasatch Plateau west of Hiawatha and Wattis (headwaters of Cedar and Miller Creeks); private and state lands northwest of the EIS Project Area (headwaters of the North Fork of Gordon Creek); and private and state lands north of the EIS Project Area within the watershed of the Price River.

### 5.2.6 Narrows Dam Project

The U.S. Bureau of Reclamation has prepared a Draft EIS on this proposed project. The purpose of the project is to develop an additional supply of municipal water to support population growth in north Sanpete County, Utah. The proposed Narrows Dam would be located in the Upper Price River drainage basin between the lower Gooseberry Reservoir and the Fairview Lakes. The reservoir capacity would be approximately 17,000 acre-feet, and the project would divert 5,400 acre-feet per year from the Price River basin to the San Pitch River basin. This would create an average annual depletion in the Price River drainage of approximately 5,709 acre-feet per year. The project sponsor, Sanpete Water Conservancy District, is applying for financing for the Narrows Project under the Small Reclamation Projects Act of 1956, as amended (personal communication with Bureau of Reclamation, July 1998).

## 5.3 RESULTS OF CUMULATIVE EFFECTS ANALYSIS

The following sections describe the results of the cumulative effects analysis conducted for the alternatives considered in this EIS. The discussions of individual resources follow the same order as chapters 3 and 4.

### 5.3.1 Geology and Minerals

Except for the removal of natural gas and conflicts with coal leases, no cumulative effects on geology and minerals were identified for any of the Ferron Natural Gas Project alternatives. Up to 4.3 trillion cubic feet (RCF) of natural gas could be recovered under the RFD. Certain RFD wells would overlay mineable coal resources. Any future drilling would require resolution of the conflict prior to approval of the drilling.

### 5.3.2 Water Resources

The cumulative effects analysis for water resources consisted of a review of changes in water quantity, water quality, and uses within the cumulative effects area of Carbon and Emery counties.

#### 5.3.2.1 Water Supply and Use

Water resources in Carbon and Emery counties are used for irrigation, domestic, and industrial uses. Land uses in the cumulative effects area include cropland, range, residential, fossil fuel development, mining, and logging. Fossil fuel development includes coal bed methane, coal mining, and conventional oil & gas production . There are fourteen underground coal, six gypsum, one bentonite, one uranium, and multiple gravel mines in Carbon and Emery counties. Additional water consumption includes the recharge of wetland and alluvial aquifers.

The USGS analyzed water consumption in hydrologic basins throughout the country in 1990 (USGS 1998a and 1998b). Data from the San Rafael and Price River Basins (**Table 5–3**) confirm data from the Utah Division of Water Resources described earlier in Chapter 3. Most water use is derived from surface water and irrigation is the predominant use of water in Carbon and Emery counties, accounting for 130.74 mgd or 64 percent of the 202.3 mgd of water consumed. Approximately 1,670 acres are spray irrigated and 39,110 acres are flood irrigated in the two basins. Evaporation from reservoirs in the two basins accounts for 9.7 mgd, if averaged over the entire year. Consumption by the coal fired power plants accounts for 62 mgd or 31 percent of the water. Domestic supply is responsible for 6.84 mgd or 3.3 percent of the water.

**Table 5–3**
**Water Use in the San Rafael and Price River Basins, Utah**

| Use | Surface Water (mgd) | Groundwater (mgd) | Total (mgd) |
|---|---|---|---|
| Irrigation | 130.74 | | 130.74 |
| Reservoir Evaporation | 9.7 | | 9.7 |
| Fossil Fuel Thermoelectric Power Use | 62.02 | 0.78 | 62.8 |
| Public Supply | 2.82 | 3.66 | 6.48 |
| Self-supplied Domestic Use | 0.08 | 0.25 | 0.33 |
| Mining | 0 | 1.55 | 1.55 |
| Stock Watering | 0.25 | 0.01 | 0.26 |
| Total | 196.04 | 6.25 | 202.29 |

Source: USGS 1998a and 1998b

Natural gas development would consume water through construction needs. Consumption of water during construction would shift a minor quantity of water (less than 50 acre feet annually for five years) from irrigation to industrial purposes. The Price CBM Project estimated about 45 acre feet would be consumed annually over a ten-year construction period, or 0.039 mgd.

The Ferron Natural Gas Project would generate a maximum of 3.4 mgd produced water (1.9 mgd average), assuming a minimum 100 bwpd produced water per well through the lifetime of the project. The Price CBM Project would generate a maximum of 4.1 mgd. Using a similar relationship as observed in the Ferron Natural Gas Project, Price CBM Project wells would generate 2.3 mgd on average. This water is being pumped from the Ferron Sandstone aquifer and the majority is disposed into the deeper Navajo aquifer and some is evaporated.

There is a potential for cumulative impacts on the water resources of the Ferron Sandstone from dewatering associated with gas development. As identified in **Table 5–1**, there could be 1,797 production wells under the RFD scenario. It is difficult to calculate the volume of water that would be produced from individual wells under this scenario due the combined drawdown effect between two or more wells, and the unsteady water production rate during a well's lifetime. However, assuming similar water production rates as anticipated for the Proposed Action, the volume of water withdrawn from the Ferron coals would increase proportionally with the number of wells. The maximum peak water production has been estimated to be 424,500 BWPD. As discussed in **Section 4.2.1.1.1**, the poor water quality and depth of the Ferron Sandstone renders the water within it uneconomical for most uses. Therefore, the cumulative production of water from the Ferron Sandstone is not considered a significant impact to the quantity or quality of the water in the coal seams.

The risk of causing water quality degradation in the non-potable portions of the Navajo-Nugget Aquifer as a result of injecting produced waters is considered to be low if all the proposed and reasonable foreseeable projects were developed. Negative impacts to the water quality within the Navajo-Nugget aquifer are not expected to occur since the quality of the injected water is typically much better than that of the Navajo-Nugget Aquifer.

Disposal of the waters resulting from coal seam dewatering has the potential to impact the water resources of the Navajo-Nugget Aquifer. Assuming all of the 1,779 RFD wells would be drilled, upwards of 42 disposal wells may be necessary to handle the maximum peak water production. If each of these injection wells would carry an average of 10,000 BWPD, and they are all equally distributed in the immediate vicinity of the Project Area, then no adverse cumulative impacts to the water quality of potable portions of the Navajo-Nugget aquifer would be anticipated. This aquifer is not an important water source in the EIS Project Area because of its poor water quality and great depth.

Coal mines either dewater their mines or pump water into closed portions of the mine. The coal mines in the Wasatch Plateau and Book Cliffs coal fields mine coal in the Blackhawk formation, which, stratigraphically, is several thousand feet higher than the Ferron. Any water discharged from these mines add slightly to surface water resources.

The limited amount of ground water used for domestic and public supplies is derived from alluvial aquifers. The Ferron Sandstone water is too saline to be used for domestic purposes and is too deep throughout most of Carbon and Emery counties for use to be economical. However, there are some wells completed in the Ferron near the outcrop that may be used for watering stock.

Applied Hydrology Associates (AHA 1998) modeled the decrease of the water level in the Ferron Sandstone from CBM dewatering of Ferron Natural Gas Project and Price CBM Project wells. Water wells completed in the Ferron Sandstone on or immediately west of the outcrop will exhibit lower water levels. The outcrop is located approximately five miles east of the eastern boundaries of the Project Area. The report is available at the Price BLM Field Offices and the BLM State Office in Salt Lake City. Projected drawdowns at observation wells along the outcrop would range from 6.6 to 77 feet after 20 years of operation in the Ferron Natural Gas Project and an additional five years in the Price CBM field (Year 26). Drawdown would increase with distance from the outcrop. A review of potential ground water right filings from the Utah Department of Water Resources Division of Water Rights identified five wells which could be producing water from the Ferron Sandstone and which could exhibit drawdowns from the Ferron Natural Gas Project and Price CBM projects. Additional site specific information on these wells is needed . Additional drilling of natural gas wells as identified in the RFD could generate additional drawdowns. Any drawdown would be a significant impact to individual users.

The modeling also showed that while the water table would be lowered, pumping reduced the steady state outflows from the Ferron Sandstone nine percent from the steady state condition at the Ferron Outcrop after 20 years of production. Thus, dewatering would not result in significant impacts to overall surface and ground water resources.

### 5.3.2.2 Water Quality

Disposal of Ferron Sandstone produced water into the Navajo-Nugget would yield a slightly less briny water quality in the Navajo. Negative impacts to the Navajo-Nugget water quality are not anticipated as the quality of the injected water would be much better than that of the Navajo-Nugget. The Navajo-Nugget aquifer is not an important water source in RFD scenario area due to its poor water quality and great depth.

Sediment and salinity would increase immediately downstream of any surface disturbance. Existing disturbances within the two counties consist of more than 3,000 acres dirt and gravel roads, 1,670 acres of cropland (assuming all spray irrigated lands are croplands [USGS 1998a and 1998b]), 5,767 acres of CBM disturbance (2,050 acres from the Ferron Natural Gas Project, 3,717 acres from the Price CBM Project),

1,735 acres associated with other oil and gas activity (RFD Scenario), 700 acres for underground coal mines (approximately 50 acres per mine for 14 mines), and an unknown acreage associated with housing.

Carbon and Emery counties are largely unvegetated and yield an erosional landscape due to low precipitation, steep slopes, and/or the presence of unproductive shale-based soils. Estimates of sediment loss have been developed, but they are backed up by numerous assumptions and yield widely varying values. Estimates were calculated for sediment loss (BLM 1997c) of 16.8 tons per acre per year for the Price CBM area. Sediment loss from the Ferron Natural Gas Project would be 10.7 tons per acre per year. It is assumed that sediment loss from the remaining 923 RFD scenario wells would be midway between the Ferron and Price Projects, or about 13.7 tons per acre per year. The average sediment loss of 13.7 tons per year per acre would slightly exceed the maximum naturally occurring rate of 12 tons per acre per year. Similar estimates are not available for croplands, rangelands, coal mines, and housing. However, all drainage from coal mine facility disturbances must pass through a siltation reservoir prior to discharging, thereby limiting the sediment contributions from coal mines.

The 1994 305B report (UDEQ 1995) indicates the Price and San Rafael Basins had use attainment limitations associated with total dissolved solids (TDS) and irrigation. Irrigation of saline soils results both in increased levels of TDS in the return flows as well as lower vegetative productivity for the irrigated fields. Estimates of salt production have also been made for oil and gas projects, but they share the weaknesses identified for the sediment loss analyses. Salt loss was estimated at between 0.31 tons per acre per year for Price CBM Project (BLM 1997c) and 0.30 tons per year for the Ferron Natural Gas Project. It can be assumed that the additional RFD wells would experience similar salt delivery rates. The average rate of 0.3 tons per acre per year is within the upper limit of the naturally occurring rate of 0.51 tons per acre per year. Therefore, it can be concluded that the cumulative effect should not have any net change on effects on the Colorado River Basin salinity levels.

### 5.3.2.3 Future Developments

The Price CBM EIS (BLM 1997c) identified two probable projects that could influence surface water supplies in the area. Community expansion of as many as 70 new lots could result in additional consumption of 0.024 mgd of potable water for domestic purposes or less than 0.4 percent of total domestic use in Carbon and Emery counties. The U.S. Bureau of Reclamation's Narrows Project Alternatives describe a transbasin diversion of 4,935 to 5,400 ac-ft of water per year from Gooseberry Creek and the northern portion of the Price river watershed to Cottonwood Creek and the central portion of the Price River watershed for the Narrows Dam.

The Price CBM EIS (BLM 1997c) also suggested that future logging on state and local lands in the headwaters of the Price River basin could yield elevated sediment and TDS levels immediately following logging. These impacts would be short to medium in term prior to revegetation, and would be minimized by BMPs to reduce sediment: the use of buffer zones next to streams and the use of culverts at road crossings. No information was available on the extent of logging.

Additional coal mines are likely. Discharges would also flow into the Price and San Rafael basins. These mines are anticipated to have similar minimal impacts to those described earlier.

## 5.3.3 Air Quality

### 5.3.3.1 Cumulative Impact $NO_X$ Sources

The cumulative impact analysis of air quality within and near the Project Area includes the major sources of $NO_X$, the only significant pollutant associated with the Ferron Project. The sources include the Hunter, Huntington and Carbon County coal-fired power plants, the Hiawatha co-generation facility, the Carbon County co-generation facility, the Sunnyside co-generation facility, the Questar Dew Point plant, the approved Price CBM natural gas-fired compressors, the Questar Amine Carbon Dioxide Removal Plant, and the proposed Ferron natural gas-fired compressors. The cumulative sources are the same as those used in the Price CBM EIS cumulative analysis with the added effect of the Ferron Project and the Questar Amine Plant. The $NO_X$ sources are described below and the location and emissions of these facilities are shown on **Table 5–4**. Sources other than the Price CBM and Ferron compressors contribute 97.4 percent of the $NO_X$ emissions in the vicinity of the Project Area. The proposed Ferron compressors would contribute only 1.2 percent of the $NO_X$ emissions in the area.

- The five natural gas-fired Price CBM compressors would emit 755 tpy of $NO_X$, an amount 113 percent greater than the total of the Ferron compressors.

- The Hiawatha co-generation project is currently comprised of the American Syngas project and the Carbon County co-generation project. These projects result in an $NO_X$ emission rate of 191 tons per year (tpy) that is 29 percent of the Ferron compressors combined.

- The Questar Pipeline Dew Point Plant is an existing compressor station on Questar's natural gas transmission line, and is a relatively small source of $NO_X$ emitting 50 tpy.
- The Sunnyside Co-generation is an existing co-generation project that emits 765 tpy, or an 115 percent of the Ferron compressors combined.

- The PacifiCorp Hunter, Huntington, and Carbon Plants are coal-fired electric generating stations that contribute 96 percent of the $_{NOX}$ emissions considered in the cumulative impact analysis.

- If the RFD of additional wells were to reach its full potential, additional compressor units would be required. The present uncertainty of the number of compressors, type, location, air pollutant emissions, etc. is too speculative to justify an air quality analysis at this time. The impact of additional compressors would have to be evaluated in the future if development increases above those levels that have been analyzed in the Proposed Action. Given the air quality impacts identified in the analysis of the Proposed Action and the recommended mitigation, it is highly likely that additional development under the RFD would cause additional air quality and visibility impacts.

### 5.3.3.2 Cumulative Impact Air Quality Modeled Results

The cumulative effects to air quality were modeled in the same manner as described in the Proposed Action. The modeled concentrations to the area $NO_2$ background of 17 $\mu g/m^3$. As shown on **Plate 5–2**, the maximum annual $NO_2$ ambient concentration would be 60.7 $\mu g/m^3$ the Huntington Power Plant in T17S R7E Section 1. By far, the largest impact areas would be on elevated terrain east and south of the Huntington Power Plant. If other compressors would be required under the RFD scenario, it is unlikely that they could be added without violation of the $NO_2$ NAAQS for the Project Area and surroundings. Further NEPA analysis would be required, and the operators would be required to individually obtain construction and operating permits

**Table 5–4**
**$NO_x$ Emissions in the Cumulative Impact Analysis Area**

| Facility | Location | Emission Rate (g/s) | Annual emissions (tons) |
|---|---|---|---|
| Price CBM Compressor D1 | T14S R8E S2 | 2.42 | 83.8 |
| Price CBM Compressor F1 | T14S R8E S27 | 2.42 | 83.8 |
| Price CBM Compressor E1 | T14S R9E S32 | 7.25 | 251.7 |
| Price CBM Compressor B1 | T16S R9E S2 | 4.83 | 167.8 |
| Price CBM Compressor C1 | T16S R9E S16 | 4.83 | 167.8 |
| Hiwatha Co-Generation Project | T16S R8E S34 | | |
| American Syngas | | | |
| Main Stack | | 2.69 | 93.4 |
| Generator | | 0.04 | 1.4 |
| Carbon County Co-Gen | T13S R9E S1 | | |
| Main Stack | | 2.77 | 96.2 |
| PacifiCorp Carbon Plant | | | |
| Plant #1 | | 64.64 | 2,245.0 |
| Plant #2 | | 90.72 | 3,150.8 |
| PacifiCorp Hunter Plant | T19S R8E S16 | | |
| Plant #1 | | 411.01 | 14,274.9 |
| Plant #2 | | 287.71 | 9,992.5 |
| Plant #3 | | 339.57 | 1,179.7 |
| PacifiCorp Huntington Plant | T17S R7E S1 | | |
| Plant #1 | | 412.78 | 14,336.4 |
| Plant #2 | | 257.1 | 8,929.4 |
| Questar Dew Point Plant | T14S R13E S12 | | |
| Compressor Engine | | 1.45 | 50.4 |
| Sunnyside Co-Generation | T15S R14E S6 | | |
| Boiler | | 22.05 | 765.8 |
| Ferron Total | | | 664.4 |
| Area Total | | | 56,535.2 |

from the UDEQ. Comparison to the PSD Class II $NO_2$ increment is not appropriate because of a mix of non-increment consuming sources, complex terrain, assumed conservative emission source parameters, and screening-level modeling procedures. All NEPA analysis comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern, and do not represent a regulatory PSD Increment Consumption Analysis. The determination of PSD increment consumption is a regulatory agency responsibility conducted as part of the New Source Review process, which also includes a PSD Class I Federal Land Management Agency's evaluation of potential impacts to Air Quality Related Values (AQRV) such as visibility, aquatic ecosystems, flora, fauna, etc. The review would be conducted by the Utah Department of Environmental Quality when the Companies apply for construction and operating permits.

The cumulative $NO_X$ emission sources were also modeled and compared to Class I PSD increments at the closest boundary to the Canyonlands, Arches, and Capitol Reef National Parks. The Class I $NO_2$ increment is 2.5 $\mu g/m^3$. The highest annual $NO_2$ concentrations would be 1.05 $\mu g/m^3$ at the Canyonlands and Arches National Parks, and 1.57 $\mu g/m^3$ at Capitol Reef National Park. By far, most of this impact results from the power plants near the Project Area and not the Ferron Project compressors. For comparison, the impacts resulting from only the Ferron Project at these Class I airsheds were 0.041 $\mu g/m^3$ at Canyonlands and Arches and 0.062 $\mu g/m^3$ at Capitol Reef.

### 5.3.3.3 Regional Haze Near-Field Cumulative Impacts

The cumulative effect on regional haze considered the effects of compressor emissions from of the Ferron Natural Gas and Price CBM Projects. The analysis procedure was the same as for the Proposed Action regional haze analysis. With the Price CBM compressors added to the Ferron compressors, the regional visual range is predicted to be reduced by at least 10 percent on 11 days. However, there is no visibility standard for this location.

### 5.3.3.4 Regional Haze Far-Field Class I Cumulative Impacts

The cumulative effect on regional haze at the three National Parks considered the effects of compressor emissions from of the Ferron Natural Gas and Price CBM Projects because these would be the two new developments since the visibility baseline data in 1995. The procedure was the same as the Proposed Action regional haze analysis for Class I airsheds. The cumulative effect, when all compressors would be fueled by natural gas from the operating wells and operating at maximum capacity, would be that standard visual range would be reduced more than 10 percent on 11 days at Capitol Reef and two days at Canyonlands. The visual reduction would be less than 10 percent on all other days considered in the air quality analysis. Therefore, it can be concluded that the cumulative effect of the Ferron Natural Gas Project with the Price CBM Project would result in a significant impact on the visibility at Capitol Reef National Park because of its closer proximity to the Project Area.

### 5.3.3.5 Mitigated Cumulative Impacts

Because of concerns raised by public comment concerning adverse visibility impacts at Class I areas under the Proposed Action and Alternative 2, this section analyzes the cumulative air quality and visibility impacts that would be associated with two options for Ferron Natural Gas Project and Price CBM Project compressors. The first option is compressors with lower emissions rates and more realistic exhaust parameters. The second option, similar to the second option of the Proposed Action, analyzes air quality impacts if all compressors would be electrically powered. Obviously, if all electric compressors would be constructed and operated for the Ferron Natural Gas Project, there would be no direct cumulative air quality or visibility impacts resulting from the Ferron Natural Gas Project. Therefore, the rest of this section discloses the reduced cumulative impacts that would occur with lower emission rates and more refined exhaust parameters.

#### *5.3.3.5.1 Compressor Emissions*

The compressor emissions and stack parameters used in the mitigation analysis are fully described in **Section 4.3.3.2**. The actual engine configuration would be based on specific data once the actual engine configuration is selected and would conform to BACT based upon the UDEQ Approval Order. These emission levels are analyzed for this mitigation because they are attainable in the industry and would

significantly reduce potential impacts to visibility at Class I areas as well as significantly reduce ambient air concentrations of pollutants near proposed compressor locations. Based on these operating parameters, the $_{NOX}$ emissions from the 12 proposed Ferron Natural Gas Project compressors would be 232 tons per year (or 35 percent of the Proposed Action emissions), and the total emissions from the Price CBM Project compressors would be 264 tons per year, as shown in **Table 5–5**.

**Table 5–5**
**Cumulative $NO_X$ Mitigated Emissions from Compressors**

| | | | | $NO_X$ and CO Emissions | |
|---|---|---|---|---|---|
| Company | Compressor Rating (HP) | Number of Compressors Locations | Total Compression (HP) | lbs/hour | tons/year |
| Anadarko | 3,400 | 6 | 20,400 | 31.46 | 124.1 |
| Texaco | 4,000 | 3 | 12,000 | 18.50 | 72.9 |
| Chandler | 2,200 | 2 | 4,400 | 6.78 | 29.7 |
| | 850 | 1 | 850 | 1.31 | 5.7 |
| **Ferron Total** | | 12 | 37,650 | 58.05 | 232.4 |
| Price CBM D1 | 5,100 | 1 | 5,100 | 6.71 | 29.4 |
| Price CBM F1 | 5,100 | 1 | 5,100 | 6.71 | 29.4 |
| Price CBM E1 | 15,300 | 1 | 15,300 | 20.1 | 88.0 |
| Price CBM B1 | 10,200 | 1 | 10,200 | 13.4 | 58.7 |
| Price CBM C1 | 10,200 | 1 | 10,200 | 13.4 | 58.7 |
| **Price CBM Total** | | 5 | 45,900 | 60.32 | 264.2 |
| Cumulative Total | | 17 | 83,550 | 118.37 | 496.6 |

### *5.3.3.5.2 Cumulative Modeled Impacts*

$NO_X$ and CO emissions from each compressor station under the mitigation were modeled using both the 1986 and 1987 Clawson meteorological data and compared to the Class II PSD increments and the NAAQS. The modeled concentrations were multiplied by a factor of 0.75 to represent the conversion of total $NO_X$ to $NO_2$. The concentration contours are shown on **Plate 5–3**. The maximum concentrations for both pollutants were slightly higher using the 1986 data. Using the 1987 meteorological data, the highest $NO_2$ annual concentration with the 17 $\mu g/m^3$ background would be would be 75.9 $\mu g/m^3$, a value 75.9 percent of the annual NAAQS. This maximum concentration would occur on elevated terrain near the Huntington Power Plant located in T17S R7E Section 36. The second highest concentration would be 44.2 $\mu g/m^3$ at the same location. Using the 1986 meteorological data, the highest $NO_2$ annual concentration with the 17 $\mu g/m^3$ background would be would be 60.3 $\mu g/m^3$, and the second highest concentration would be 56.4 $\mu g/m^3$. This maximum concentration would occur on elevated terrain near the Huntington Power Plant located in T17S R7E Section 36.

Comparison to the PSD Class II NO2 increment is not appropriate because of a mix of non-increment consuming sources, complex terrain, assumed conservative emission source parameters, and screening-level modeling procedures. All NEPA analysis comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern, and do not represent a regulatory PSD Increment Consumption Analysis. The determination of PSD increment consumption is a regulatory agency responsibility conducted as part of the New Source Review process, which also includes a PSD Class I Federal Land Management Agency's evaluation of potential impacts to Air Quality Related Values (AQRV) such as visibility, aquatic ecosystems, flora, fauna, etc. The review would be conducted by the Utah Department of Environmental Quality when the Companies apply for construction and operating permits. Based on the results of cumulative air quality modeling with mitigation, it can be concluded that no adverse impacts on air quality would occur.

#### *5.3.3.5.3 Cumulative Near-Field Visibility Modeled Impacts*

The visibility analysis for the mitigation used the same methodology as for the Proposed Action. Using the modified method, the standard visual range (SVR) in and near the Project Area would not be reduced by more than ten percent on any day using both the 1986 and 1987 meteorological data. Therefore, it can be concluded that the cumulative sources with mitigated emission source parameters would have no effect on the regional haze in the vicinity of the Project.

#### *5.3.3.5.4 Cumulative Far-Field Class I Visibility Modeled Impacts*

The IWAQM screening method along with modifications by the Utah Department of Environmental Quality was used to evaluate effects on regional haze at Canyonlands, Arches and Capitol Reef National Parks. Based on this method when using the 1986 meteorological data, the modeled 24-hour $NO_X$ concentrations at the Class I areas, the regional haze reduction would exceed 5 percent on two days at Capitol Reef National Park and one day at Canyonlands. The visibility would not be reduced more than ten percent at any time. When using the 1987 meteorological data, the regional haze reduction would be more than 5 percent on 14 days at Capitol Reef and 10 days at Canyonlands. The visibility is predicted to be reduced by ten percent or more on five days at Capitol Reef and one day at Canyonlands.

The slight exceedance using the conservative IWAQM screening analysis represents the potential effect at Capitol Reef and Canyonlands if the full development would occur. The analysis demonstrates that there may be a minor impact to visual resources at Capitol Reef and Canyonlands if all the natural-gas fired compressors from the Ferron Natural Gas and Price CBM Projects would be permitted and operated at mitigated levels. Further analysis of potential visibility impacts may be required by the Utah Division of Air Quality in the future when Approval Order applications are submitted. Because there is a slight potential of adverse visibility impacts at Class I areas, there may be a upper level of gas-fired development approved by the Utah Division of Air Quality. Therefore, considering that the Ferron Natural Gas Project is considering the installation of 12 compressor stations and the Price CBM Project is considering five compressors, but higher horsepower, any compressor proposed beyond an upper level may be disapproved or have to be electrically powered.

## 5.3.4 Soils

The cumulative impact analysis for soils resources includes the Price River Coal Bed Methane project, the proposed Ferron Natural Gas project and potential future developments in both project areas. The projects have or would disturb soils with similar characteristics as those in this EIS project area. Therefore impacts to soils would be similar to those described in **Section 4.4**, but the magnitude would be greater. Long-term

impacts include removal of vegetation, exposure of soils, mixing of soil horizons, breakdown of soil structure, reduction of soil productivity, increased runoff, erosion, off-site sedimentation/salinity, and difficulty with reclamation.

A high percentage of soils in the area are classified as critical and are susceptible to erosion. The soils also tend to be saline. Many of these soils also exhibit an unsuitable reclamation potential and would require many growing seasons and multiple efforts to reseed and successfully generate a vegetative cover similar to existing conditions.

The rigorous implementation of erosion control measures and effective reclamation would reduce potential impacts to soils resources. The same environmental protection measures and mitigation to control erosion and soil loss as discussed in **Sections 4.2** (Water Resources), **4.4** (Soils), and **4.17** (Reclamation) would have to be applied at a much larger scale. These protection measures should bring erosion and salt delivery to within the range of natural rates for the area.

If all of the proposed and reasonably foreseeable development would occur within and near the Price CBM and Ferron Natural Gas Projects, the total long-term disturbance would be 6,897 acres. Development of all potential wells would not be likely to result in cumulative effects to regional soils. Much of the area is Federal lands and would be subject to requirements for erosion control and reclamation. In addition, development would affect a relatively small portion of the land within the RFD area and impacts would be dispersed throughout. Ongoing and potential projects would affect only about 3 percent of the area.

### 5.3.5 Vegetation

Implementation of all three alternatives would minimally contribute to cumulative effects to vegetation in the analysis area. Only projects that would occur within the North Area or South Area would generate effects that would overlap in time or space with the effects generated by the three alternatives considered in this EIS. Because few projects have been identified that would disturb vegetation within the North Area or South Area, little potential exists for the effects of these projects to contribute to each other cumulatively. The projects that may contribute effects cumulatively with the Ferron Natural Gas Project include the RFD Scenario, Des-Bee Dove Mine Reopening.

Cumulatively, the Ferron Natural Gas Project, RFD Scenario, and Des-Bee Dove Mine Reopening would combine to disturb an additional 3,785 acres of vegetation types within the Project Area, which is about 3.4 percent of the 111,781 acres of the combined Project Area and pipeline corridor. The Ferron Natural Gas Project would contribute almost half of 3,785-acre total disturbance.

Although the projects would ultimately disturb about 3,785 acres of vegetation types in the Project Area, the total acreage would not all be disturbed simultaneously, because the projects would not be constructed simultaneously. Thus, some of the disturbed acreage would be reclaimed or would be in the process of being reclaimed when new disturbances are initiated. As a result of interim reclamation that would occur upon completion of drilling, the total areal extent of simultaneous, long-term disturbance would probably be about 763 acres under alternatives 1 and 2. Implementation of Alternative 3 would result in total long-term disturbances of almost 370 acres.

Three minor, but unquantifiable, impacts would occur to the vegetation resources from the cumulative natural gas scenario. Dust generated from construction activities would slow the photosynthesis process by the deposit of dust on plants. This effect would be somewhat mitigated by the State of Utah requirement to apply

dust reduction techniques, described in Chapter 4, to reduce dust during construction activities. The dust would also make the forage less palatable to livestock, and they may utilize the dust covered vegetation less. A third factor would be the potential import and spread of noxious weeds around project activities. The proposed plans of the natural gas developers to control noxious weeds around their facilities would help to alleviate the spread of noxious weeds. If these plans and procedures would be applied to all natural gas development in the future, the impact of noxious weeds would be minimized.

## 5.3.6 Riparian Areas

Implementation of the three alternatives considered in this EIS would contribute minimally to cumulative effects in the Project Area. As with vegetation, only projects that would occur within the North Area or South Area and would affect riparian vegetation would generate effects that would overlap in time or space with the effects generated by the three alternatives considered in this EIS. A review of the RFFAs suggests only the RFD Scenario has components that may affect riparian areas. Thus, the RFD Scenario may contribute effects cumulatively with the Ferron Natural Gas.

Although at least some disturbance to riparian areas from roads appears likely under the RFD Scenario, locations of potential roads are unknown. Thus, no specific quantitative estimation of disturbances can be made. However, development of the RFD Scenario likely would parallel the Ferron Natural Gas Project. Consequently, it is estimated that 15 to 20 acres of riparian areas would be disturbed.

## 5.3.7 Wildlife

### 5.3.7.1 Aquatic Species

Direct, indirect, and cumulative effects on aquatic species primarily originate from changes in stream flow and sedimentation. As discussed under the water resources and aquatic species sections of Chapter 4, direct and indirect effects to water quality and aquatic species would be minor and limited to segments of streams immediately downstream of the proposed crossings. Additionally, the cumulative effects analysis for water resources suggests the combination of direct and indirect effects to surface waters (changes in flows or sedimentation) from the RFFAs would not be perceptible cumulatively (over the long term in particular). Because the primary direct, indirect, and cumulative effects to the quality and quantity of surface waters would be minor and localized, the combination of effects from the projects comprising the RFFAs is not expected to generate perceptible cumulative effects to the aquatic species resource.

### 5.3.7.2 Terrestrial Wildlife

The primary cumulative effects of concern are the loss and fragmentation of winter ranges for mule deer and elk. The RFFAs occur within the two mule deer herd units and one elk herd unit the Ferron Natural Gas Project would affect. Thus, the effects of these projects on mule deer and elk winter ranges would compound cumulatively. Additionally, illegal harvests of deer and elk are expected to increase cumulatively with implementation of the RFD scenario.

The primary projects of concern for mule deer and elk winter ranges are the Price CBM Project, Ferron Natural Gas Project, and the natural gas development comprising the RFD Scenario. The other projects comprising the RFFAs would have minor or no cumulative effects on these winter ranges because they would involve limited amounts of winter range, if any.

As shown on **Table 5–6**, at least most 65,300 acres of winter range (crucial and high value) for mule deer would be disturbed cumulatively. Most of this disturbance (almost 55,224 acres) would occur in the Manti-Nebo mule deer herd unit. UDWR has identified about 1,063,573 acres of winter range within the Manti-Nebo mule deer herd unit. Thus, the RFFAs would cumulatively affect about 5 percent of the winter range delineated in the Manti-Nebo mule deer herd unit.

**Table 5–6**
**Summary of Cumulative Effects to Mule Deer Winter Range**

| | Crucial Winter Range | | High Value Winter Range | | Total Winter |
|---|---|---|---|---|---|
| Project | Direct (acres) | Indirect (acres) | Direct (acres) | Indirect (acres) | Range (acres) |
| Price CBM | 1,272 | 10,005 | 886 | 9,525 | 20,416 |
| Ferron | | | | | |
| North Area | 164 | 2,819 | 65 | 1,416 | 4,300 |
| South Area | 500 | 7,533 | 390 | 5,972 | 13,895 |
| Total | 664 | 10,352 | 455 | 7,388 | 17,740 |
| RFD Scenario | | | | | |
| North Area | 201 | 3,983 | 107 | 2,124 | 6,214 |
| South Area | 563 | 11,151 | 469 | 9,293 | 20,913 |
| Total | 764 | 15,134 | 576 | 11,417 | 27,126 |
| Total | 2,700 | 35,491 | 1,917 | 28,330 | 65,282 |

The other 10,058 acres (Ferron North Area) would occur in the Anthro/Range Creek mule deer herd unit. UDWR has delineated about 695,568 acres of winter range within the Anthro/Range Creek mule deer herd unit. The RFFAs would cumulatively affect about 2 percent of the winter range delineated in the Anthro/Range Creek mule deer herd unit. The extent of these disturbances would be similar for Alternatives 1 and 2. The extent under Alternative 3 would be somewhat smaller.

As shown on **Table 5–7**, at least 56,900 acres of winter range (crucial and high value) for elk would be disturbed cumulatively. All of this disturbance would occur in the Manti-Nebo mule elk herd unit. UDWR has identified about 786,463 acres of elk winter range within the Manti-Nebo elk herd unit. Thus, the RFFAs would cumulatively affect about 7 percent of the winter range delineated in the Manti-Nebo mule elk herd unit. As with mule deer, the extent of these disturbances would be similar for Alternatives 1 and 2. The extent under Alternative 3 would be somewhat smaller.

## 5.3.8 Special-Status Species

Overall, implementation of any of the alternatives considered in this EIS is not expected to induce substantive cumulative effects to the 53 special-status species of plants, terrestrial wildlife, or aquatic life shown on **Table 4–10**.

There could be a loss of some individual plants of the winkler cactus, the Creutzfeldt-flower, and the Canyon Sweetvetch. This loss would result from surface disturbance during development and use of off-highway vehicles in the plant's habitat. These losses would not be significant enough to endanger the continued

**Table 5–7**
**Summary of Cumulative Effects to Elk Winter Range**

| | Crucial Winter Range | | High Value Winter Range | | Total Winter |
|---|---|---|---|---|---|
| Project | Direct (acres) | Indirect (acres) | Direct (acres) | Indirect (acres) | Range (acres) |
| Price CBM | 496 | 7,435 | 1,588 | 35,953 | 44,976 |
| Ferron | | | | | |
| North Area | 0 | 0 | 0 | 0 | 0 |
| South Area | 173 | 8,989 | 34 | 2,980 | 12,003 |
| Total | 173 | 8,989 | 34 | 2,980 | 11,969 |
| RFD Scenario[1] | 295 | 0 | 295 | 0 | 0 |
| Total | 964 | 16,424 | 1,917 | 38,933 | 56,945 |

Note:
1. The indirect effects of the RFD Scenario's wells would involve the same acreage already affected indirectly by the Ferron Natural Gas Project in the South Area. Therefore, no additional acreage was included for the indirect effects of the RFD Scenario.

existence of the Creutzfeldt-flower and the Canyon sweetvetch or to cause them to be listed. For the winkler cactus, these losses would be in addition to the plants lost in the development of a bentonite mine and an exploration well developed outside of the RFD area. The winkler cactus has recently been listed as threatened by the USFWS, and these impacts were addressed in the listing package published in the Federal Register (USFWS 1998a). Individual applications could be denied if endangered species provisions could not be met.

There would be limited impacts to terrestrial wildlife. The peregrine falcon and bald eagle may experience a small loss of prey, but no sufficient enough to be significant. Their aeries would be protected with stipulations on when and what can be built within one mile of the aeries.

There would be limited impacts to aquatic wildlife. Not enough water would be removed from the watershed to impact the endangered fish in the Colorado River drainage.

None of the species listed in **Table 4–10** should be affected to any extent by the RFD scenario. All actions would require clearance surveys before construction. These surveys would be closely coordinated with the USFWS and UDWR to determine if any species may be impacted and what mitigation would be required. This would ensure that none of the special-status species would experience cumulative effects from the implementation of the Project.

## 5.3.9 Cultural Resources

The area for consideration of cumulative effects to cultural resources is the same as the RFD area, the combined Ferron Natural Gas and Price River Coal Bed Methane project areas (**Plate 5–1**). There have been approximately 200 wells drilled in cumulative analysis area. There is the potential for approximately 1,600 additional wells with associated facilities that could be drilled at full development under Alternatives 1 and 2. About 1,400 additional wells could be drilled with Alternative 3. Currently, there are about 680 wells proposed for the RFD area under Alternatives 1 and 2, and 480 wells proposed under Alternative 3.

A cultural resources Programmatic Agreement (PA) between the BLM, the State Historic Preservation Officer and the Advisory Council on Historic preservation has been completed for the Price Coal Bed Methane project area. For Alternatives 1 and 2 of this EIS, completion of a PA for the Ferron Natural Gas Project would combine with the Price Coal Bed Methane Project to provide a plan for management and treatment of cultural properties for nearly 40 percent of the projected development in the RFD area. Under alternative 3, if a PA were completed, 30 percent of the projected wells would be covered.

On Federal lands, all surface disturbing activities would be required to identify, evaluate, and, if necessary, treat cultural and historic properties, consult with Native American groups regarding traditional cultural properties, evaluate and treat historic properties encountered during construction or operation, and deal with any human remains encountered. Monitoring of identified sites could also be necessary.

Direct disturbance or destruction of archaeological sites would take place in areas subject surface disturbance from development. Indirect impacts could result from vandalism, inadvertent damage, or removal of cultural sites and properties. With the increased level of activity identified in the development scenario, the probability of effects to cultural resources would increase. However, as there has been no area wide cultural survey or statistical sampling completed for the area, the impacts cannot be accurately quantified.

Because cultural resource surveys would be completed prior to surface disturbances in areas not previously inventoried, the potential for increased impacts to cultural sites would be minimized. By avoiding known cultural and historical sites during the layout of drill sites, access roads and pipeline corridors, the potential for incremental increases in cumulative impacts would be avoided. Where this is infeasible, the development of data recovery and site mitigation plans would be necessary and would provide information on the cultural and historical properties of the area. On Federal lands, adherence to requirements for protection of cultural resources should provide measures to mitigate adverse effects. However, despite the best efforts to avoid and protect cultural resources, some direct and indirect impacts would be possible under the projected activities of the RFD. While mitigation or data recovery of cultural sites provides valuable historic information, the actions would affect the sites. Loss, destruction or damage to cultural resource sites would be an irreversible effect.

## 5.3.10 Land Use

Existing, planned or foreseeable activities in Carbon and Emery counties include continued natural gas development on state and private lands in the Project Area and adjacent areas. As of the end of 1997, natural gas developments in addition to the Proposed Action included the Price CBM Project and the wells included in the RFD Scenario. The proposed long-term disturbance to public and private lands by the Price CBM Project is 1,519 acres. The proposed disturbance resulting from an additional 923 wells under the RFD Scenario would be 4,615 acres, based upon an average disturbance per well of five acres, including the well pad, roads, and facilities. The total number of long-term disturbances on all lands from existing and proposed natural gas developments would be 6,897 acres or 0.5 percent of the 1,234,715 acres in Carbon and Emery counties.

The long-term disturbances from most existing and foreseeable natural gas developments occur primarily in the historical and existing land uses of grazing, agriculture, and wildlife habitats. These resources are discussed in other sections. An increase in activities near residential areas could be anticipated.

Increased traffic levels associated with the construction periods of all natural gas projects should not significantly overlap in time and space. Price CBM development has been ongoing for two years. The

construction should be complete by 2001. Ferron construction would begin in 1999 and be completed by 2004. Therefore, increased traffic levels from the Ferron and Price CBM projects should occur from 1999 to 2001 and then decrease to Ferron numbers. With increased construction related traffic near the Price area from 1999 to 2001, the probability of traffic accidents should increase slightly. Increased traffic near residences would result in increased noise and traffic dust. Generally speaking, the construction period for the RFD wells and facilities would probably not begin until the Ferron project is complete. Therefore, the rest of the impacts described above would continue for the duration of activities.

## 5.3.11 Livestock Management

The minor direct and indirect effects on livestock management associated with each alternative for the Ferron Natural Gas Project would contribute to the effects of the RFFAs within the analysis area. However, the Ferron Natural Gas Project's cumulative contribution also would be minor and limited. Overall, the Ferron Natural Gas Project's effects would contribute to a slight drop in AUMs available on the BLM's allotments within the resource areas. However, the effects on the individual allotments would be imperceptible overall.

The new roads that would need to be constructed would create more access into the grazing allotments. Increased harassment of livestock and vandalism to both livestock and facilities could occur. Dust from construction activities could decrease the palatability of forage for livestock, reduce the photosynthesis rate for growth, and decrease the rate of new growth and subsequent reclamation efforts when the gas development projects end.

## 5.3.12 Recreation

Additional population growth in Carbon and Emery counties is possible as a result of various in-migration factors, and could result in additional demand for recreational opportunities under all alternatives. Population growth and demand for recreation opportunities could reflect current growth in other areas of Utah, and that at some point during the life of the project, overall demand for recreational use could exceed supply in both counties.

There are currently no developed recreation areas in Carbon and Emery Counties that are affected by existing natural gas projects. The Price CBM Project and the existing development in both the North and South Areas have begun to affect dispersed recreational opportunities such as hunting, OHV use and trail-related activities near the Price area.

Other public lands in the counties may see an increase in visitors who seek solitude. However, opportunities for solitude in a natural setting would continue to decrease near the Price area. Natural gas development in the North Area, in conjunction with the adjacent development of the Price CBM Project, would continue to decrease the opportunity for local residents to experience the solitude and natural setting that is both nearby and convenient. The trail systems that have informally developed over the years would be altered, and in some cases destroyed, by natural gas development. On the other hand, the additional development would open more access roads although these roads would not be inherently designed for recreational use. If the local people near Price would be driven from the nearby North Area and Price CBM project areas because of a loss of solitude and natural setting, more opportunities for solitude, but not natural setting, may be available in parts of the South Area even if the distance would be longer to newer locations.

## 5.3.13 Visual Resources

Cumulative impacts to visual resources would result from other planned or foreseeable natural gas development activities that could occur on lands adjacent or located near to the proposed project in addition to existing developments. This analysis incorporates the visual impacts of the Price CBM Project, the Ferron Natural Gas Project, and the wells that would be drilled and operated under the RFD Scenario. These projects would involve the following wells and roads: Price CBM Project — 521 wells and 350 miles of roads; Ferron — 347 wells, 98 miles of new roads, and upgrading approximately 100 miles of existing roads; RFD — 923 wells and 1,170 miles of roads. The road mileage for the RFD Scenario is based on the assumption that each well would result in 5 acres disturbance, 1.3 acres would be the well pad disturbance, 3.3 acres would be the road disturbance. The average road would be 24 feet wide and 1.27 miles long.

All of these project lands are managed under BLM VRM Classes II, III, and IV. Class II areas are managed to retain the existing character of the landscape. The level of change should be low and not attract the attention of the casual observer. Class III objectives are to provide for management activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character. Activities may be visually evident, but should not be dominant. Class IV objectives provide for major modification of the landscape, and allow management activities to dominate the landscape. **Table 5–8** summarizes the total number of each component of wells that would be constructed in the three BLM VRM classes.

Cumulatively, 34 wells could be drilled and operated in VRM Class II areas. All of these wells would be located on State and private lands. Even if the recommended mitigation of this EIS would be applied, the Class II VRM objectives would not be met. Cumulatively, 223 wells in the Ferron and Price CBM Project Areas would be constructed in VRM Class III areas. Visual mitigation described in Chapter 4 would alleviate the impact of these wells in VRM Class III areas. If the same mitigation would be applied to the 518 wells in VRM Class III areas considered in the RFD, the visual impact would be lessened. Regardless of the mitigation applied, the cumulative impact would be to change the predominantly rural character of the landscape in the Castle Valley area between Helper in Carbon County and Ferron in Emery County to a rural/industrial landscape character.

Electrical power maybe installed for Ferron Natural Gas Project facilities. To determine the cumulative impacts to visual resources from the aboveground power poles and lines, it is assumed that all the Price CBM project and the RFD scenario would also be electrically powered. Additionally, it is assumed that all the lines with poles at 300-foot intervals, would be installed along existing and proposed roads. Under the Ferron Proposed Action, 187 miles of power lines and 3,300 poles, would be installed. Approximately 350

**Table 5–8**
**Cumulative Well Placement by BLM VRM Class**

| Project | Number Wells | VRM Class II | VRM Class III | VRM Class IV |
|---|---|---|---|---|
| Ferron Natural Gas Project | 353 | 20 | 158 | 175 |
| Price CBM Project | 521 | 0 | 65 | 456 |
| RFD Scenario | 923 | 14 | 518 | 391 |
| Total | 1,797 | 34 | 741 | 1,022 |

miles of power lines and 6,160 poles, would be installed in the Price CBM Project Area. Approximately 1,170 miles and 20,600 poles, would be installed to power RFD facilities. Therefore, a total of 1,700 miles of overhead lines and 30,060 poles could be installed. Approximately 2 percent of these facilities would be installed in VRM Class II areas and the Class II management objectives would not be met. Another 41 percent would be in Class III areas. If the recommended mitigation in this EIS would be implemented on State and private lands, the impacts would be lessened but overall, management objectives would not be met. The remaining 57 percent of facilities would be installed in Class IV areas, and management objectives would be met.

Other industrial, commercial and residential developments may also result in changes in land uses and the visual character of some areas, as these uses are generally developed on lands previously used for agriculture or as open space. It is probable that various in-migration factors will result in economic and population growth of Carbon and Emery counties in the future. The landscape character of some areas in the counties, particularly adjacent to communities along SR 10, would change as a result as a result of increasing development on private lands. Commercial, residential and industrial uses are being developed on lands previously used for wildlife habitat and agriculture. This type of growth is expected to continue in Carbon and Emery counties in the future. Therefore it is likely that development would occur on private lands in the vicinity of the proposed natural gas facilities. The proposed project and other existing and foreseeable natural gas developments would add to the ongoing development of these lands in the counties.

These effects have changed the overall landscape of parts of Carbon and Emery counties from rural to a mixed rural/industrial landscape, and are expected to continue to occur from future growth of the region.

## 5.3.14 Noise

Cumulative noise effects would be minor in the RFD area under all alternatives. A small and short-term noise increase would occur near State Road 10 when construction vehicles and equipment are traveling south from Price to both the Price CBM Project Area and South Area. The noise would be slightly higher during the morning and evening hours when workers are traveling to the construction sites. Sufficient distance would exist between project facilities such that significant noise levels greater than 55 dBA would not overlap. This is because noise decreases approximately 6 dBA with every doubling of distance from the source. The analysis of the Ferron noise has shown that noise typically drops below a "public comfort" level of 55 dBA at about 1,500 feet from construction activities and at about 200 feet from pumping units. None of the well locations would be closer than 200 feet to each other in the Ferron, Price CBM Project, or RFD scenarios so the effects would not be additive.

## 5.3.15 Socioeconomics

### 5.3.15.1 Population

As previously mentioned, a significant amount of natural gas exploration and development activities are currently either ongoing or proposed in the Carbon County and Emery County region. Assuming all of the current proposals are approved and implemented as planned in the near future, it is probable that additional non-local contractors or permanent employees would be needed for the initial construction and installation phase. These workers may relocate to the area for a limited period of time (2–5 years) during the major construction phase of the ongoing and future natural gas projects.

It is assumed that 15 percent of the new permanent employment associated with natural gas development operations and maintenance would be hired from outside the local area. However this percentage would likely increase under the cumulative scenario. Using an average of 2.8 dependants per employee and the employment data provided in **Table 5–9**, a population increase of 80 could be expected due to the cumulative natural gas development scenario. This increase equates to 0.4 percent and 0.8 percent of the current populations of Carbon County and Emery County, respectively.

Using the same assumptions given above, the minimum peak population increase associated with natural gas development combined with given future mining activity within the project area is estimated at 180. This increase equates to approximately 0.9 percent of the current Carbon County population and 1.7 percent of the Emery County population. Population may also increase due to permanent employment increase associated with other future projects in the project area, including community expansion projects, logging projects, and the Narrow Dam Project.

The projected increase in population discussed above is only associated with permanent full-time employees residing in the local analysis area. The increase in non-local short-term and seasonal employees associated with the construction phases of the projects may create a demand for temporary housing. This would increase the demand for motels, mobile home sites, and RV sites locally and in and around specific field development sites.

Although many of the workers associated with oil and gas development projects in Carbon and Emery counties would be required during the construction phase only, the impact to long-term population growth in the region is not expected to be significant. Because the long-term, permanent increase in population growth in Carbon and Emery Counties attributable to the RFFAs would be relatively small and because the projects would be spread out over time, it is anticipated that the development market would have sufficient time to respond to population growth and associated housing needs and no significant cumulative effect would occur.

### 5.3.15.2 Employment, Wages, and Local Economy

#### *5.3.15.2.1 Employment*

Implementation of the proposed project and other RFFAs would create additional opportunities for employment in the Carbon County and Emery County region. Due to the long-term nature of the natural gas development projects, coupled with fluctuating natural gas economics, developing exact projections of employment is difficult. Therefore, the following paragraphs provide a reasonable estimate of what employment impacts would be in the cumulative project scenario.

Completion of natural gas development projects in the region would be realized several years after project initiation. Once complete, the production lifetime of the wells is expected to be in the range of 20 years. The primary influx of employment opportunities associated with the natural gas development projects is expected to occur during the well development stage. With numerous gas companies developing wells on private, state, and federal lands, new seasonal construction-oriented jobs would be available. Some of these jobs may be through the companies directly and many of them would be contractor positions. If employment in the natural gas and mining sectors is realized concurrently, recruitment of workers from outside areas may be necessary.

Once the natural gas wells have been installed, some level of sustained permanent employment would be required for operation and maintenance of the wells and pipelines. Future employment requirements would center around reclamation and abandonment of facilities at the end of the Project period.

An estimate of the number of employees required to implement the cumulative project scenario is provided in **Table 5–9**. Of this total, a large percentage of employment is associated with natural gas development and projected employment during the construction and installation period is estimated at 419 employees. It is estimated that, of these 419 employees, about 167 would be hired from the local area and 197 would come from outside the local area (Cox 1998). The average peak well development employment of 419 workers represents about 33 percent of 1995 employment in the mining, oil and gas, and construction sectors in Carbon County and 31 percent of these sectors in Emery County. This would be a draw on the workforces in Carbon and Emery Counties. However, the construction phase of the Price CBM and Ferron Natural Gas projects may overlap, which could allow for sharing of employment resources, reducing the impact on the workforces of the Counties. The operation and maintenance phase of the natural gas development scenario is estimated to require 291 employees per day over the life of the project (approximately 20 years). About 247 of these would be local hires and 44 would be hired from outside the area (Cox 1998).

Employment in Carbon and Emery counties also may increase as a result of future cumulative projects in the area, including proposed and potential mines, community expansion development, logging, and the Narrow Dam Project development. Due to the lack of detailed information available for these future projects, it is difficult to project total employment increases. However, at least 238 employees are expected to be required to meet the employment demand of future mining projects (**Table 5–9**).

#### *5.3.15.2.2 Wages and Local Economy*

Implementation of the cumulative project scenario would contribute to the local economy through the generation of earnings, which would be spent on items such as housing, food, goods and services. Based on full development of cumulative projects, spending would likely increase over current levels. However, this increase may be balanced if mines in the area close, resulting in a decrease in spending. In addition, economic benefits would occur as a result of the companies' spending on purchases of equipment and supplies from local area vendors.

Payroll earnings would increase in the region, which, in turn, would result in growth in the local economy. Although it is difficult to determine precise cumulative payroll earnings, the average project payroll would amount to about $2,200,000 ($900,000 for Ferron Natural Gas Project and $1,300,000 for Price CBM Project) annually during the first several years of the development stage. Thus, the cumulative project scenario would likely generate an increase in payroll earnings.

Direct project employment and associated earnings would also create new jobs in local communities during the construction phase of the future projects. Secondary job creation would occur primarily in the service and trade sectors, with a few additional jobs in finance, insurance, real estate, transportation, and public utilities. It is projected that about 82 secondary employment positions would be created as a result of project activities during peak natural gas development projects employment. This calculation is based on the assumptions used in the Price CBM EIS (BLM 1997c). Because the vast majority of service and retail trade activity occurs in the Price area, it is assumed that most of these jobs would be created in Price, or nearby communities in Carbon County.

## Table 5–9
## Cumulative Projects — Employment and Project Schedule Information

| Project | # of Proposed Wells (Gas Development)/ Surface Disturbance (acres) for mines | Number of Employees | Timing |
|---|---|---|---|
| ***Natural Gas Development*** | | | |
| Price CBM Project | 521 | 116 const., 98 operation[1] | Early stages of development - app. 30-year lifespan |
| Ferron Project | 353 | 98 const. 43 operation[2] | Near future - app. 20y lifespan |
| Reasonable Foreseeable Development Scenario | 923 | 205 const. 150 operation[3] | Assumes near future and 20-year lifespan |
| *Total* | *1,791* | *419 const., 291 operation* | - |
| ***Coal Mines*** | | | |
| Willow Creek Mine | 20 | 0 | Under construction |
| Dugout Canyon Mine | 10 | 0 | NA |
| C Canyon Mine | 10 | 0 | NA |
| Horizon Mine | 10–20 | 40-50 | NA |
| Horse Canyon South | 20–30 | 70-80 | Inactive - ROW appl. submitted, No mine plan submitted |
| Columbia Mine Reopening | NA | 70-80 | Inactive - ROW appl. submitted, No mine plan submitted |
| Des-Bee Dove Mine Reopening | NA | NA | No information submitted |
| Co-op Mine Expansion | NA | NA | No information submitted |
| *Total* | *70-90* | *180–210* | - |
| ***Other Mines*** | | | |
| Chalk Hills Mine | 5 | NA | Inactive |
| BJ Mine | 71 | 3 | Active |
| Eagle Canyon Mine | 30 | 6 | Active |
| Kimball Draw Mine | 107 | NA | EIS in progress |
| San Rafael Desert Mine | 1 | 2 | Active |
| Lone Tree Wedge (Hebe) Mine | 5 | 4 | Active |
| Last Chance Mine | 4-5 | 3 | Active |
| *Total* | *227–228* | *18* | - |

Notes:

1. Assumes implementation of the Price CBM Proposed Project as provided in the EIS (BLM 1997c).
2. Estimated Proposed Project employment as provided in Table 2-2.
3. Assumes a factor of 0.34 employees per well required for construction, and 0.15 employees per well required for operation. This projected ratio of employees per well is consistent with project employment.
4. NA = Not Available

#### 5.3.15.2.3 Potential for Boom/Bust Cycle

Implementation of the cumulative project scenario would create both primary and secondary employment opportunities, contribute to the local economy, and provide a significant source of revenues for local agencies through the collection of taxes. If current estimates and plans are realized, employment opportunities would occur primarily in the first several years of the projects, while revenues may extend for as long as 20 to 30 years. At which time, project activities and gas production would slow or cease and so would the associated economic benefits.

At a minimum, the natural gas development scenario alone would result in a peak of 328 new jobs for the study area, representing 14 percent of the mining and construction sector jobs in Carbon and Emery counties. After the completion of the development stage, there would be a period of layoffs and employment would decline. If project activities are staggered and begin and end in a gradual fashion, major lay-offs or royalty reductions would be reduced or avoided. In addition, there are a number of other ongoing economic activities and concerted efforts by local authorities to diversify the local economy. These factors all lead to the conclusion that while the completion of project activities would create a temporary increase in employment and the economy, implementation of the projects would not increase the potential for a boom/bust cycle.

### 5.3.15.3 Housing

To the extent the cumulative project scenario employment results in a concentrated housing demand or shortage, either short or long term, the effect would be considered significant. Effects would be experienced on both local and regional levels. If transient housing, e.g. man camps or motel rooms, is required for short-term accommodations for construction or other laborers and is currently not available, the effect would be significant.

Because many of the workers recruited for the development of projects are expected to be local, existing residents or short-term seasonal workers, it is not expected that a marked demand for housing would be experienced. Also, activities would be spread out over a two-county area. Therefore, it is unlikely that a large concentration of workers would be seeking homes all at one time, in one particular location. As the demand for additional housing opportunities or motels increases, it is expected that the local development community would respond.

Use of non-local contract workers for specialized construction activities may increase the demand for and availability of temporary housing. It is not expected that this demand would represent a significant impact because most of these workers would not have dependants accompanying them and they would most likely stay in motels, recreational vehicles, and mobile homes. Many of these workers may already be in the Project Area constructing wells on state and private lands, reducing the likelihood of a major influx of workers all seeking temporary housing at one time. An assessment of baseline conditions indicate that the combination of existing housing vacancy rate with ongoing new development would provide sufficient housing opportunities for workers seeking permanent residences.

### 5.3.15.4 Community Facilities and Services

#### 5.3.15.4.1 Roads

Access to portions of the proposed and other cumulative projects from state and federal highways would require the use of certain roads in Carbon and Emery counties. Project activities could result in increased traffic and use of roads, including additional wear and tear from heavy vehicles. The increased use of county roads may increase maintenance costs to the Counties' special districts. Both paved and non-paved roads may be affected. The royalty payments from the various developments projects should compensate for any increased maintenance costs to Carbon and Emery counties.

#### 5.3.15.4.2 Public Schools

The increase in labor demands of the cumulative projects scenario would result in immigration of workers and their families to the Project Area, thereby increasing the number of students requiring educational services. As is difficult to determine how many workers will permanently relocate to the area with their families, it is difficult to determine the extent of the increase in the number of students. However, the school districts in Carbon and Emery Counties have some capacity to accommodate additional students. The Price CBM EIS reported that each of the schools in Carbon County are generally nearing, or currently at capacity levels. However, after years of declining enrollments between 1991 and 1995, some additional capacity may be available. Similar to Carbon County, enrollment in Emery County School District has generally shown small decreases annually for the last five years. If this increase in the number of students is greater than current capacity of the school districts, the counties may have to expand facilities and hire more staff.

### 5.3.15.5 Public Finance

#### 5.3.15.5.1 Federal Mineral Royalties, and State and Local Revenues

The cumulative projects scenario would generate additional federal royalties, resulting in additional revenues for State and local governments. If all of the RFD cumulative scenario would be developed, royalties from gas activities would approximately double the level of the Ferron Natural Gas and price CBM Projects. While some increase in the demand for services and facilities is likely, local governments would also receive significant royalty payments from resource extraction activities, which could be used to fund necessary improvements.

#### 5.3.15.5.2 Local Ad Valorem Tax Revenue

Additional project revenues would be generated through the collection of an ad valorem/property tax levied on improvements constructed by the Proposed Project and other cumulative projects. Because this assessment would be based on value added to property, revenues associated with cumulative natural gas development would increase based upon the number and location of wells. No estimate of the assessment of improvements associated with well development was available, however, assessed values would be determined as a percentage of the actual costs of the facilities (Ferderber 1998). Theoretically, revenues would gradually increase over the first several years of development in both counties, providing a steady revenue stream for a period of years, and then decline as facilities are dismantled and reclaimed. These projections are subject to the number, location, and life span of facilities and gas production. The ad valorem/property tax revenues for the cumulative project scenario would increase over those associated with only the Proposed Project.

#### 5.3.15.5.3 Sales and Use Tax Revenues

Sales and use tax revenues would be generated throughout Carbon and Emery counties as a direct result of spending on goods and services in various cities throughout the Project Area. It is projected that sales and use tax revenues generated annually by the Proposed Project would range from $23,830 to $404,478. The addition of other cumulative projects in the area would increase these revenues.

### 5.3.15.6 Quality of Life

#### 5.3.15.6.1 Local Economy

Over time, the proposed project would result in effects that would be considered to both aid and deter from a common perception of a desirable quality of life. It has been concluded that over the 20-year expected life span of the Proposed Project, increased employment in certain sectors would be realized. Many jobs associated with the Proposed Project could be filled by unemployed or underemployed workers currently residing in the Project Area. These jobs would subsequently contribute to a local economy. Employment opportunities and economic stability would increase in the Project Area with the addition of other cumulative projects.

#### 5.3.15.6.2 Open Space and Visual Effects

The Proposed Project, with cumulative natural gas development projects, would noticeably increase activities on federal lands throughout the Project Area. It is expected that there would be numerous ongoing drilling operations, which would increase noise, dust, and pose local visual impairment. Well pads, pumping units, new roads, and pipeline corridors would be noticeable in certain areas. These features would affect the perception of quality of life in terms of a visual impact experienced primarily during outdoor recreational experience.

#### 5.3.15.6.3 Traffic Congestion

The Proposed Project and other cumulative projects would result in an increase in traffic on federal, state, and local roads. Truck and heavy equipment traffic on federal lands, as well as state highways and county roads would increase. Some additional traffic on local community roads may also occur over time as new employees and project activities create additional trips. In addition, recreation vehicle traffic may increase as well development activities make certain areas more accessible. Due to the large geographic coverage and time frame of the project, it is extremely difficult to predict what level of increased traffic may be expected and what effect this traffic may have on overall quality of life.

#### 5.3.15.6.4 Community Facilities and Services, Community Values

As described in previous sections, the proposed project and other cumulative projects would generate revenues currently not available to both Carbon and Emery counties. These revenues would likely be used for a variety of purposes, including funding for additional community facilities and services. Revenues would offset the demands for services placed on such things as school additions, parks and recreation facilities, additional law enforcement officers and other services and facilities.

Individuals in favor of no-growth or limited growth policies may view growth projected under the cumulative scenario as a negative impact to their values. Under the cumulative scenario, significant employment and

economic development is likely to occur in the region. While this growth may occur over an extended period of time and may be only relatively short term in nature, some community growth would be inevitable. This is not unprecedented for the area. The regional economy has historically been dependant on resource extraction and has experienced periods of employment fluctuations.

## 5.3.16 Health and Safety

Cumulative effects resulting from the implementation any of the three alternatives of the Ferron Natural Gas Project in combination with the Price CBM Project and the RFD would mainly affect traffic safety and the probability of gas flowline ruptures. Other health and safety issues such as $H_2S$ releases, encountering abnormally high pressures and well fires are considered low probability events (see **Section 4.17**) and are independent of each other. The occurrence of one of these events would not have a cumulative effect on another event occurring.

Traffic during construction activities would be expected to increase by one to two percent over present levels on major roads near the Ferron Natural Gas Project Area. The level of development of the Price CBM Project would be approximately twice that of the Ferron Project. Therefore, it can be assumed that the traffic level on major roads leading to the Price CBM Project would increase by two to four percent. Because the Ferron and Price projects' construction activities would overlap for about three years, it can be assumed that the cumulative probability of traffic accidents during these three years of overlap could increase by about five percent on SR 10, the road that most of the vehicles would use traveling to both project areas from Price.

Extra wells constructed under the RFD would most likely be constructed after completion of the Price CBM and Ferron Natural Gas projects. Therefore, the RFD well construction would not cumulatively increase the probability of traffic accidents. However, the period of time when increased traffic accidents would continue through the construction phase of RFD wells.

The probability of a gas flowline rupture would cumulatively increase. According to the Department of Transportation (see **Section 4.17**), an average of one rupture annually could be expected for every 5,000 miles of pipeline. The pipeline construction level of development under the RFD would be approximately triple that of the Ferron Natural Gas Project. The probability of a pipeline rupture for the Ferron Natural Gas Project was estimated as one rupture over the lifetime of the Project. Therefore, over the lifetime of the RFD, it is estimated that three pipeline ruptures could occur.

# CHAPTER 6

# CONSULTATION WITH OTHERS

# *CHAPTER 6*
# *CONSULTATION WITH OTHERS*

The following list of organizations were contacted or consulted during the scoping process and preparation of the DEIS and FEIS.

**Federal Offices**

Advisory Council on Historic Preservation

U.S. Fish and Wildlife Service

U.S. Environmental Protection Agency

National Park Service

Natural Resource Conservation Service

U.S. Forest Service

BLM-National Applied Research and Science Center

Bureau of Indian Affairs

Bureau of Reclamation

Department of Interior - Office of Environmental Policy and Compliance

Federal Energy Regulatory Commission

U.S. Geological Survey

**State Offices**

Utah School and Institutional Trust Lands Administration

Utah State Historic Preservation Officer

Utah Department of Community and Economic Development

Utah Division of Wildlife Resources

Utah Division of Water Rights

Utah Department of Environmental Quality, Division of Air Quality

Utah Governor's Office of Planning and Budget

Utah Department of Transportation

Utah Division of Oil, Gas and Mining

Utah Division of Water Quality

**Local Offices**

Carbon County Commission

Emery County Commission

Emery County Planning Commission

Emery County Road Department

Price River Water Improvement District

**Churches**

Spanish Assembly of God Church

**Industry**

Anadarko Petroleum Corporation

Chandler and Associates, Inc.

Texaco Exploration and Production, Inc.

Questar Pipeline Company

Castle Valley Gas Producers' Association

Cooper Energy Services

River Gas Corporation

Waukesha

**Consultants**

EIS Consultants

Applied Hydrology Associates, Inc.

Intermountain Ecosystems, LC

Rocky Mountain Resolve

**Tribes**

The following Tribes, Groups and Bands were contacted by letter in May, 1997 during scoping of this document to inform them of the proposed project and request information on concerns:

Uintah & Ouray Tribal Business Committee
Fort Duchesne, Utah

Skull Valley General Council
Gantsville, Utah

Goshute Business Council
Ibapah, Utah

Paiute Indian Tribe of Utah Tribal Council
Cedar City, Utah

Southern Ute Tribe
Ignacio, Colorado

Ute Mountain Ute Tribe
Towaoc, Colorado

Navajo Nation
Window Rock, Arizona

Hopi Tribal Council
Kykotsmovi, Arizona

San Juan Southern Paiute Council
Tuba City, Arizona

Kaibab Paiute Tribal Council
Fredonia, Arizona

Jicarilla Apache Tribe
Dulce, New Mexico

Pueblo of Taos
Taos, New Mexico

Pueblo of Tesuque
Santa Fe, New Mexico

Pueblo of Zia
Zia Pueblo, New Mexico

Pueblo fo Zuni
Zuni, New Mexico

Pueblo of Conchiti
Conchiti, New Mexico

Pueblo of Isleta
Isleta, New Mexico

Pueblo of Jemez
Jemez, New Mexico

Pueblo of Conchiti
Conchiti, New Mexico

Pueblo of Isleta
Isleta, New Mexico

Pueblo of Jemez
Jemez, New Mexico

Jicarilla Apache Tribe
Dulce, New Mexico

Pueblo of Laguna
Laguna, New Mexico

Pueblo of Nambe
Santa Fe, New Mexico

Pueblo of Picuris
Penasco, New Mexico

Pueblo of Pajoaque
Santa Fe, New Mexico

Pueblo of Sandia
Bernalillo, New Mexico

Pueblo of San Felipe
San Felipe, New Mexico

Pueblo of San Ildefonso
Santa Fe, New Mexico

Pueblo of San Juan
San Juan Pueblo, New Mexico

Pueblo of Santa Ana
Bernalillo, New Mexico

Pueblo of Santa Clara
Espanola, New Mexico

Pueblo of Santo Domingo
Santa Domingo, New Mexico

Pueblo of Laguna
Laguna, New Mexico

Pueblo of Nambe
Santa Fe, New Mexico

Pueblo of Picuris
Penasco, New Mexico

Pueblo of Pajoaque
Santa Fe, New Mexico

Pueblo of Sandia
Bernalillo, New Mexico

Pueblo of San Felipe
San Felipe, New Mexico

Pueblo of San Ildefonso
Santa Fe, New Mexico

Pueblo of San Juan
San Juan Pueblo, New Mexico

Pueblo of Santa Ana
Bernalillo, New Mexico

Pueblo of Santa Clara
Espanola, New Mexico

Pueblo of Santo Domingo
Santa Domingo, New Mexico

Pueblo of Acoma
Pueblo of Acoma, New Mexico

Ysleta del Sur Pueblo
El Paso, Texas

Burns-Paiute General Council
Burns, Oregon

Timbisha Shoshone Tribe
Death Valley, California

Northwestern Band Of Shoshoni Nation
Blackfoot, Idaho

Fort Hall Business Council
Fort Hall, Idaho

Duckwater Shoshone Tribal Council
Dukwater,Nevada

Ely Colony Council
Ely, Nevada

Fallon Business Council
Fallon, Nevada

Fort McDermitt Tribal Council
McDermitt, Nevada

Tribal Council of the Te-Moak Western Tribe
Elko, Nevada

Elko Band Council
Elko, Nevada

South Fork Band Council
Lee, Nevada

Battle Mountain Band Council
Battle Mountain, Nevada

Wells Indian Colony Band Council
Wells, Nevada

Walker River Paiute Tribal Council
Schurz, Nevada

Washoe Tribal Council
Gardnerville, Nevada

Pyramid Lake Paiute Tribal Council
Nixon, Nevada

Reno-Sparks Tribal Council
Reno, Nevada

Shoshone Paiute Business Council
Owyhee, Nevada

Summit Lake Paiute Council
Winnemucca, Nevada

Las Vegas Tribal Council
Las Vegas, Nevada

Lovelock Tribal Council
Lovelock, Nevada

Moapa Band of Paiute
Moapa, Nevada

Shoshone Business Council
Fort Washakie, Wyoming

Comanche Business Council
Lawton, Oklahoma

# CHAPTER 7

# LIST OF PREPARERS

# CHAPTER 7
# LIST OF PREPARERS

This final EIS was prepared by Greystone, a third-party contract, under the direction of the BLM. Representatives from the cooperating agencies contributed to and participated in the NEPA process. Technical input regarding the proposed project was provided by the Companies. The following sections present the names of individuals and their area or areas of responsibility from the BLM and Greystone who were involved in the preparation of the final EIS. Brief biographical information also is provided.

**Table 7–1**
**List of Preparers for BLM**

| Name | Education/Experience | Responsibility |
|---|---|---|
| George Diwachak | B.S. Environmental Sciences<br>21 Years Professional Experience | Project Manager, Hazardous Materials, Waste |
| Jeff Williams | M.A. Economics<br>6 Years Professional Experience | Assistant Project Manager, Socioeconomics |
| Ann Marie Aubry | B.S. Geology<br>16 Years Professional Experience | Geology |
| Don Gray | M.S. Geography<br>24 Years Professional Experience | Mapping |
| Joan Hubert | B.A. English<br>13 Years Professional Experience | Land Use |
| Gil Hunt | B.S. Geology<br>19 Years Professional Experience | Water Resources, UDOGM Rep |
| Ray Jenson | B.S. Range Science<br>33 Years Professional Experience | Livestock, Vegetation |
| Mike Kaminski | B.S. Biological Science<br>15 Years Professional Experience | Soils, Reclamation |
| Jaynee Levy | M.S. Forest Sciences<br>25 Years Professional Experience | Recreation, VRM |
| Wayne Ludington | B.S. Wildlife Management<br>22 Years Professional Experience | Wildlife |
| Al McKee | B.S. Petroleum Engineering<br>15 Years Professional Experience | Health & Safety, Noise, Gas Operations |
| Blaine Miller | M.S. Archaeology<br>27 Years Professional Experience | Cultural Resources |
| Rod Player | M.S. Range Wildlife Relationships<br>20 Years Professional Experience | Forest Service Rep |
| Neil Simmons | B.S. Geological Engineering<br>26 Years Professional Experience | GIS |

**Table 7–1 (continued)**
**List of Preparers for BLM**

| Name | Education/Experience | Responsibility |
|---|---|---|
| George Tetreault | B.S. Metallurgical Engineering<br>19 Years Professional Experience | Coal |
| William Wagner | Ph.D. Radiation Bio-Science<br>33 Years Professional Experience | Air Quality, Noise |
| Chris Wehrli | B.A. History<br>1 Year Professional Experience | Land Use |

**Table 7–2**
**List of Preparers for Greystone**

| Name | Education/Experience | Responsibility |
|---|---|---|
| Randy Schroeder | M.S. Environmental Science<br>B.S. Natural Resource Management<br>21 Years Professional Experience | Principal-in-Charge; Review; Environmental Compliance; Environmental Assessment Documentation |
| David Cameron | M.S. Terrestrial Ecology<br>B.A. Biology<br>19 Years of Professional Experience | Project Manager; Wildlife; T&E |
| Don Douglas | M.S. Meteorology<br>28 Years Professional Experience | Assistant Project Manager; Air Quality; Noise |
| Cathy Begej | B.S. Environmental Geology<br>19 Years Professional Experience | Water Resources |
| Mike Bonar | B.S. Environmental Biology<br>8 Years Professional Experience | Wildlife; T&E; Biological Assessment |
| Ed Fleming | B.S. Aquatic Biology<br>10 Years Professional Experience | Aquatic Resources |
| John Forsythe | B.A. Environmental Studies and Planning | Socioeconomics |
| Susan Hoffmeister | M.S. Applied Ecology<br>B.S. Environmental Biology<br>7 Years Professional Experience | Vegetation; Wetlands; Floodplains; T&E |
| Larry Keith | B.L.A. Landscape Architecture<br>23 Years Professional Experience | Visual Resources |
| Will Mahoney | M.A. Geography<br>B.A. Geology<br>16 Years Professional Experience | Soils; Geology |
| Nick Mathis | B.S. Geology<br>10 years Professional Experience | Hazardous Materials |

**Table 7–2 (continued)**
**List of Preparers for Greystone**

| Name | Education/Experience | Responsibility |
|---|---|---|
| Brad Norling | M.S. Wildlife Biology<br>B.A. Wildlife Biology<br>11 Years Professional Experience | GIS, Wildlife, T&E |
| Jack Sosebee | M.S. Environmental Studies<br>B.S. Chemistry<br>B.A. Geology<br>24 Years Professional Experience | Groundwater |
| Carl Späth | Ph.D. Anthropology<br>M.A. Anthropology<br>B.A. Anthropology<br>27 Years Professional Experience | Archaeology; Cultural Resources |
| Lisa Welch | B.S. Earth Sciences<br>6 Years Professional Experience | Land Use; Recreation; Visual Resources |

# CHAPTER 8

# GLOSSARY AND ACRONYMS

# CHAPTER 8
# GLOSSARY AND ACRONYMS

**Acre-feet** – The volume of liquid or solid required to cover one acre to a depth of one foot, or 43,560 cubic feet; measure for volumes of water, reservoir rock, etc.

**Active Raptor Nest** – a nest documented as occupied by a raptor within the 3-year period preceeding proposed construction.

**Adsorb** – A process by which molecules are taken up on the surface of a solid by chemical or physical action. Large amounts of gases, for example, may be adsorbed on the surface of a porous material such as charcoal.

**Ad valorem** – A tax on items which is imposed at a rate percent of value.

**Affected Environment** – The natural, physical, and human-related environment that is sensitive to changes due to proposed actions; the environment under the administration of a land management agency.

**Agency** – The land management agency, in this case the BLM.

**Air Dispersion Modeling** – A complex computer model that calculates ambient concentrations of air pollutants.

**Allotment** – A unit of land suitable and available for livestock grazing that is managed as one grazing unit.

**Alluvial** – Deposited by a stream.

**Alluvial Fan** – A fan-shaped deposit of unsorted stream sand and gravel located where an ephemeral stream issues from a relatively steep mountain valley on to a relatively flat plain.

**Alluvial Valley** – A valley containing stream-deposited silt, sand, and gravel.

**Alluvium** – Unconsolidated or poorly consolidated gravel sands and clays, deposited by streams and rivers on riverbeds, floodplains, and alluvial fans.

**Ambient** – The environment as it exists at the point of measurement and against which changes or impacts are measured.

**Ambient Concentration** – The mass of a pollutant in a given volume of air. It is typically measured as micrograms of pollutant per cubic meter of air.

**Amine Unit** – A facility in which "sour" natural gas is contacted with amine solutions to remove hydrogen sulfide and carbon dioxide (thus "sweetening"). The amine solutions react with the unwanted gas constituents to form other compounds which can then be removed.

**Ancillary Facility** – Additional support structures required to develop the mineral resource. In the case of CBD development, this consists of gas compressor facilities, disposal wells, roads, collection pipelines, and electric transmission lines.

**Anhydrite** – An evaporite mineral composed of calcium sulfate and found in sedimentary rocks associated with gypsum.

**Animal Month** – For a cow/calf operations, it is the amount of forage consumed by a 1,000 pound cow and calf (less than 6 months of age) over a one month period. It is approximately 1,050 pounds of forage.

**Animal Unit Months (AUMs)** – For the BLM allotments, it is the amount of forage consumed by a 1,000 pound cow over a one month period, approximately 800 pounds of forage. An animal unit month is then multiplied by 1.32 for a cow/calf operation and is equivalent to an animal month for purposes of this document.

**Anion** – A negative ion, which in electrolysis, travels to the anode and is there discharged.

**Annulus** – The space between the well casing and the boundary of the hole.

**Antiquities** – A general term for archaeological or paleontological resources which are at least 100 years of age and which tangibly represent or have the potential to yield information on historical or prehistoric cultures, or extinct plants and animals.

**Aquatic Resources** – Biological resources (plants, animals, and other life forms) present in or dependent on streams, lakes, and other surface water.

**Aquifer** – A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

**Assemblage** – A group of rocks grouped together by age or similar origin.

**Authorizing Officer** – Person designated by the Agency as being in the position to speak for and commit the agency to action.

**Avoidance Area** – An environmentally sensitive area designated by the Agency. Authorizations would be granted only in cases where there is a prevailing need and no practical alternative exists, and then only with provisions to protect the sensitive resources.

**Azimuth** – Horizontal direction expressed as the angular distance between the direction of a fixed point and the direction of the object.

**Background** – The viewing area of a distance zone that lies beyond the foreground-middleground. Usually from a minimum of 3 to 5 miles to a maximum of about 15 miles from a travel route, use area, or other observer position. Atmospheric conditions in some areas may limit the maximum to about 8 miles or increase it beyond 15 miles.

**Best Management Practices (BMP)** – a practice or combination of practices determined by the state to be the most effective and practicable (including technological, economic and institutional considerations)

means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

**Big Game** – Large species of wildlife which are managed for hunting.

**Biotic** – Pertaining to life and living organisms.

**Blow Out Prevention Equipment** – A series of valves on the drill rig which can close down the well in the event that the drill bit penetrates extreme pressure zones.

**Bond** – Financial guarantee to ensure compliance with the Mineral Leasing Act, including complete and timely plugging of wells, reclamation of lands or adversely affected surface waters, payment of royalties, assessments or penalties.

**Broadcast Seeding** – Distribution of seed by a fan spreader or by hand spreading.

**Canopy** – The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

**Carbon Dioxide ($CO_2$)** – A non-hydrocarbon, corrosive gas that occurs naturally in the gaseous phase in the natural gas reservoir, or is injected into the reservoir in connection with pressure maintenance, gas cycling, or other secondary or enhanced recovery projects.

**CAS number** – chemical abstract number tracking number

**Casing** – (N) A steel pipe which maintains the opening of a drill hole. (V) The act of installing pipe within a well.

**Catalyst** – A substance that enables a chemical reaction to proceed at a usually faster rate or under different conditions than otherwise possible.

**Cation** – A positive ion, which in electrolysis, travels to the cathode and is discharged there.

**Cavity Pump** – A high pressure, low flow positive displacement pump.

**Cement Bond Log** – A geophysical log which confirms the continuous placement of cement within the annulus of the well, to isolate the formation of interest and to prevent commingling of different aquifers around the casing.

**Central Processing Unit** – A centralized site where gas compression occurs prior to transport in gas delivery lines.

**Central Production Facility** – All storage, separation, treating, dehydration, power supply, compression, pumping, metering, monitoring, flowline, and other equipment directly associated with gas wells.

**Characteristic Landscape** – The established landscape within an area being viewed. The term does not necessarily mean a naturalistic character, but may refer to features of the cultural landscape, such as a farming community, an urban landscape, or other landscape that has an identifiable character.

**Class I, II Whitewater** – Ranking of boating difficulty. Class I is Easy. Fast moving water with riffles and small waves. Few obstructions. Risk to swimmers is slight; self-rescue is easy. Class II is Novice. Simple rapids with wide channels which are evident without scouting. Occasional maneuvering may be required but obstructions are easily missed. Swimmers are seldom injured and group assistance is seldom needed.

**Climatology** – Science of climate and its causes.

**Coalbed** – A seam or stratum of coal parallel to the rock stratification.

**CFR** – Code of Federal Regulations, the compilation of federal regulations adopted by federal agencies through a rule-making process.

**Colluvial** – Consisting of a mixture of soil and angular fragments of rock which have accumulated at the foot and on slopes of mountainsides under the influence of gravity.

**Colluvium** – A mixture of soil and angular fragments of rock which have accumulated at the foot and on slopes of mountainsides under the influence of gravity.

**Community (plant community)** – An assembly of plants living together, reflecting no particular ecological status.

**Community Types (vegetation)** – A group of plants living in a specific region under relatively similar conditions.

**Compressor** – Equipment (electrically or diesel-driven) used to increase the pressure on the produced gas to move it into transmission lines or into storage.

**Conglomerate** – A sedimentary rock comprised of an unstratified mixture or stratified layers of cobbles, gravel, and sand.

**Coniferous** – Referring to a cone-bearing, usually evergreen, tree.

**Coniferous Forest** – A forest dominated by cone-bearing, usually evergreen, trees.

**Contrast** – The effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.

**Criteria Pollutants** – Air pollutants for which the EPA has established State and National Ambient Air Quality Standards. These include particulate matter ($PM_{10}$), nitrogen oxides (NOx), sulfur dioxide ($SO_2$), carbon monoxide (CO), and volatile organic compounds (VOC).

**Critical Habitat** – Sensitive use areas that are of limited abundance and/or possess unique qualities, thereby constituting irreplaceable, critically necessary habitat.

**Crucial Habitat** – Lands on which wildlife or plant species not federally listed as threatened or endangered depend for survival. No alternative suitable habitat is available because of some site limiting factor(s).

**Cubic Foot** – The volume of gas contained in one cubic foot of space at a standard pressure base of 14.7 psia and a standard temperature base of 60 degrees Fahrenheit.

**Cultural Resources** – The archaeological and historical remains of human occupation or use. Includes any manufactured objects, such as tools or buildings. May also include objects, sites, or geological/geographical locations significant to Native Americans.

**Cultural Significance** – Is embodied in those qualities of prehistoric or historic districts, sites, buildings, structures or objects that meet the National Register Criteria for Evaluation (36CFR60.4). The application of these criteria is explained in the National Register Bulletin 15, distributed by the National Park Service.

**Cumulative Effects** – As defined by 40 CFR 1508.7, cumulative effects are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

**dBA** – The sound pressure levels in decibels measured with a frequency weighing network corresponding to the A-scale on a standard sound level meter. The A-scale tends to suppress lower frequencies, e.g., below 1,000 Hz.

**Decibels (dBA)** – Units for describing amplitude of sound frequencies to which the human ear is sensitive.

**Deciduous** – Trees or shrubs which lose their leaves each year during a cold or dry season.

**Deciduous Forest** – A forest characterized by trees and shrubs which lose their leaves each year during a cold or dry season.

**Decommissioning** – Generally, the removal of a facility or piece of equipment from service, or a change in status from active to inactive.

**Demographic** – Pertaining to the study of human population characteristics including size, growth rates, density, distribution, migration, birth rates, and mortality rates.

**Desorb** – To restore an adsorbed substance.

**Direct Effects** – As defined by 40 CFR 1508.9, these are effects which are caused by the action and occur at the same time and place as the action. Synonymous with direct impacts.

**Direct Impact Area** – An area analyzed for the effects of an action that would occur at the same place in time.

**Directional Drilling** – The intentional deviation of a wellbore from vertical to reach subsurface areas off to one side from the drilling site.

**Discharge** – The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second (cfs), gallons per minute (gpm), or million gallons per day (mgd).

**Dispersed Recreation** – A general term referring to recreation use outside the developed recreation sites. This includes activities such as scenic driving, hunting, hiking, OHV use, and biking.

**Disposal Well** – Any well used for the disposal or air, gas, water or other substance into any underground stratum.

**Distance Zones** – Areas of landscapes denoted by specified distances from the observer. Used as a frame of reference in which to discuss landscape characteristics or activities of man.

Background (bg) – Area located from 3–5 miles to infinity from viewer.

Middleground (mg) – Area located from 0.25–0.50 to 3–5 miles from the viewer.

Foreground (fg) – The detailed landscape found within 0 to 0.25–0.50 mile from the viewer.

**Disturbance** – An event that changes the local environment by removing organisms or opening up an area, facilitating colonization by new, often different, organisms.

**Disturbed Area** – Area where natural vegetation and soils have been removed or disrupted.

**Diversity** – The distribution and abundance of different plant and animal communities and species within the area covered by a Land and Resource Management Plan.

**Drainage** – Natural channel through which water flows some time of the year. Natural and artificial means for effecting discharge of water as by a system of surface and subsurface passages.

**Drill Bit** – The cutting devise used to drill a well. It is typically made of hardened steel, and may have industrial grade diamond components.

**Drilling Mud** – The circulating fluid used to bring cuttings out of the well bore, cool the drill bit, provide hole stability and pressure control. Drilling mud includes a number of additives to maintain the mud at desired viscosities and weights. Some additives which may be used are caustic, toxic, or acidic.

**Earthquake** – Sudden movement of the earth's crust resulting from faulting, volcanism, or other mechanisms.

**Ecosystem** – An interacting system of organisms considered together with their environment for example, marsh, watershed, and stream ecosystems.

**Ecotone** – The boundary or transition zone between adjacent plant communities, often delineating different habitat types.

**Effects** – Environmental consequences as a result of a proposed or alternative action. Included are direct effects, which are caused by the action and occur at the same time and place, and indirect effects, which are caused by the action and are later in time or further removed in distance but which are still reasonably foreseeable. Also referred to as impacts.

**Endangered Species** – Any species of animal or plant which is in danger of extinction throughout all or significant portions of its range and has been designated "endangered" in the Federal Register by the Secretary of the Interior. Disturbance of the habitat of endangered species is prohibited by the Endangered Species Act of 1973, as amended.

**Endemic** – Confined naturally to a particular geographic area. Often used in opposition to the word epidemic.

**Environment** – The aggregate of physical, biological, economic and social factors affecting organisms in an area.

**Environmental Analysis** – An analysis of alternative actions and their predictable environmental effects, including physical, biological, economic, and social consequences and their interactions; short- and long-term effects; direct, indirect, and cumulative effects.

**Environmental Assessment (EA)** – A concise public document which serves to (a) Briefly provide sufficient evidence and analysis for determining whether to prepare an EIS or a Finding of No Significant Impact; (b) Aid an agency's compliance with NEPA when no EIS is necessary; (c) Facilitate preparation of an EIS when necessary.

**Environmental Impact Statement (EIS)** – An analysis of alternative actions and their predictable environmental effects, including physical, biological, economic, and social consequences and their interactions; short- and long-term effects; direct, indirect, and cumulative effects.

**Environmental Justice** – Executive Order 12898 (February 11, 1994) mandates Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

**Ephemeral Drainage** – A drainage area or a stream that has no base flow. Water flows for a short time each year but only in direct response to rainfall or snowmelt events.

**Erosion** – Detachment or movement of soil or rock fragments by water, wind, ice, or gravity. Accelerated erosion is much more rapid than normal, natural or geologic erosion, primarily as a result of the influence of activities of man, animals, or natural catastrophes.

**Escarpment** – An inland cliff or steep slope, formed by the erosion of inclined strata of hard rocks, or possibly as a direct result of a fault.

**Evaporation Pond** – An industrial containment area designed to allow briny water to evaporate by using solar energy.

**Exclusion Area** – An area where no surface occupancy would be allowed. This stipulation would prevent well pads, roads, and/or ancillary facilities from being constructed in specific areas.

**Exploration** – The search for economic deposits of minerals, ore, and other materials through practices of geology, geochemistry, geophysics, drilling, and/or mapping.

**Eyrie** – A nesting and roosting area for raptors, typically at height and secluded (also Aeries).

**Fault** – A fracture in bedrock along which there has been vertical and/or horizontal movement caused by differential forces in the earth's crust.

**Faulting** – Relative displacement of adjacent bedrock along a fracture.

**Fisheries** – Streams and lakes used for fishing.

**Fisheries Habitat** – streams, lakes and reservoirs that support fish.

**Flaring** – The controlled ignition of natural gas at a well head.

**Floodplain** – That portion of a river valley, adjacent to the channel, which is built of recently deposited sediments and is covered with water when the river overflows its banks at flood stages.

**Fluvial** – Comprehensive term for river processes.

**Footprint** – The actual surface area physically disturbed by oil and gas operations and ancillary facilities.

**Forage** – Vegetation used for food by wildlife, particularly big game wildlife and domestic livestock.

**Forb** – A broad-leaved flowering plant.

**Foreground-Middleground** – The area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape, and vegetation is apparent only in pattern or outline.

**Frac Fluids** – A mixture of water, guar gel, sand and pH and bacterial control chemicals used in the development of a well for fluid extraction.

**Fracturing** – A method of stimulating well production by increasing the permeability of the producing formation. Fracture fluids which include propping agents such as sand or glass beads are pumped into the formations under extremely high hydraulic pressure. The propping agents facilitate the formation of channels to release water and gas into well.

**Fugitive Dust** – Dust particles suspended randomly in the air from road travel, excavation, and rock loading operations.

**Game Species** – Animals commonly hunted for food or sport.

**Gas Venting** – The release of gas into the atmosphere following well development and prior to successful installation of the collection pipeline system.

**Geotechnical** – A branch of engineering concerned with the engineering design aspects of slope stability, settlement, earth pressures, bearing capacity, seepage control, and erosion.

**Glacial Outwash** – The material deposited by streams flowing within a glacier, and by melt-waters during times of glacial advance and retreat.

**Grade** – A slope stated in terms of feet per mile or as feet per feet (percent); the content of precious metals per volume of rock (ounces per ton).

**Ground Water** – All subsurface water, especially that as distinct from surface water portion in the zone of saturation.

**Habitat** – The place or type of site where a plant or animal naturally or normally lives and grows. Includes all biotic, climatic, and soils conditions, or other environmental influences affecting living conditions.

**Habitat Diversity** – the distribution and abundance of different plant and animal communities and species within a specific area..

**Habitat Fragmentation** – The process by which habitats are increasingly subdivided into smaller units, resulting in their increased isolation as well as loss of total habitat area.

**Habitat Type** – The aggregate of all areas that support or can support the same primary vegetation at climax.

**Herbaceous** – The plant strata which contain soft, not woody, stemmed plants that die to the ground in winter.

**Historic Landscape** – A type of historic district that is a geographic area, or the sites, buildings, structures, natural and cultural features, and objects within a defined geographic area, that together represent a defined historic or prehistoric theme and period. The definition of a historic landscape includes: (1) a significant theme (linkage or continuity) such as a particular economic activity or ethnic group, (2) definitions of those sites, buildings, structures, natural features, cultural landscape modifications, and objects (property types) which represent the theme, and (3) a cultural period or date range.

**Hydrogen Sulfide ($H_2S$)** – A flammable, poisonous, corrosive gas with an odor suggestive of rotten eggs, which can occur naturally in the gaseous phase in natural gas reservoirs.

**Hydrologic Subarea** – The contributing watershed to a specific reach of a river.

**Hydrology** – A science that deals with the properties, distribution, and circulation of surface and subsurface water.

**Hydrostatic Testing** – Testing of the integrity of a newly placed, but uncovered pipeline for leaks. The pipeline is filled with water and pressurized to operating pressures, and the pipeline is visually inspected.

**Impoundment** – The accumulation of any form of water in a reservoir or other storage area.

**Indemnify** – To secure against, or to provide compensation for incurred loss, hurt, or damage.

**Indirect Effects** – As defined by 40 CFR 1508.8, these are effects which are caused by the action but occur later in time or are removed in distance from the action, but are still reasonably foreseeable. Synonymous with indirect impacts.

**Infiltration** – The movement of water or some other liquid into the soil or rock through pores or other openings.

**Infrastructure** – The basic framework or underlying foundation of a community including road networks, electric and gas distribution, water and sanitation services, and facilities.

**Intermittent Stream** – A stream which flows only at certain times of the year when it receives water from alluvial ground water, springs or from some surface source such as melting snow in mountainous areas.

**Ion** – An atom or group of atoms that have an excess or a deficiency of electrons and is thus electrically charged. An ion may be formed in a gas or in a solution and is capable of carrying current through either medium.

**Irretrievable** – Applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

**Irreversible** – Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity and aspen regeneration. Irreversible also includes loss of future options.

**Key Observation Point (KOP)** – Critical viewpoints that are usually along commonly traveled routes or at other likely observation points.

**Landform** – Any physical, recognizable form or feature of the Earth's surface, having a characteristic shape and produced by natural causes. Includes major features such as plains, plateaus, and mountains, and minor features, such as hills, valleys, slopes, canyons, arroyos, and alluvial fans.

**Landscape Character** – The arrangement of a particular landscape as formed by the variety and intensity of the landscape features as defined as the four basic elements (form, line, color, and texture). These factors give the area a distinctive quality that distinguishes it from its immediate surroundings.

**Landslide** – A perceptible downhill sliding or falling of a mass of soil and rock lubricated by moisture or snow.

**Land Use** – Land uses determined for a given area that establish the types of activities allowed (e.g., mining, agriculture, timber production, residential, industrial).

**Lease** – Any contract, profit-share arrangement, joint venture or other agreement issued or approved by the United States under a mineral leasing law that authorizes exploration for, extraction of or removal of oil or gas.

**Lek** – An area used by sage grouse for mating displays (strutting ground).

**Lithic Scatter** – Is a surface scatter of cultural artifacts and debris that consists entirely of lithic (i.e., stone) tools and chipped stone debris. This is a common prehistoric site type that is contrasted to a cultural material scatter, which contains other or additional artifact types such as pottery or bone artifacts, to a camp which contains habitation features, such as hearths, storage features or occupation features, or to other site types that contain different artifacts or features.

**Loam** – A mixture of sand, silt, and clay containing between 7 and 27 percent clay, 28 to 50 percent silt, and less than 50 percent sand.

**Locus** – Is a discrete place or physical location generally used in describing the qualities of a site. When the term is used in contrast to a site, it refers to a locality containing the traces of a brief, limited or transient cultural activity.

**Long-Term Impacts** – For the purpose of the Ferron Natural Gas EIS analysis, long-term effects generally last beyond the construction period.

**LRMP** – a program for the management of the National Forest's renewable resources. Each unit of the National Forest System is required by the National Forest Management Act to prepare a Land and Resource Management Plan every ten to fifteen years.

**Macroinvertebrates** – Aquatic invertebrate animals that live on or in the surface of the substrate of streams or lakes.

**Manageability/Boundaries** – one of the six roadless area characteristics and wilderness features; relates to the ability of the Forest Service to manage an area to meet size criteria and the roadless area characteristics and wilderness features of natural integrity, apparent naturalness, remoteness, solitude, and special features. Changes in the shape of an area influence how it can be managed, as many of the six elements may be compromised. To meet the requirements of size, an area must be at least 5,000 acres.

**Management Area** – an area composed of aggregate pieces of land (generally several to many analysis areas) to which a given management objective and prescriptions are applied.

**Management Direction** – a statement of multiple use and other goals and objectives, along with the associated management prescriptions and standards and guidelines to direct resource management.

**Median** – A value in an ordered set of values above and below which there are an equal number of other values.

**Mesic** – A habitat characterized by moderate moisture and temperature conditions and by a profusion of plant life.

**Methane ($CH_4$)** – The simplest hydrocarbon; natural gas is nearly pure methane.

**Mitigate** – To lessen the severity.

**Mitigation** – Actions to avoid, minimize, reduce, eliminate, or rectify the impact of a management practice.

**Modified Mercalli Intensity Scale** – A qualitative measurement scale describing the intensity (degree of shaking) felt by people, structures, and the ground. Intensities range from I (felt by few, if any, people) to XII (damage total).

**Monitor** – To systematically and repeatedly watch, observe or measure environmental conditions in order to track changes.

**Monoculture** – An area characterized by the vegetation consisting of a single species, e.g. a wheat field.

**Mottled** – Marked by different shaded spots.

**National Register of Historic Places** – A list, maintained by the National Park Service, of areas which have been designated as being of historical significance.

**Native Species** – Plants that originated in the area in which they are found, i.e., they naturally occur in that area.

**Natural Gas** – Those hydrocarbons, other than oil and other than natural gas liquids separated from natural gas, that occur naturally in the gaseous phase in the reservoir and are produced and recovered at the wellhead in gaseous from. Natural gas includes coalbed methane gas.

**NEPA** – The National Environmental Policy Act of 1969. It is the national charter for protection of the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations at 40 CFR 1500–1508 implement the act.

**Nesting Substrate** – The site on which a nest is placed such as a tree, cliff, or ground.

**Non-emergency Workover Operations** – workover operations to correct or reverse a gradual loss of production over time (loss of production of 20 percent or less over a 60-day period). Emergency workover operations are defined as downhole equipment failure problems or workover operations necessary to avoid shut-in of the well or to avoid an immediate safety or environmental problem. Loss of production greater than 20 percent within a 60-day period of time is indicative of pump failure and would be considered an emergency workover operation.

**Noxious Weeds** – An alien, introduced, or exotic undesirable species that is aggressive and overly-competitive with more desirable native species.

**NTU** – nephelometric turbidity units (see WATER TURBIDITY).

**One-hundred year, twenty four-hour storm event (100-year, 24-hour)** – The maximum precipitation predicted to occur within any 24-hour period over a period of 100 years; a storm with a one percent probability of occurrence.

**Ozone** – A molecule containing three oxygen atoms ($O_3$) produced by passage of an electrical spark through air or oxygen ($O_2$).

**Paleontology** – The science which deals with the history and evolution of life on earth.

**Passerine** – A taxonomic order which includes perching birds and songbirds.

**Peak Flow** – The greatest flow attained during melting of winter snowpack or during a large precipitation event.

**Pediment** – An erosional surface of low relief, often covered with a veneer of gravel, forming at the foot of a mountain range.

**Perennial** – A plant whose life cycle lasts longer than two years. The tops of herbaceous perennials die down at the end of the growing season, buds, roots, and underground portions persist.

**Perennial Stream** – A stream or reach of a stream that flows throughout the year.

**Permeability** – The capacity of a soil or groundwater aquifer to transmit water.

**Permeable** – The property or capacity of a porous rock, sediment, or soil to transmit a liquid.

**pH** – The negative $\log_{10}$ of the hydrogen ion activity in solution; a measure of acidity or basicity of a solution.

**Physiographic** – Pertaining to the genesis and evolution of landforms.

**Pipe Stringing** – Linking casing together to form a continuous string to the target formation. Twenty-foot lengths of casing are screwed together.

**$PM_{10}$** – Airborne suspended particles with an aerodynamic diameter of 10 microns or less.

**Porosity** – The voids or openings in geological materials.

**Potentiometric surface** – A surface that represents the total head in an aquifer; it represents the height at which the water level stands in tightly cased wells that penetrate the aquifer.

**Preservation** – Use of an acid or base to stabilize the chemical speciation within a water quality sample.

**Produced Water** – Formation water pumped during the development of a gas well.

**Productivity** – In reference to vegetation, productivity is the measure of live and dead accumulated plant materials.

**Project Alternatives** – Alternatives to the proposed Project developed through the NEPA process.

**Range** – Land producing native forage for animal consumption and lands that are revegetated naturally or artificially to provide forage cover that is managed like native vegetation, which are amenable to certain range management principles or practices.

**Raptor** – A bird of prey with sharp talons and strongly curved beaks which preys on living animals (e.g., eagles, hawks, falcons, and owls).

**Rearing Habitat** – The river or stream areas where juvenile salmonids must find food and shelter to survive for a period of time.

**Reciprocating Pump** – A pump with a plunger that moves up and down in the well bore. The plunger has a valve in it that opens on the downstroke and closes on the upstroke thus mechanically lifting water or gas in the well.

**Recharge** – Replenishment of the water supply in an aquifer through the outcrop or along fracture lines.

**Reclamation** – The process of restoring disturbed areas using any of several methods; recontouring, spreading topsoil or growth medium, seeding, and planting, among others.

**Recontouring** – Restoration of the natural topographic contours by reclamation measures, particularly in reference to roads.

**Record of Decision (ROD)** – A decision document for an Environmental Impact Statement or Supplemental EIS that publicly and officially discloses the responsible official's decision regarding the actions proposed in the Environmental Impact Statement and their implementation.

**Recreation Opportunity Spectrum (ROS) Settings** – A system of measuring the land's ability to meet the expectations of recreation users. Six recreation categories, from primitive (natural) to urban (highly modified) describe the activities, settings and experiences an area offers. The following categories may be found in or near the analysis area:

Urban – a highly modified environment, although the background may have natural elements. Sights and sounds of man predominate, and large numbers of users can be expected.

Rural – an area characterized by the sights and sounds of rural residential and agricultural land uses. The interaction between users is often moderate to high.

Roaded Natural – a road corridor with a landscape that is characterized as natural or natural appearing. The road has moderate to high use.

Semi-Primitive Motorized – a natural area predominantly unmodified by man. There are opportunities for isolation from the sights and sounds of man, but occasional evidence of other area users.

**Recreation Visitor Day** – A measurement equivalent to 1 person recreating for 12 hours or several people for a total of 12 hours.

**Reserve Pit** – A pit prepared on a well pad prior to drilling to use for waste water retention, evaporation and disposal. Waste waters will have a fine solids component.

**Reserves** – Identified resources of mineral-bearing rock from which the mineral can be extracted profitably with existing technology and under present economic conditions.

**Residuum** – Unconsolidated material which accumulates by weathering of parent material in place.

**Resources (geologic)** – Reserves plus all other mineral deposits that may eventually become available – either known deposits that are not recoverable at present, or unknown deposits, that may be inferred to exist but have not yet been discovered.

**Riffle** – A shallow section of stream with rapid current and a surface broken by gravel, rubble, or boulders.

**Rights-of-Way (ROWs)** – An accurately located strip of land with defined width, point of beginning, and point of ending. It is the area within which the user has authority to conduct operations approved or granted by the landowner in an authorizing document, such as a permit, easement, lease, license, or Memorandum of Understanding.

**Riparian** – Land areas which are directly influenced by water. They usually have visible vegetative or physical characteristics showing this water influence. Streamsides, lake borders, or marshes are typical riparian areas.

**Riparian Ecosystem** – a transition between the aquatic ecosystem and adjacent upland terrestrial ecosystem; identified by soil characteristics and distinctive vegetation communities that require free or unbounded water.

**Rockfall** – Rapid fall of a detached piece of bedrock from a cliff or steep slope.

**Roosting** – To rest or sleep in a roost. A bird will typically use the same roost over an extended period of time.

**Runoff** – That part of precipitation that appears in surface streams; Precipitation that is not retained on the site where it falls and is not absorbed by the soil.

**Salmonidae** – A family of fish which includes salmon and trout.

**Salmonid Spawning Areas** – Waters which provide or could provide a habitat for active self-propagating populations of salmonid fishes.

**Scatter (archeological)** – Random evidence of prior disturbance that is distributed about an area rather than concentrated in a single location.

**Scoping** – Procedures by which agencies determine the extent of analysis necessary for a proposed action, (i.e., the range of actions, alternatives, and impacts to be addressed; identification of significant issues related to a proposed action; and the depth of environmental analysis, data, and task assignments needed).

**Sedge** – Plants which resemble grasses but have hollow rather than woody stems.

**Sediment** – Soil or rock particles that have been transported to stream channels or other bodies of water. Sediment input comes from natural sources, such as soil erosion, rock weathering, agricultural practices, or construction activities.

**Sediment Load** – The amount of sediment (sand, silt, and fine particles) carried by a stream or river.

**Sedimentary** – Rock formed from fragments of pre-existing rocks (e.g. sandstone) or by precipitation from solution (e.g. limestone).

**Seedling** – Newly germinated plants.

**Seismic** – Pertaining to or produced by earthquakes.

**Sensitive Species** – Those species of plants or animals that have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species under the Endangered Species Act. This also includes species that are on an official state list or are recognized by the Land Manager as needing special management to prevent their being placed on federal or state lists.

**Sensitivity Level** – a particular degree or measure of viewer interest in the scenic qualities of the landscape.

Sensitivity Level 1 – The highest sensitivity level, referring to areas seen from travel routes and use areas with moderate to high use.

Sensitivity Level 2 – An average sensitivity level, referring to areas seen from travel routes and use areas with low to moderate use.

Sensitivity Level 3 – The lowest sensitivity level, referring to areas seen from travel routes and use with low use.

**Short-Term Impacts** – For the purpose of the Ferron natural Gas EIS analysis, short-term impacts are generally defined as those that would occur during the construction period.

**Shut In** – Refers to a well that is completed, is shown to be capable of production in paying quantities, and is not presently being operated.

**Significant** – As used in NEPA determination of significance requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).

**Slump** – Slide or earthflow of a soil mass.

**Soil** – Loose, unconsolidated surface material comprising topsoil and subsoil.

**Spawning** – The deposition of eggs and sperm by fish.

**Species** – Organisms that successfully reproduce among themselves and cannot reproduce successfully with other organisms.

**Species of Special Concern** – A native species whose population is low and limited in distribution or has suffered significant reductions because of habitat loss.

**Specific Conductance** (umhos/cm) – A measure of electrical conductivity in water that is influenced by the mineral content of the water.

**Stiff Diagram** – a graphic technique to display the relative concentrations of the major constituents of water.

**STORET Sites** – Water sampling locations for which data has been stored in the EPA database STORET.

**Stormwater Runoff** – Overland runoff from snowmelt or a precipitation event.

**Strata** – An identifiable layer of bedrock or sediment; does not imply a particular thickness of rock.

**Strip topsoil** – To salvage a specific depth of topsoil with a scraper, dozer, or grader for use in future revegetation of the site.

**Substrate** – Material consisting of silts, sands, gravels, boulder and woody debris found on the bottom of a stream channel.

**Talus** – An aggregation of fallen loose rock which forms at the base of a steep slope.

**Target formation** – The geological association of rocks which contain the exploitable mineral reserves.

**Telemetry** – Instrumentation to transmit scientific equipment readings from remote locations to a central site.

**Temperature Inversion** – A local weather condition in which relatively cold air near the earth's surface is trapped below a layer of relatively warm air aloft. This condition is the reverse of the normal air temperature gradient and traps polluted air within the cold surface layer.

**Threatened Species** – Any species of animal or plant which is likely to become endangered within the foreseeable future throughout all or significant portions of its range. It has been designated in the Federal Register by the Secretary of the Interior as a threatened species. Disturbance of the habitat of threatened species is prohibited by the Endangered Species Act of 1973, as amended.

**Thrust Faulting** – Low angle fracturing of bedrock in response to horizontal stress within the earth's crust

**Total Dissolved Solids (TDS)** – Total amount of dissolved material, organic or inorganic, contained in a sample of water.

**Total Suspended Soils (TSS)** – Amount of undissolved particles suspended in liquid.

**Track Excavator** – A large backhoe type excavating machine which is self-propelled on caterpillar-type tracks.

**Transmission pipeline** – A pipeline larger than gathering or collection pipelines, typically larger than 10 inches diameter, for transporting oil or natural gas over long distances.

**Transmissivity** – The rate at which water is transmitted through a unit width of a groundwater aquifer or confining bed under a unit hydraulic gradient.

**Trilinear Diagram** – A method graphically plotting the chemical composition of the major anions and cations of a water sample in a multi-coordinate field.

**Trip a Drill String** – Removal of the drill bit and its associated piping.

**Turbidity** – A fisheries measurement of the total suspended solids in water expressed as nephelometric turbidity units (NTU).

**Two-Phase Separator** – A basin which accommodates the separation of different density fluids, in this case gas and produced water.

**Typic Cryoboralfs** – A soil which has developed in a cold, relatively moist climatic regime and has a subsurface horizon with clay accumulation.

**Understory** – The trees and other woody species growing under a more-or-less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

**Variety Class** – a particular level of visual variety or diversity of landscape character. There are three variety classes; A,B, and C.

Variety Class A – distinctive
Variety Class B – common
Variety Class C – minimal

**Vegetation** – All of the plants growing in and characterizing a specific area or region; the combination of different plant communities found there.

**Visual Resource** – The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.

**Visual Resource Management System** – The BLM system for evaluating and classifying visual resources. The system uses line, form, color, texture, scale and space to categorize lands into one of four classes:

Class I. Preservation
Class II. Retention
Class III. Partial Retention
Class IV. Modification

**Water Quality** – refers to a set of chemical, physical, or biological characteristics that describe the condition of a river, stream, or lake. The quality of water determines which beneficial uses it can support. Different instream conditions or levels of water quality are needed to support different beneficial uses.

**Waters of the United States** – A jurisdictional term from Section 404 of the Clean Water Act referring to water bodies such as lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce.

**Watershed** – All of the land that drains surface water to a given stream above a designated point (usually its mouth); also called a stream drainage or drainage basin.

**Well Head** – The equipment used to maintain surface control of a well. It is composed of the casing head, tubing head and a series of valves and fittings.

**Well Pad** – A level area constructed for the purpose of drilling a well.

**Wetlands** – Areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

**Winter Range** – The place where migratory (and sometimes nonmigratory) animals congregate during the winter season.

**Workover** – Well maintenance activities which require onsite mobilization of a drill rig to repair the well bore equipment (casing, tubing, rods, or pumps) or the wellhead. In some cases, a workover may involve development activities to improve production from the target formation.

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|---|---|
| AADT | Annual Average Daily Traffic |
| ADT | Average Daily Traffic |
| APD | Application for Permit to Drill |
| APE | Area of Potential Effects |
| ATV | All-Terrain Vehicle |
| AUM | Animal Unit Month |
| AWA | American Whitewater Affiliation |
| BEBR | Bureau of Economic and Business Research |
| BLM | Bureau of Land Management |
| BMP | Best Management Practices |
| BOPE | Blowout Prevention Equipment |
| CBM | Coalbed Methane |
| CERCLA | Comprehensive Environmental Response Compensation and Liability Act |
| CFR | Code of Federal Regulations |
| CO | Carbon Monoxide |
| $CO_2$ | Carbon Dioxide |
| COE | U.S. Army Corps of Engineers |
| CPF | Central Production Facility |
| CSU | Controlled Surface Use |
| CTQ | Community Tolerance Quotient |
| DEIS | Draft Environmental Impact Statement |
| DNA | Deoxyribonucleic acid |
| DWQ | Division of Water Quality |
| EIS | Environmental Impact Statement |
| EPA | Environmental Protection Agency |
| EPT | Ephemeroptera Plecoptera Trichoptera |
| FAA | Federal Aviation Administration |
| FAR | Federal Airport Regulation |
| FEIS | Final Environmental Impact Statement |
| FEMA | Federal Emergency Management Agency |
| FLPMA | Federal Land Policy and Management Act |
| FS | Forest Service |
| GOPD | Governor's Office of Planning and Budget |
| H | Shannon Weiner Diversity Index |
| HBI | Hilsenhoff Biotic Index |
| HDPE | High Density Polyethylene |
| $H_2S$ | Hydrogen Sulfide |
| ISCST3 | Industrial Source Complex Short-Term 3 Dispersion Model |
| JL | Jurisdictional Lateral |
| kcra | known coal resource area |
| KOP | Key Observation Point |

| | |
|---|---|
| KWH | Kilowatt Hours |
| LRMP | Land and Resource Management Plan |
| MFP | Management Framework Plan |
| NAAQS | National Ambient Air Quality Standards |
| NEPA | National Environmental Policy Act |
| NL | No Lease |
| $NO_2$ | Nitrogen Dioxide |
| $NO_x$ | Nitrogen Oxides |
| NOI | Notice of Intent |
| NOS | Notice of Staking |
| NRCS | National Resource and Conservation Service |
| NSO | No Surface Occupancy |
| NSR | New Source Review |
| OD | Outer Diameter |
| OHV | Off-Highway Vehicle |
| OSHA | Occupational and Safety Health Act |
| PCIF | Permanent Community Impact Fund |
| PL | Public Law |
| $PM_{10}$ | Particulate Matter with an aerodiameter of 10 microns or less |
| PRWID | Price River Water Improvement District |
| PSD | Prevention of Significant Deterioration |
| RFFA | Reasonable Foreseeable Future Actions |
| RGU | River Gas Utilities |
| RFD | Reasonably Foreseeable Development |
| RMP | Resource Management Plan |
| ROD | Record of Decision |
| ROS | Recreation Opportunity Spectrum |
| ROW | Right-of-Way |
| RQ | Reportable Quantities |
| SARA | Superfund Amendment and Reauthorization Act |
| SCORP | State Comprehensive Outdoor Recreation Plan |
| SCS | Soil Conservation Service |
| SHPO | State Historic Preservation Office |
| SIA | Significant Impact Area |
| SITS | Smithsonian Institution Trinomial System |
| SITLA | School and Institutional Trust Land Administration |
| SLT | Standard Lease Terms |
| $SO_2$ | Sulfur Dioxide |
| SR | State Road |
| SUP | Special Use Permit |

| | |
|---|---|
| SUPO | Surface Use Plan of Operations |
| SWR | State Wildlife Reserve |
| TCP | Traditional Cultural Properties |
| TCU | Transportation, Communication, Utilities |
| TDS | Total Dissolved Solids |
| TL | Timing Limitation |
| TSS | Total Suspended Solids |
| TVOR | Terminal Very High Frequency Omnirange |
| UDEQAQD | Utah Department of Environmental Quality Air Quality Division |
| UDEQ | Utah Department of Environmental Quality |
| UDNR | Utah Department of Natural Resources |
| UDOGM | Utah Division of Oil, Gas and Mining |
| UDOT | Utah Department of Transportation |
| UDWQ | Utah Department of Water Quality |
| UDWR | Utah Division of Wildlife Resources |
| UPDES | Utah Pollutant Discharge Elimination System |
| UPL | Utah Power and Light |
| USC | United States Code |
| USDC | U.S. Department of Commerce |
| USDI | U.S. Department of the Interior |
| USDOT | U.S. Department of Transportation |
| USFS | U.S. Forest Service |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| USOE | U.S. Office of Education |
| VQO | Visual Quality Objectives |
| VRM | Visual Resource Management |
| WTP | Water Treatment Plant |

# CHAPTER 9

# REFERENCES

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# REFERENCES CITED


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